# SECTION 4.0 – GSP – INTRODUCTION

## 4.0.1 GENERAL PLANT SYSTEM PLAN

Hydro One Networks Inc. (Hydro One) has prepared a General Plant System Plan (GSP) for the 2023 to 2027 period, which presents proposed investments in the General Plant assets and functions that are relied on and shared by the Transmission and Distribution businesses. As the first five-year GSP prepared by Hydro One, this GSP is based on guidance from the Chapter 5 Filing Requirements for Electricity Distribution Applications: Consolidated Distribution System Plan Filing Requirements - issued on June 24, 2021, and the Chapter 2 Filing Requirements for Electricity Transmission Applications: Revenue Requirement Applications - issued on February 11, 2016.

Consistent with the Filing Requirements discussed above, this GSP provides a consolidated view of the capital expenditure plan for its General Plant assets and the asset management and investment planning process (as detailed in SPF Section 1.7) that underpinned the development of this plan. The GSP reflects the unique functionalities and lifecycle characteristics of General Plant assets (e.g. Fleet, Facilities and Real Estate, Information Technology (IT), Operating Technology (OT) and Security), which are indispensable in supporting Hydro One's business operations and delivering services to customers.

## 4.0.2 FORMAT OF THE GSP

Consistent with the Filing Requirements discussed in 4.0.1 above, Hydro One's GSP is organized as follows.

| GSP Section | Content Description |
|---|---|
| **Section 4.1** | **GSP – Overview** – This section provides an overview of Hydro One's General Plant assets, the factors that were considered in developing the investment plan, and a summary of the investment plan. |
| **Section 4.2** | **GSP – Asset Information and Life Cycle Strategies** – This section presents the state of Hydro One's power system assets and their asset management and life-cycle strategies. |
| **Section 4.3** | **GSP – Benchmarking and Other Studies** – This section presents the external studies that have been undertaken to inform the investment plan. |
| **Section 4.4** | **GSP – Placeholder** – This section is not applicable for the GSP. It is included in the GSP structure to maintain alignment with the structures of the TSP and DSP. |
| **Section 4.5** | **GSP – Placeholder** – This section is not applicable for the GSP. It is included in the GSP structure to maintain alignment with the structures of the TSP and DSP. |
| **Section 4.6** | **GSP – Other Capital Planning Factors and Considerations** – This section details other factors which have informed the investment plan, including customer engagement, regulatory reform and policy, and system modernization. |
| **Section 4.7** | **GSP – Investment Planning Process** – Describes asset management and investment planning process specifics that are applicable to General Plant relative to the overall planning process (described in SPF Section 1.7). |
| **Section 4.8** | **GSP – Capital Expenditures – Overview** – This section presents Hydro One's capital investment plan for General Plant investments for the five-year period (2023-2027). |
| **Section 4.9** | **GSP – Capital Expenditure – Trends and Variances** – This section assesses Hydro One's historical capital spending to previous OEB-approved funding and provides a ten-year snapshot (2018 – 2027) of Hydro One's capital spending in General Plant investments. |

| GSP Section | Content Description |
|---|---|
| **Section 4.10** | **GSP – Capital Work Execution Strategy** – This section discusses the capital delivery process and Hydro One's approach to accomplish the proposed capital investment plan. |
| **Section 4.11** | **GSP – Material Investments Summary Documents** – This section includes detailed summaries of large investments (with forecast spending over $3 million in Transmission or $1M for Distribution in any given year) over the 2023-2027 period planned in the OEB's General Plant investment category. |

To assist parties in their review of the GSP, Hydro One has prepared a Table of Concordance found at Appendix 'A', which aligns the sections of this GSP with the Filing Requirements.

Unless otherwise specified, the asset information contained in this GSP is taken as of December 31, 2020. Forecast costs for the 2023 to 2027 period are as forecast in Hydro One's 2023-2027 Business Plan (as presented in Exhibit A-03-01-01).

## APPENDIX ‘A’ – TABLE OF CONCORDANCE

| Hydro One Reference | OEB Filing Requirements |
|---|---|
| **4.0 GSP – Introduction** | 5.2, 5.2.1 d),e) |
| **4.1 GSP - Overview** | |
| 4.1.1 Introduction | 5.2.1 |
| 4.1.2 General Plant Functions | 5.2.1, 5.3.2 |
| 4.1.3 Capital Expenditure Plan | 5.2.1, 5.4, 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| 4.1.4 Appropriateness of the GSP | 5.2.1, 5.4, 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| **4.2 GSP – Asset Information and Life Cycle Strategies** | |
| 4.2.1 Introduction | |
| 4.2.2 Transport and Work Equipment | 5.3.2, 5.3.3 a) b) |
| 4.2.3 Facilities and Real Estate | 5.3.2, 5.3.3 a) b) |
| 4.2.4 Information Solutions and System Operations | 5.3.2, 5.3.3 a) b) |
| **4.3 GSP – Benchmarking and Other Studies** | |
| 4.3.1 2019 Fleet Operations Benchmarking Report - Utilimarc | 5.2.3 a);<br>2.4.3 (Transmission) |
| 4.3.2 Fleet Lifecycle Study - Utilimarc | 5.2.3 a);<br>2.4.3 (Transmission) |
| 4.3.3 Enterprise IT Spending and Staffing Benchmark - Gartner | 5.2.3 a), d);<br>2.4.3 (Transmission) |
| 4.3.4 Attachments: Benchmarking Studies | 2.4.3 (Transmission) |
| **4.4 Placeholder** | |
| **4.5 Placeholder** | |
| **4.6 GSP – Other Capital Planning Factors and Considerations** | |
| 4.6.1 Fleet | 5.2.1 b), 5.4 a) |
| 4.6.2 Facilities and Real Estate | 5.2.1 b), 5.4 a) |
| 4.6.3 Information Solutions and System Operations | 5.2.1 b), 5.4 a), b) |
| **4.7 GSP – Investment Planning Process** | |
| 4.7.1 Overview | 5.3.1 b) |
| 4.7.2 Strategy and Context | 5.3.1 a) |
| 4.7.3 Asset Management Process | 5.3.1 b), 5.4 a), 5.4.1 |
| 4.7.4 Investment Planning Process | 5.2.1 b), 5.3.1 b), 5.4 a),<br>5.4.1;<br>2.3.2 (Transmission) |
| **4.8 GSP – Capital Expenditures - Overview** | |
| 4.8.1 Introduction | |
| 4.8.2 Fleet | 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |

| **Hydro One Reference** | **OEB Filing Requirements** |
|---|---|
| 4.8.3 Facilities and Real Estate | 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| 4.8.4 Information Solutions | 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| 4.8.5 System Operations | 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| 4.8.6 Other General Plant | 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| 4.8.7 Attachments | 5.4.2, 5.4.3.1 |
| **4.9 GSP – Capital Expenditure – Trends and Variances** | |
| 4.9.1 Introduction | |
| 4.9.2 Historical Capitcal Expenditures Variances | 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| 4.9.3 Forecast Capital Expenditures Trends and Variances | 5.4.2, 5.4.3.1;<br>2.4.3 (Transmission) |
| 4.9.4 Attachments | 5.4.2, 5.4.3.1 |
| **4.10 GSP - Capital Work Execution Strategy** | |
| 4.10.1 Introduction | |
| 4.10.2 Fleet | 5.3.3 a) |
| 4.10.3 Facilities and Real Estate | |
| 4.10.4 Information Solutions | |
| **4.11 GSP - Material Investments Summary Documents** | 5.4.2, 5.4.3.2;<br>2.4.3 (Transmission) |

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# SECTION 4.1 – GSP – OVERVIEW

## 4.1.1 INTRODUCTION

Hydro One Networks Inc. (Hydro One) has prepared a comprehensive General Plant System Plan (GSP) for the 2023 to 2027 period, which presents proposed investments in the General Plant assets and functions that are relied on and shared by the Transmission and Distribution businesses. As the first five-year GSP prepared by Hydro One, this GSP is based on guidance from the Chapter 5 Filing Requirements for Electricity Distribution Applications: Consolidated Distribution System Plan Filing Requirements - issued on June 24, 2021, and the Chapter 2 Filing Requirements for Electricity Transmission Applications: Revenue Requirement Applications - issued on February 11, 2016. It is aligned with the principles and expectations articulated by the OEB in its *Renewed Regulatory Framework* (RRF).

Consistent with the Filing Requirements, this GSP provides a consolidated view of the capital expenditure plan for Hydro One's General Plant assets and the asset management and investment planning process (as detailed in SPF Section 1.7) that underpinned the development of this plan. The GSP reflects the unique functionalities and lifecycle characteristics of General Plant assets (e.g. fleet, facilities and real estate, information technology (IT), operating technology (OT) and security), which are indispensable in supporting Hydro One's business operations and delivering reliable services to customers. The proposed investments are paced appropriately to help ensure that safe, reliable and functional General Plant assets are available to enable the Transmission and Distribution businesses to execute their work program and achieve their strategic objectives.

In the development of its GSP, Hydro One considered a diverse set of inputs, such as customer preferences, asset condition, lifecycle strategies to minimize costs, independent third party benchmarking, and Transmission and Distribution operational needs. The capital plan that resulted from the investment planning process represents the optimized level and composition of investments to balance and address a wide range of needs, such as:

- Assets in poor condition or nearing end of vendor support that require renewal;
- Operational requirements to execute the Distribution and Transmission work program, including access to adequate facilities and fleet, real estate to support acquisition of rights and property, and addressing gaps in technology capabilities;
- Investments in critical operating infrastructure to maintain compliance with North American Electric Reliability Corporation (NERC) standards;
- Upgrades of IT and OT systems to ensure systems and applications are available on a reliable basis, maintain power grid reliability, and enable lines of business to more effectively leverage technology in performing their functions; and
- Improving the maturity of Hydro One's physical, cyber and personnel security programs to maintain a robust security posture and ensure resilience to security risks across the organization.

### 4.1.2 GENERAL PLANT FUNCTIONS

General Plant assets are critical to the utility's operational continuity and the successful execution of a complex portfolio of Transmission and Distribution work programs. The main Hydro One functions that fall under General Plant include Fleet, Facilities and Real Estate (F&RE), Information Solutions and System Operations, and Other General Plant. Each of these functions is described in the following subsections.

#### 4.1.2.1 FLEET

Hydro One Fleet manages Transport and Work Equipment (TWE) assets to support the execution needs of the Distribution and Transmission work programs and staffing requirements. TWE assets cover a broad range of functional requirements to meet the differing operational needs and work methods for various lines of business. The main types of equipment are listed in Table 1 and described below.

**Table 1 - TWE quantities by equipment type (as of January 2021)**

| Equipment Type | Quantity |
|---|---|
| Light | 2,728 |
| Heavy | 1,441 |
| Off-Road | 453 |
| Small Off-Road | 1,138 |
| Miscellaneous | 2,459 |
| Helicopters | 8 |

- Light duty vehicles are used universally across all lines of business. These include vehicles for employees who drive more than 20,000 km annually, and vans and pickup trucks to transport tools and crews to work locations.
- Given the remote and expansive locations covered by their work programs, Distribution Lines, Forestry and Transmission Lines require access to similar types of TWE. The TWE categories that are primarily used by these lines of business include the following:
    - Heavy duty vehicles such as service trucks, highway tractors, cranes, bucket trucks and radial boom trucks are used to perform activities that range from towing large equipment and off-road units, lifting poles and other material, working at heights, and setting poles.
    - Large off-road equipment is used to build roads and right-of-ways, clear brush, build/maintain lines and act as personnel/material carriers.
    - Small off-road equipment such as snowmobiles and utility task vehicles (side-by-sides) are used to perform activities in remote locations that do not require the capabilities of the large off-road equipment.
    - Helicopters are used to inspect transmission lines, conduct line maintenance and transport workers and materials to remote locations. These are especially useful for quickly accessing remote locations during storm response.
- Fleet also manages a myriad of miscellaneous equipment that caters to specific needs such as boats, tensioners, chippers, trailers, manlifts and forklifts.

By providing ready access to this equipment, Fleet enables the lines of business to efficiently and safely complete their work. This function directly contributes to Hydro One's focus on continuous improvement in productivity and cost performance. To maximize equipment availability while optimizing fleet size and associated costs, Hydro One manages and sets inventory levels based on actual staff counts requiring vehicles, composition and volume of work programs, geographic locations, utilization levels, and customer service commitments. Notably, location and performance of TWE are monitored using a fleet telematics system. To ensure the optimal number of vehicles for work programs and staffing requirements, operational data derived from telematics is analyzed on a monthly basis to identify areas of performance improvement and to redistribute existing units according to work program needs. Increasing performance and redistributing TWE mitigate the need for pursuing other more costly options to meet the TWE demands associated with increasing Transmission and Distribution work programs – namely, short term rentals and new asset acquisitions.

### 4.1.2.2 FACILITIES AND REAL ESTATE

Hydro One’s F&RE manages sites and buildings located across the Province of Ontario that support administrative and service functions for various lines of business and network system assets. F&RE assets are geographically distributed to align with the configuration and demands of Hydro One’s network and customers, as well as the diverse operational requirements of the various lines of business.

Hydro One manages a complex and diverse portfolio of F&RE assets, consisting of operational facilities that house administrative and operations work centres, and network buildings that house power grid assets. F&RE’s objective is to ensure that lines of business have access to adequate and appropriate facilities to perform their daily activities. Each line of business has distinct requirements which relate to the facility size, configuration and function. F&RE strategically invests in facilities and real estate properties to ensure these requirements are met, to provide adequate protection for high criticality electrical equipment, and to ensure a safe operating and productive environment for employees and customers.

F&RE relies on a range of processes and inputs to establish asset needs and corresponding investments, including ongoing inspections/maintenance and Building Condition Assessments

(BCAs) to gather condition data as well as coordinated reviews with other internal lines of business to identify facility-related requirements. In deciding the appropriate manner and scope of intervention, planners seek not only to sustain ongoing business functions being supported by individual F&RE assets, but also drive operational efficiencies. To maximize value to Hydro One customers, investments are developed through a strategic lens of the asset portfolio to avoid duplication, maximize utilization and minimize costs.

Hydro One's F&RE group manages over 1,400 buildings, including over 1,000 network buildings across 352 transmission and 1,029 distribution sites, plus approximately 400 buildings across 135 operational facilities located throughout the province. All of these transmission and distribution related sites and facilities are owned by Hydro One, except for the facilities that are leased on approximately 45 sites.

Similar to the Fleet function, F&RE enables the lines of business to efficiently and safely complete their work and contributes to Hydro One's focus on continuous improvement in productivity and cost performance. Benefits are realized through a number of areas, such as lower operating and maintenance costs, improved operational performance, reduced health and safety risks, reduced risk of component failure resulting in business disruptions, and accommodation of facility-related operating requirements. It enables effective facilities maintenance through timely replacement of major building system/components and aligns commitments (e.g., facility leases) and investments with known and emerging operating requirements and corporate business decisions.

#### 4.1.2.3 INFORMATION SOLUTIONS AND SYSTEM OPERATIONS

Information Solutions is accountable for the IT and security assets that enable Hydro One's Transmission and Distribution businesses to effectively perform day-to-day operations and meet customer service obligations. In addition, Information Solutions looks after the implementation and execution of OT solutions, while the planning for OT systems is performed by Hydro One System Operations. The OT systems are comprised of physical hardware, operating tools and applications that directly enable the monitoring, control, and operations of the Transmission and Distribution power network.

The assets managed comprise of systems that include both hardware and software applications across 140 office locations and data centres, including approximately 800 business software applications. Hardware includes servers, enterprise data storage, desktops, laptops, tablets, printers, plotters, and telecommunication infrastructure including switches and computer-telephony interfaces that provide support across the entire business. The reliability and security of these systems are crucial as they must be available to customers and to the personnel delivering Hydro One's business services to serve customers effectively.

IT systems refers to technology that support cross-business capabilities, which include: customer functions such as billing or external facing websites and applications; internal corporate functions such as finance and human resources; work and asset management functions such as work program planning, scheduling and execution, and asset details and condition reporting; and the underlying IT hardware, software and applications that are required to run these functions.

OT systems comprise of physical hardware, operating tools and applications that directly enable the monitoring, control, and operations of the Transmission and Distribution power network through Hydro One's control centres. These include: the Network Management System that provides tools for Transmission network control, monitoring and operations; the Distribution Management System that provides tools for Distribution network control, monitoring and operations; and the Outage Management Response System that provides tools for outage response and crews dispatch for efficient restoration. These assets are required to maintain compliance with regulatory standards (including NERC reliability standards and the OEB's Transmission System Code). They range from critical network applications to the IT infrastructure that supports them, including data storage, computer servers, computer consoles, IT networks and operating systems.

Security assets protect Hydro One's Transmission and Distribution system assets as well as IT and OT systems from personnel, physical and cyber threats. A broad range of Security assets include hardware and applications that manage identity and physical access, physical barriers, surveillance systems, and cyber security equipment.

Information Solutions and System Operations are essential partners to the Transmission and Distribution business. These investments enable the lines of business to effectively perform their work and provide solutions that help continuously improve operations and introduce opportunity for improved customer service and cost savings. The following points below provide examples of such activities.

- OT applications support Hydro One's Transmission License and ensure compliance with Regulatory bodies such as NERC, IESO and the OEB's Transmission and Distribution System Codes. Likewise, cyber security assets ensure compliance with NERC Critical Infrastructure Protection (CIP) standards and alignment with the *Ontario Cyber Security Framework* and National Institute of Standards and Technology's *Cybersecurity Framework*.
- From an operational perspective, OT applications ensure reliable operation of the grid, while investments in Hydro One's Geographic Information System (GIS) and communication infrastructure support grid modernization for Distribution and faster response times to outages.
- Enterprise wide applications allow Hydro One's lines of business to perform critical business tasks and have data connected across the organization to increase visibility of Hydro One's investments, execution progress, and work program plans.
- Customer facing technology connects Hydro One to its customers and provides customers access to tools that help them make more informed decisions on their energy services and consumption.
- Corporate enabling technology ensures that lines of business across Hydro One have reliable access to technology that is required to perform critical business activities including financial reporting, supply chain management and various corporate initiatives.
- Work and asset management (WAM) technology allows planning to effectively perform their work and communicate plans to the field, and allow field users to receive and record details of their work.
- Security assets protect Hydro One's power system and business operations from personnel, physical and cyber security threats and support faster recovery times from realized risks or interruptions.

#### 4.1.2.4 OTHER GENERAL PLANT

In addition to these main functions, the GSP also includes General Plant investments that are managed by the Transmission and Distribution businesses, including Transmission grid operations costs and capital contributions from Hydro One Distribution to Hydro One Transmission.

### 4.1.3 CAPITAL EXPENDITURE PLAN

For the purposes of this Application, the GSP presents total expenditures for General Plant investments and the allocation of those expenditures to Transmission and Distribution.[1] Accordingly, this section provides a comprehensive view of Hydro One's General Plant portfolio.

The GSP capital expenditure plan for the 2023-2027 forecast period is provided below in Table 2 and displayed in Figure 1.

**Table 2 - Planned net capital expenditures for General Plant by function from 2023-2027**

| OEB Category | Forecast Period (Planned $M) | | | | |
|---|---|---|---|---|---|
| | **2023** | **2024** | **2025** | **2026** | **2027** |
| Fleet | 76.4 | 78.0 | 78.9 | 80.0 | 82.6 |
| Facilities & Real Estate | 91.4 | 92.1 | 61.7 | 58.1 | 50.5 |
| Information Solutions | 119.9 | 118.1 | 113.6 | 122.1 | 106.1 |
| System Operations | 27.4 | 18.5 | 8.2 | 8.0 | 6.5 |
| Other | 27.5 | 24.6 | 22.0 | 23.2 | 22.3 |
| **General Plant Total** | **342.7** | **331.4** | **284.3** | **291.4** | **268.0** |
| **General Plant - Transmission Allocation** | 146.8 | 124.0 | 114.2 | 115.9 | 105.0 |
| **General Plant - Distribution Allocation** | 195.9 | 207.4 | 170.1 | 175.5 | 162.9 |

[1] General Plant investments include capital expenditures that are either (i) shared between Transmission and Distribution; or (ii) are fully attributable to Transmission or Distribution and fall under the General Plant OEB investment category. For shared investments, the allocation between Transmission and Distribution is based on Black and Veatch's Shared Asset Allocation Study presented in Exhibit E-04-08 Attachment 1.

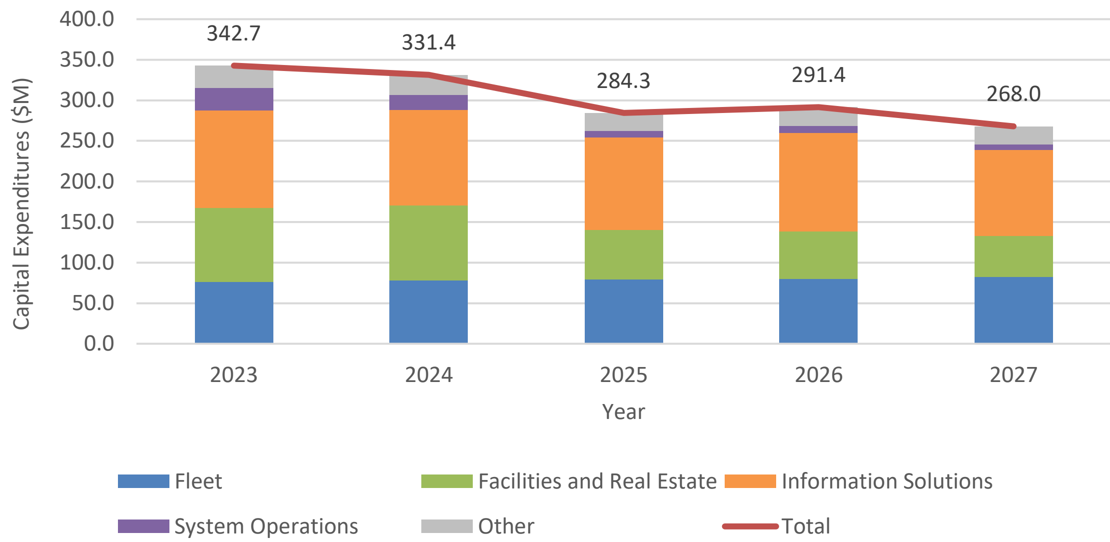


**Figure 1: Planned net capital expenditures for General Plant by function from 2023-2027**

The annual GSP capital spend levels range from $268.0M to $342.7M during the test years, with higher levels in 2023 and 2024. Year–to-year variations in total capital expenditures are mainly driven by the timing of investments for F&RE and System Operations.

The investments planned under the GSP are summarized below by function:

- **Fleet** – Planned fleet investments costs remain relatively steady during the test years, gradually increasing from $76.4M to $82.6M per year. This level of investment is required to minimize fleet lifecycle costs and equipment downtime. In turn, this allows Hydro One to optimize fleet equipment levels to meet work program demands and mitigate potential delays in response time to unplanned system interruptions, such as trouble calls and storm response. Details on the Fleet investments can be found in GSP Section 4.11, G-GP-01 and G-GP-02.
- **Facilities and Real Estate** – Planned investments in F&RE are just above $90M in 2023 and 2024, and then follow a decreasing trend from $61.7M in 2025 to $50.5M in 2027. The initial peak in the earlier test years is driven by projects to address end of life assets, consolidate facilities to manage lease expirations, and meet facility-related operational requirements of Hydro One's Transmission and Distribution businesses. The current sites

are sub-optimal for operations due to overcrowding conditions, inefficient configurations, and disparate sites for field teams. The proposed investments seek to consolidate these facilities to increase efficiencies, provide room for growth and reduce operational costs by terminating leases. Similar investments are planned in 2025 through 2027, but at a lesser volume. Throughout all test years, there are baseline investments of approximately $30M reserved for on-going sustainment program work to address end of life conditions, safety and security with our facility grounds, exterior structures and elements, and building systems and accommodations. Details on the F&RE investments can be found in GSP Section 4.11, G-GP-03 and G-GP-04.

- **Information Solutions** – These investments range from $106.1M to $122.1M annually, with a focus on providing Hydro One lines of business with the technology required to complete their work and enable them to achieve the expected outcomes of their respective System Plans. These investments include:
    - upgrades to existing applications that are approaching their end of vendor support, such as foundational investments in Hydro One's SAP enterprise software (GSP Section 4.11, G-GP-06 through G-GP-08) and Geographic Information System (GIS) enterprise platform (GSP Section 4.11, G-GP-08); and refreshes to IT hardware and software to ensure lines of businesses have reliable access to technology to complete daily work (GSP Section 4.11, G-GP-05);
    - digital transformations of paper processes and automation of manual tasks to improve operational efficiencies and access and quality of data (GSP Section 4.11, G-GP-06 and G-GP-07) ;
    - updates to systems used by Transmission and Distribution planning, execution and field teams to improve efficiencies in work delivery and increase visibility of asset conditions and work plans across these lines of businesses (GSP Section 4.11, G-GP-08);
    - maintaining and, in some areas, improving Hydro One's security posture, such as upgrades to the cyber security equipment protecting the OT infrastructure and applications that monitor and control Hydro One's power system (GSP Section 4.11, G-GP-09); upgrades to the physical security protecting critical stations and

facilities to reduce the risk of external threats (GSP Section 4.11, G-GP-10); and a refresh of Hydro One's security monitoring solution that is nearing its end of life and vendor support period (GSP Section 4.11, G-GP-11).

- **System Operations** – These investments decrease over the forecast period, starting from \$27.4M in 2023 and decreasing to \$6.5M in 2027. This trend reflects the upgrade of all critical systems applications that are or are nearing the end of vendor support, including the Network Management System, Outage Response Management System and Distribution Management System. Details on the System Operations investments can be found in GSP Section 4.11, G-GP-12 through G-GP-18.
- **Other General Plant –** These investments include the replacement of grid control equipment that is nearing its end of vendor support and capital contributions from Hydro One Distribution to Hydro One Transmission. These capital expenditures are relatively steady during the planning period, ranging from \$22.0M to \$27.5M annually. Investments in grid control are required to ensure compliance with IESO market rules and the capital contributions between Hydro One's Distribution and Transmission businesses are required as per the Transmission System Code. For additional details on these investments, please refer to GSP Section 4.11, G-GP-19 through G-GP-22.

### 4.1.4 APPROPRIATENESS OF THE GSP

The following subsections highlight how the capital expenditures in the GSP are appropriately sized and paced, by demonstrating Hydro One's:

- alignment with the RRF outcomes of Customer Focus, Operational Effectiveness, Response to Public Policy, and Financial Performance;
- alignment with customer preferences as identified in Hydro One's customer engagement process (SPF Section 1.6); and
- ability to execute the plan.

#### 4.1.4.1 ALIGNMENT WITH THE RRF

This GSP demonstrates how Hydro One has aligned its investment planning processes and intended outcomes with the principles and expectations articulated by the OEB in the RRF, namely by focusing on: identified customer preferences; continuous improvement in productivity, reliability and cost performance; public policy responsiveness; and financial performance.

**CUSTOMER FOCUS**

General Plant investments play a critical, behind-the-scenes role in ensuring that Hydro One's Transmission and Distribution businesses are able to deliver safe and reliable energy and meet the needs and expectations of its customers. Fleet and F&RE ensure that the businesses have ready access to appropriate vehicles, equipment and infrastructure, respectively to run their day-to-day activities and respond promptly to outages and emergency situations. System Operations' investments provide critical control functions to manage Ontario's electricity grid and Information Solutions provides the underlying IT infrastructure and applications used to deliver and manage work programs and run Hydro One's corporate operations.

These areas require investment to ensure Transmission and Distribution can effectively complete their work programs and, in turn, provide customers with safe and reliable service (GSP Section 4.6 discusses the GSP's considerations of customer preferences). This GSP also includes investments to replace and upgrade customer-facing technology that is nearing the end of vendor support, helping ensure that customers have reliable access to their accounts and other resources to help them make informed decisions. Examples include the Customer Information System (CIS), which allows Hydro One to manage the customer lifecycle (move-in, start service, meter, bill, collect payments and manage filed services) for all 1.4 million Distribution customers, and the online self-service tool (see GSP Section 4.11, G-GP-07).

**OPERATIONAL EFFECTIVENESS**

In alignment with Hydro One's strategic priorities to enable the grid of the future and be the safest and most efficient utility, the GSP includes investments to help reliably operate, monitor and control the grid, and to continue to provide safe and secure facilities for employees and critical grid infrastructure. For example, investments are planned to address critical OT applications such as the Network Management System (GSP Section 4.11, G-GP-16), Outage Response Management System (GSP Section 4.11, G-GP-17) and Distribution Management System (GSP Section 4.11, G-GP-18) that are approaching their end of vendor support and require upgrades to continue to operate reliably. These applications provide real-time power system monitoring and control, and are vital not only for grid reliability but also for the safety of field staff and the protection and sustainment of Hydro One power system assets.

General Plant investments also have a strong focus on continuous improvement in productivity and cost performance. This is demonstrated through its sustained contributions to Hydro One's productivity achievements through 2022. The productivity initiatives under General Plant functions include: Fleet Optimization, Provincial Secondary Land Use, Procurement, and Contract Reductions as presented in SPF Section 1.4. In addition, Hydro One's Information Solutions Division also materially supports multiple productivity initiatives by providing the underlying technology solution.

Through this GSP, Hydro One is maintaining its focus on continuous improvement through various initiatives, including:

- Adjusting the fleet lifecycle replacement strategy to more closely align with third-party expert recommendations to reduce overall lifecycle costs;
- Prudently consolidating facilities and real estate to provide field operations with adequate accommodations, address operational limitations/inefficiencies arising from sub-optimal facility configurations, and reduce operating costs such as leases; and
- Transitioning to a new target operating model for its Information Solutions Division, which provides sustained overall savings through a revised outsourcing strategy.

**PUBLIC POLICY RESPONSIVENESS**

Hydro One's OT assets must be compliant with regulatory requirements relating to the safe and effective system operations, including those set by the NERC, IESO, and the OEB's Transmission and Distribution System Codes. Likewise, Information Solutions manages Hydro One's security assets to ensure compliance with NERC CIP standards and alignment with the *Ontario Cyber Security Framework* and National Institute of Standards and Technology's *Cybersecurity Framework*.

Hydro One's facilities are also responsive to changes in regulations and policies. For example, elements of existing facilities are being upgraded in response to the federal PCB (polychlorinated biphenyl) Regulations (SOR/2008-273), which impose requirements to protect the natural environment and health and safety of occupants and require the phase-out of certain PCB containing equipment by 2025. In relation to F&RE assets, this has necessitated the implementation of the PCB Lighting Program to remove the PCB-containing light fixtures/components.

**FINANCIAL PERFORMANCE**

To maximize value to customers, General Plant investments are thoroughly assessed from a lifecycle cost perspective. Replacements are timed to minimize the overall cost of an asset, without jeopardizing its functionality, performance or reliability. For example, Hydro One is better aligning its fleet vehicle lifecycle replacement strategy to the assets' optimal life span to help control day-to-day operating costs while enabling field productivity through improved equipment availability. IT and OT investments are also carefully assessed to minimize overall costs, including by pursuing extended vendor support (where feasible), leveraging existing applications for additional business needs, and minimizing customization by investing in commercial-off-the-shelf applications.

### 4.1.4.2 CUSTOMER ENGAGEMENT CONSIDERATIONS

To align with and achieve these outcomes, Hydro One has established strategic priorities and objectives (as discussed in SPF Section 1.7.2) that set the context for and guide the implementation of the investment planning process. This process is underpinned by proactive customer engagement to understand their needs, preferences and priorities with respect to Hydro One's work while aiming to provide quality service that is focused on the safe, reliable and cost effective delivery of electricity.

To support the preparation of its System Plans, Hydro One conducted an extensive customer engagement process, which informed the development of the System Plans in various respects as described in SPF Section 1.6. Two main customer engagement findings relate specifically to General Plant:

1. "…a majority of customers support Hydro One making the necessary investments in general plant to meet the same standard as similar businesses rather than just make do and only invest to address the most urgent needs."[2]
2. Hydro One customers also identified "minimizing the impact on the environment" as a "very important" outcome.[3]

The GSP addresses the first finding by focusing on prudently managing the lifecycles of its assets and prioritizing critical facilities and applications. For example, instead of a break/fix approach, fleet asset replacements are prioritized based on asset condition and mileage. This ensures that the reliable and functional assets are available to support work execution when and where needed. Similarly, F&RE prioritizes facilities that serve critical functions to minimize adverse impact on system reliability or disruptions to business operations and services delivered by Hydro One's business units to its customers.

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[2]Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 5
[3] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 15

IT and OT software applications are managed according to industry standard practices related to lifecycle management. A primary consideration is maintaining vendor support, so that the assets can be fixed and/or upgraded expeditiously in the event of malfunction or failure. Prudent lifecycle management helps to avoid:

- disruptions to critical systems that support or directly interact with customers;
- non-compliance with regulatory requirements;
- frequent and/or prolonged service outages that would directly impact the job performance and productivity of staff;
- increases in operating costs to support and service these applications internally; and
- cyber security risks if security patches were not available due to cessation of vendor support.

To reduce Hydro One's impact on the environment, this GSP includes greenhouse gas (GHG) reduction efforts, working towards a long-term, sustainable carbon footprint reduction. GHG mitigation is not a driver of Hydro One's investments, but the company looks for opportunities to prudently mitigate GHGs when identifying investments (refer to SPF Section 1.8.3 for more details on Hydro One's response to climate change). GSP investments that will contribute towards lower overall GHG emissions include:

- **Transport and Work Equipment renewal (GSP Section 4.11, G-GP-01)** – Hydro One's commercial fleet is beginning the gradual transition to low or zero emission technology, increasing the rate of electric vehicles from an estimate 5% of the renewal forecast in 2021 to 50% by 2030. The rate of vehicle replacement will be done as needed to maintain an optimized fleet, and where the total cost of ownership of an electric vehicle versus conventional fuel-based has no significant incremental cost.
- **Facilities & Real Estate (GSP Section 4.11, G-GP-03)** – Hydro One is implementing energy savings initiatives at Operations and Service Centres, including installation of high-efficiency equipment (e.g., Heating, Ventilation, and Air Condition (HVAC) units, generators and lighting) and the Remote Command Centre program which monitors energy consumption remotely and allows Hydro One to take the appropriate actions required to minimize energy consumption. In addition to prudently addressing business

needs, these investments have the added benefit of contributing to GHG emissions reductions.

### 4.1.4.3 ABILITY TO EXECUTE THE PLAN

The plan presented in this GSP is sized and paced to enable the Transmission and Distribution businesses to achieve their strategic objectives. The planned investments reflect the increasing pressure on General Plant functions, such as Fleet and F&RE, to support the needs of the Transmission and Distribution work program. The growing importance of technology in Hydro One's field and corporate operations is also a significant factor to this growth – Information Solutions and System Operations are essential enablers of the Company's efforts to modernize the power system, Hydro One's relationship with customers, and how it manages work across the enterprise. These investments ensure that the lines of business have reliable access to appropriate equipment, technology and facilities, so they can focus on core power system work programs.

To provide an understanding of how this plan compares to historical investments, Figure 2 displays the total General Plant net capital expenditures next to the planning period.

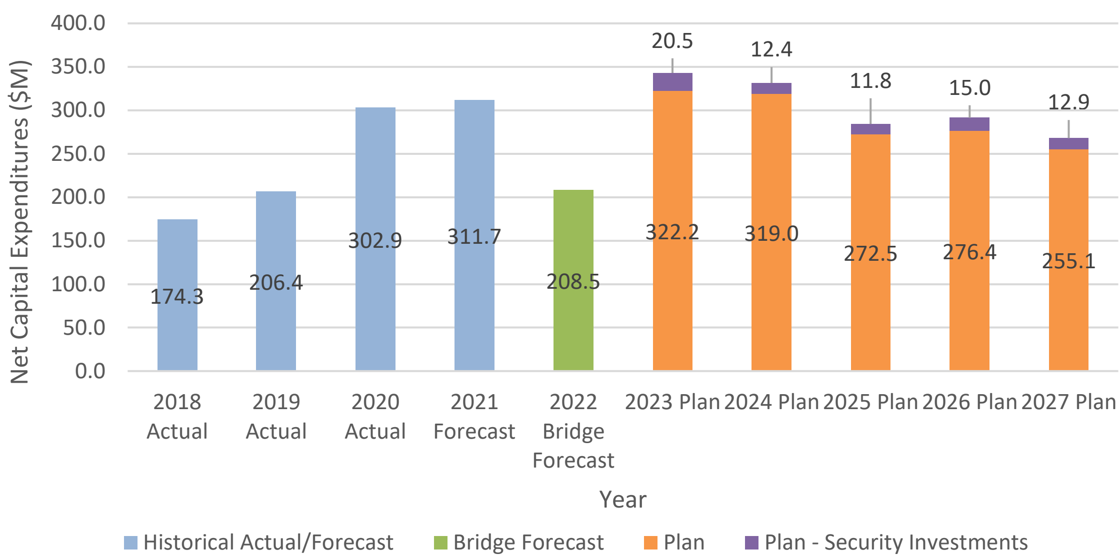


**Figure 2: General Plant Net Capital Expenditures for Historical, Bridge and Test Years[4]**

[4] Beginning in 2023, security investments (included under GSP Section 4.11 G-GP-09, G-GP-10, and G-GP-11) have been reclassified from System Renewal to General Plant. These costs are highlighted in Figure 2 as "Plan – Security Investments" to illustrate their incremental impact on the General Plant portfolio.

The 2023-2027 planned investment levels reflect the increasing requirements for General Plant assets to effectively and efficiently support the needs of the Transmission and Distribution work programs, continuing the trend that is evident in the latter part of the historical period. During the current rate period, and especially in 2020 and 2021, Hydro One has increased investment in General Plant to enable and prepare for the growing power system work programs, and to make better use of new technologies that can support the Company's strategic objectives.[5]

As shown in Figure 2, the 2023 and 2024 overall capital expenditures are, on average, about 10% higher than the 2020 actual and 2021 forecast. Of this 10%, approximately 5% is related to security investments, which have been reclassified from System Renewal to General Plant beginning in 2023. These costs are highlighted in Figure 2 to illustrate their incremental impact on the General Plant portfolio. The other test years from 2025-2027 are 8% below the 2020 and 2021 levels. When security investments are excluded for historical comparisons, the 2023 and 2024 levels are only 5% higher than 2020 and 2021, a growth rate that is below inflation.

In terms of execution strategy, each function follows processes that consider the unique characteristics of their assets. Summaries of the work execution strategies employed by each General Plant function are provided below.

[5] The 2022 bridge year forecast is significantly lower than the prior two historical years. This is primarily driven by the timing of major projects– the Integrated System Operating Centre (ISOC) and the Design Optimization and Transformation (DOT) project are forecasted to complete in 2021, and there are no significant in-year project costs (i.e., greater than $10M in a fiscal year) in 2022.

**FLEET**

Fleet has a number of processes in place to ensure that equipment is ordered efficiently and is delivered on time and in proper working condition, providing value to customers. Examples include:

- purchasing fleet equipment directly from manufacturers to leverage volume discounts;
- reserving build slots with original equipment manufacturers to provide sufficient lead time for the manufacturing process and to ensure that Hydro One is able to secure the required equipment on time; and
- having contracts in place with manufacturers that include penalties for late delivery, failure of delivery, and deficiencies on arrival.

The delivery of the equipment does not mark the end of Fleet's oversight on the delivery process. Before Hydro One accepts any piece of delivered equipment, fleet inspectors confirm that each vehicle or piece of equipment meets Hydro One's specifications. Anything that does not meet these specifications is addressed with the supplier prior to acceptance of delivery. This inspection is done at the outset, prior to commencement of work, to avoid future downtime and to ensure that the integration of new equipment into work programs is as seamless as possible.

In the event of premature retirement of a vehicle before the arrival of its replacement, Fleet works with the internal line of business to develop a solution that meets their needs. This could involve, for example, vehicle retention, leveraging equipment from another Hydro One location, or renting equipment from an external source.

Fleet continuously monitors the performance of the equipment to help contain costs and meet the need of the work programs. Fleet tracks the total cost of ownership of the equipment as well as uptime and equipment utilization. With the use of telematics, Fleet is able to collect and leverage valuable operational data and obtain a continuous review of the fleet to ensure the optimal number of vehicles for work programs and staffing requirements. The data is analyzed on a monthly basis to continuously identify instances of relatively low utilization and to redistribute existing units to work programs in need. This performance data allows Fleet to assess the efficacy of equipment to support work planning and execution activities.

**FACILITIES AND REAL ESTATE**

To construct new facilities or execute major renovations, Hydro One considers two main methods for project delivery: conduct the project internally or through BGIS Global Integrated Solution Canada LP (BGIS), a Canadian firm specializing in facilities management and project delivery services. Hydro One has partnered with BGIS under a 10-year agreement for facilities maintenance (refer to Exhibit E-05-01 for contract details) and has established agreements with BGIS that cover new-build and capital sustainment projects.

The selected approach for each project is determined by the delivery method that achieves the best overall value and can meet the required schedule. Whether a project is executed through BGIS or internally, both processes follow Hydro One's Supply Chain policies, and a competitive Request for Proposals (RFP) will be conducted in order to drive innovative solutions, efficiencies, and value for our customers. Before the construction tender package is issued, consideration is given to opportunities for cost savings, value engineering, and economies of scale that could be achieved by grouping programs and projects of similar scope together. Successful bidders are selected and approved by Hydro One and BGIS leads the execution process with support from Hydro One in accordance with project charters that address project scope, schedule, risks, milestones, and other project deliverables.

For the construction of new capital projects that involve unique, one-off work and require detailed scope and specifications, Hydro One may engage specialized consultants or larger construction firms to develop a design technical package, which will then be included in an RFP to solicit qualified vendors. In such cases, Hydro One internally tracks project progression to ensure the successful completion of the project. For capital sustainment programs and projects such as roofing, wall refurbishment, building upgrades, and electric vehicle (EV) charger installation, BGIS arranges for consulting and construction work through a competitive bidding process to achieve cost efficiencies.

**INFORMATION SOLUTIONS**[6]

Information Solutions is transitioning to a new target operating model for its division to continuously improve capital work execution, provide better internal customer service to other Hydro One lines of business and provide sustained overall savings through a revised sourcing strategy. The model involves the delivery, sustainment, and enhancement of IT solutions across their lifecycle by small, flexible work teams, called "pods", comprised of a business owner, leader, a technology architect, as well as functional and technical subject-matter experts. Each pod directly supports a specific subset of technology for a particular line of business, in recognition of the fact that each line of business has specific needs and uses specific technologies. In this way, the pods act as an integrated service provider for a line of business, integrating the IT delivery, sustainment, and enhancement functions within one work team. For example, the business owner will work closely with the various stakeholders and the pod ensuring that work is prioritized between "run" and "grow and transform". The pod delivery model is a hybrid, which supports two methodologies: waterfall and agile. Most new projects will deliver solutions leveraging the agile methodology. The agile methodology is being widely adopted as it has demonstrated to improve the velocity in which solutions are delivered through "Continuous Integration", the quality of the product through "Continuous Testing", and finally deploying new solutions rapidly through "Continuous Deployment". Hydro One expects this new operating model to enable the company to deliver IT solutions more quickly, more efficiently, and with higher standards of technical support.

In addition to the restructuring described above through the target operating model, Hydro One has in-sourced several IT functions, resulting in greater in-house subject-matter expertise and expected cost savings. Hydro One also has a new negotiated services arrangement with Capgemini Canada Inc. (see Exhibit E-05-01 for details on the contract) which represents a reduction in the amount of services provided by third parties for Information Solutions' capital and sustainment work compared to the previous agreement with Inergi. The new agreement requires Capgemini

[6] As noted above in Section 4.1.2.3, Information Solutions is responsible for the execution of System Operations investments, in addition to their own.

to deliver innovative solutions and improved service delivery outcomes to Hydro One at market-competitive costs. The structure of this agreement provides Hydro One with increased transparency with respect to the resources, skillsets, labour costs, and overall value being delivered. In order to obtain improved service from Capgemini, the contract also provides Hydro One with an increased number of contractual service levels that Capgemini must meet for various types of project service delivery.

Overall, the strategic organizational changes described above achieve the following outcomes:

- Better alignment between Information Solutions capital work and business needs by improving collaboration and interaction points through pods;
- Appropriate prioritization of sustainment (run) versus capital (grow and transform) work by imbedding the business into the delivery and sustainment pods;
- Faster product delivery through smaller, more frequent incremental investments leveraging agile methodologies of Continuous Integration and Continuous Deployment;
- Improved quality by leveraging agile testing methodologies such as Continuous Testing; and
- Appropriate enterprise alignment through financial and technology governance.

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# SECTION 4.2 – GSP – ASSET INFORMATION AND LIFE CYCLE STRATEGIES

## 4.2.1 INTRODUCTION

General Plant assets are critical to the utility's operational continuity and enable the successful execution of a complex portfolio of Transmission and Distribution work programs. This section presents the purpose, characteristics, condition, demographics, and performance information for Hydro One's General Plant assets relating to Transport and Work Equipment (TWE), Facilities, Information Solutions and System Operations, along with their lifecycle optimization policies and practices.

This exhibit is organized by the following functions: TWE (4.2.2), Facilities (4.2.3), and Information Solutions and System Operations (4.2.4). All information presented is current as of December 31, 2020, unless otherwise noted.

## 4.2.2 TRANSPORT AND WORK EQUIPMENT

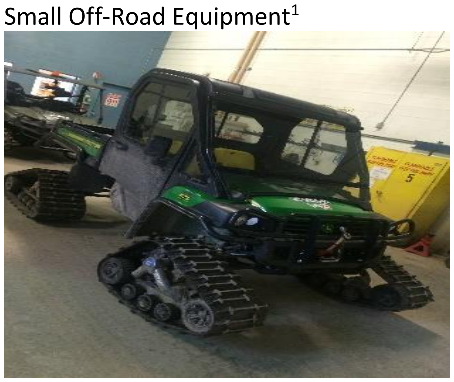
### 4.2.2.1 ASSET DESCRIPTION / PURPOSE

Hydro One Fleet Management Services manages TWE assets to support Distribution and Transmission work programs and staffing requirements. These assets enable efficient work execution by the lines of business, ensure compliance with regulatory requirements and functional needs (including adherence to engineering specifications and designs), reduce environmental impacts by minimizing downtime and travel time, and leverage technology with continuous improvement opportunities.

TWE assets are categorized into 6 equipment categories – light duty, heavy duty, large off-road, miscellaneous, small off-road, and helicopters. Table 1 shows the equipment types that comprise each category and outlines the functional purpose served by each equipment type.

**Table 1 - Summary of TWE Asset Types**

| Categories | Equipment Type | Line of Business Requirement |
|---|---|---|
| Light duty  | Cars/SUVs | Used by all lines of business for employees who drive more than 20,000 km annually |
| | Vans/Pickups | Used by all lines of business to transport tools and crews to work locations and to tow small trailers. |
| Heavy duty<br><br>Radial Boom Derrick  | Service Trucks | Used primarily by Distribution Lines, Forestry, Stations, Construction, Transmission Lines and Fleet Maintenance to support and service off-road units and work locations. |
| | Highway Tractors | Used primarily by Distribution Lines, Forestry, Transmission Lines and Construction to tow large equipment and Off-Road units. |
| | Cranes | Used primarily by Distribution Lines, and Transmission Lines for lifting poles and other material. |
| | Bucket Trucks | Used primarily by Distribution Lines and Forestry to work at heights to complete line maintenance and tree trimming. |
| | Radial Boom Derricks (RBD) | Used by Distribution Lines to dig holes and to set poles at road side and for heavy towing. |
| Large Off-Road  | Off Roads | Used by Distribution Lines, Forestry and Transmission Lines to perform activities such as building roads and right-of-ways, clearing brush, build/maintain lines and act as personnel/material carriers. |
| Miscellaneous<br><br>Chipper | Boats | Used primarily by Distribution Lines and Forestry work programs and strategically located around the |

| | | |
|---|---|---|
|  | | province to minimize hauling the boats from waterway to waterway to access our isolated customers. |
| | Trailers | Used by all lines of business and includes boat trailers, office trailers, open-deck trailers, cargo trailers, pole trailers for various business requirements. |
| | Chippers | Used by Forestry in conjunction with the bucket trucks required for environmental cleanup. |
| Tensioner  | Manlifts | Used by Stations working within a non-energized environment and by Fleet for working on elevated equipment/aerial devices. |
| | Forklifts | Used by all lines of business and are required for loading/unloading material at various work sites. |
| | Tensioners | Used by Distribution Lines and Transmission Lines for stringing projects. |
| Small Off-Road Equipment[1]  | Snowmobiles | Used by Distribution Lines, Forestry and Transmission Lines to perform the following activities in remote areas in the winter months that are not easily accessible: clearing brush, build/maintain lines and act as personnel/material carriers. |
| | UTV/Side-by-Side | Used by Distribution Lines, Forestry and Transmission Lines to perform the following activities in remote areas that are not easily accessible and can be completed without large off-road units: clearing brush, build/maintain lines and act as personnel/material carriers. |
| | 6 Wheeler | |
| | 8 Wheeler | |

[1] Small Off-Road Equipment were previously managed by the Lines of Business and were amalgamated into TWE in 2019.

| | | |
|---|---|---|
| Helicopters  | Helicopter | Used by Distribution Lines, Forestry and Transmission Lines to inspect transmission lines, conduct line maintenance and to transport workers and materials to remote locations. |

Fleet Services and other Lines of Business also have Service Equipment which are minor fixed assets such as generators, power washers, sprayers and compressors these are purchased by the Lines of Business on an as needed basis and managed locally.

#### 4.2.2.2 ASSET DEMOGRAPHICS, CONDITION AND PERFORMANCE

Hydro One’s TWE investments are determined in large part by examining the assets’ expected service life (ESL) based on age, mileage and engine hours. These factors are indicators of the overall condition of the fleet. Condition reports from technicians are also reviewed and considered to verify that specific assets identified for replacement are indeed in a deteriorated condition.

**DEMOGRAPHICS**

Hydro One has 8 helicopters, approximately 7,000 vehicles and other fleet equipment, as well as approximately 1,000 small off-road equipment. Table 2 shows the breakdown of the TWE asset quantities and demographics by average age and, where applicable, mileage and engine hours. Engine hours are relevant considerations for various types of heavy equipment due to their use of Power Take Off (PTO) (i.e. taking power from a running engine) to enable the operation of the aerial devices. Table 2 also shows the 2023 projected average age, mileage and engine hours for the assets, based on the current funding levels for 2021 and 2022. Table 3 provides the breakdown of the helicopter asset demographics.

**Table 2 - Average Age and Mileage as of January 2021**

| Equipment Type | Actual based on January 2021 | | | | | Projected for January 2023 | | |
|---|---|---|---|---|---|---|---|---|
| | Quantity | Percent of TWE Fleet | Average Age (Years) | Average Mileage (km) | Average Engine Hours | Average Age (Years) | Average Mileage (km) | Average Engine Hours |
| Light | 2,728 | 33% | 4.9 | 129,000 | N/A | 6.1 | 161,000 | N/A |
| Heavy | 1,441 | 18% | 7.5 | 135,000 | 7,500 | 9.5 | 171,000 | 9,500 |
| Off-Road | 453 | 6% | 10.4 | N/A | N/A | 12.8 | N/A | N/A |
| Miscellaneous | 2,459 | 30% | 10.2 | N/A | N/A | 12.4 | N/A | N/A |
| Small Off-Road | 1,138 | 14% | 7.4 | N/A | N/A | 9.4 | N/A | N/A |

**Table 3 - Demographics of Helicopters as of January 2021**

| Tail Number | Type of Aircraft | Age (Years) | Annual flight hours |
|---|---|---|---|
| C-GOHY, C-GOHH, C-GHOH | AS 350B2 | 30, 30, 18 | 400 hrs each |
| C-GHOY, C-GHOD, C-GHON | AS 350B3 | 14, 13, 12 | 450 hrs each |
| C-GHOQ | H125 | 2 | 550 hrs |
| C-GOHA (Twin engine) | AS 335NP | 7 | 350 hrs |

## CONDITION

Fleet asset condition is determined relative to various factors, notably: the ESL of the fleet based on overall mileage and/or engine hours (as applicable) and asset age, as illustrated in Table 4, and assessed mechanical condition. As explained in Section 4.2.2.3 below, these end of life criteria are used to identify assets due for replacement.

Table 4 shows ESL criteria for Hydro One's TWE assets based on Utilimarc's fleet lifecycle study and manufacturer recommendation.

**Table 4 - ESL of Fleet**

| Equipment Type | ESL Age (Years) | ESL Mileage (km) | ESL Engine Hours (Engine hours) |
|---|---|---|---|
| Light | 8 | 180,000 | N/A |
| Heavy | 11-14 | 300,000 to 400,000 | 14,000 |
| Off-Road | 14 | N/A | N/A |
| Miscellaneous | Individual Asset Assessment | N/A | N/A |
| Small Off-Road | 8 | N/A | N/A |

The mileage range of on-road vehicles is illustrated in Figure 1, with the Over Mileage column representing assets that have exceeded their ESL in terms of overall kilometres. Similarly, the age of the fleet by equipment type is illustrated in Figure 2, with the Overaged column representing assets that have exceeded their ESL in terms of age.

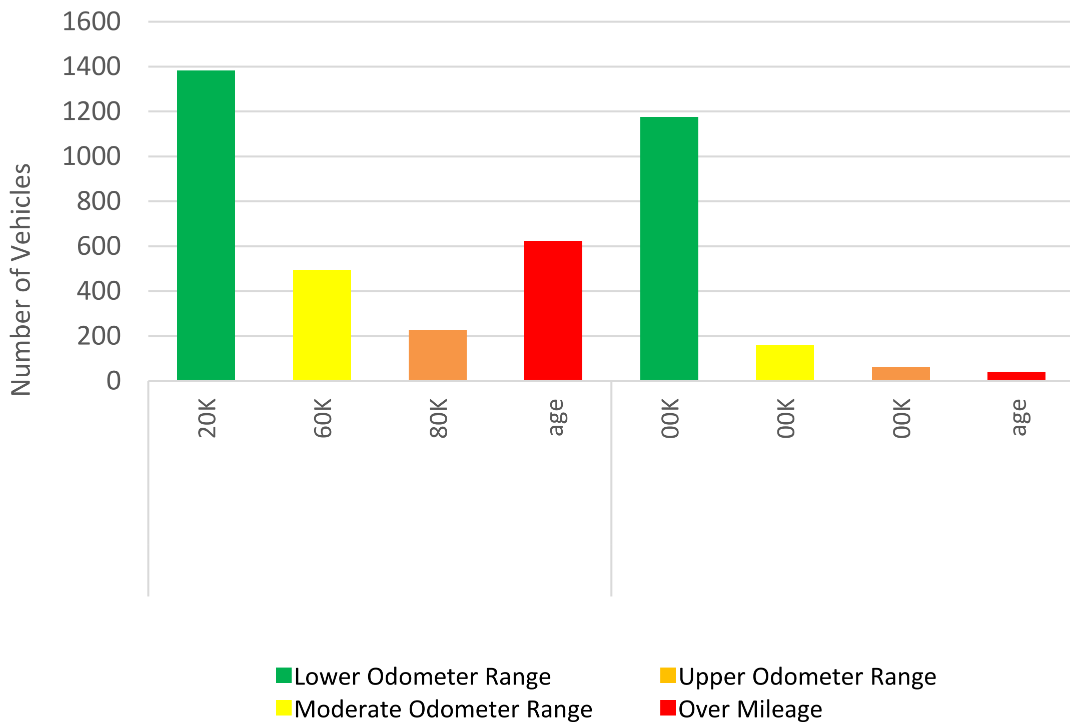



**Figure 1: Mileage of On-Road Fleet as of January 2021**

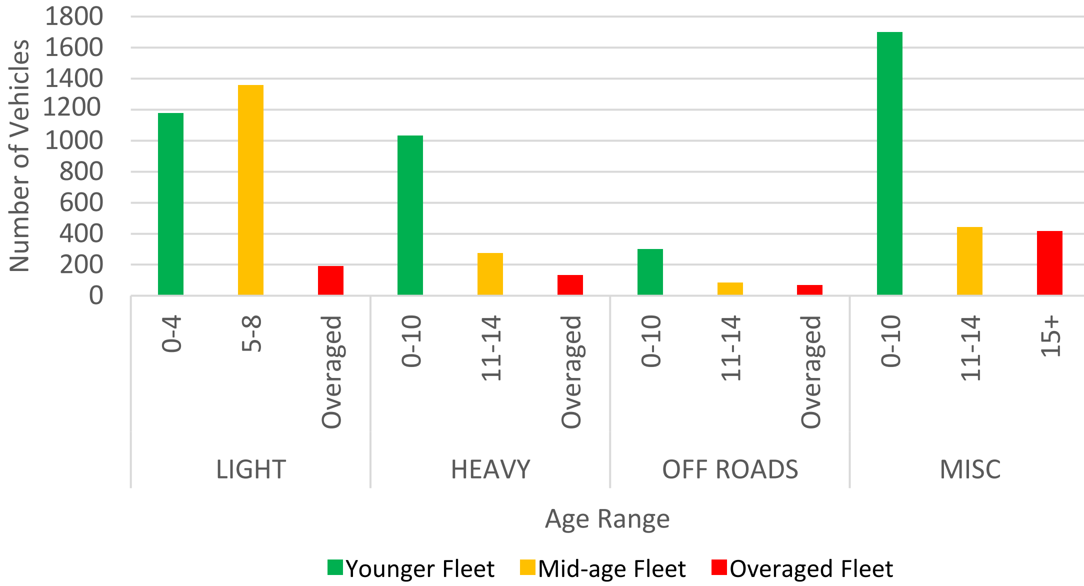



**Figure 2: Age of the Fleet as of January 2021**

The proportion of beyond ESL assets directly impacts the safe and reliable operations of TWE, leading to increased maintenance costs and downtime as more units become deteriorated in mechanical condition. At the fleet level, the proportion of assets beyond ESL must be managed to minimize TWE lifecycle costs. Based on Utilimarc's fleet lifecycle study in (see GSP Section 4.3, Attachment 2), Figure 3 below illustrates the significant projected increase in the proportion of beyond-ESL assets as well as the increase in average age from 2023 to 2027 if current funding levels are maintained.

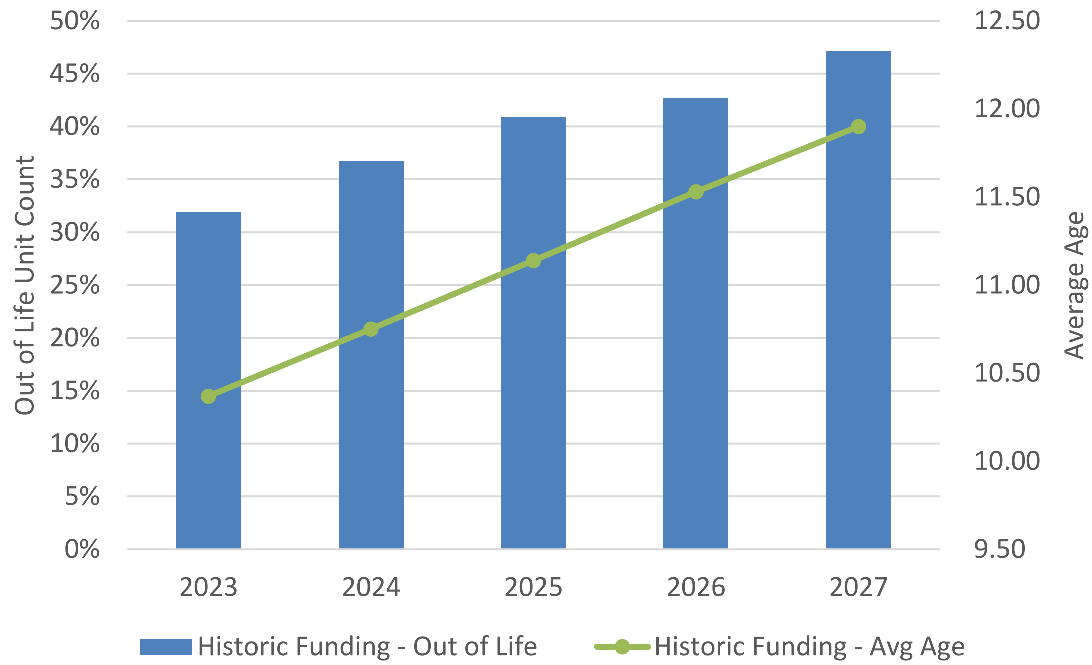



**Figure 3: Out of Life Unit Count and Average Age of the Fleet over the Planning Period assuming the Historic Funding scenario from Utilimarc's Fleet Lifecycle Study[2]**

**PERFORMANCE**

The performance of Hydro One's TWE assets can be assessed by their availability to meet work demands. In 2019, Fleet Management Services started to monitor the real time availability of heavy and off-road work equipment. Maintenance, inspection and repair work on this equipment is completed in-house by Hydro One's specialized heavy duty mechanics and tracked to measure and minimize downtime. For example, as a result of this additional monitoring and visibility, vehicles can quickly be redirected from a Hydro One garage that is at capacity to an alternate Hydro One garage that has repair capacity, leading to optimized garage space and reduced downtime. This means that equipment availability is maximized to enable work programs that are essential to deliver reliable and safe service to customers. In 2020, the average monthly uptime

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[2] Values are based on the Historic Funding scenario presented on page 13 of the Utilimarc Fleet Lifecycle Study (GSP Section 4.3, Attachment 2). "Out of Life" is the term used by Utilimarc to describe units that have exceeded their ESL.

of the heavy and off-Road category was 92%, an increase from the 2019 uptime of 90% (when monitoring began). Hydro One will continue to monitor garage production rates and strive for continuous improvement.

To maximize equipment availability while optimizing fleet size and associated costs, Hydro One manages and sets inventory levels based on actual staff counts requiring vehicles, composition and volume of work programs, geographic locations, utilization levels, and customer service commitments. Notably, location and performance of TWE are monitored using a fleet telematics system.[3] To ensure the optimal number of vehicles for work programs and staffing requirements, operational data derived from telematics is analyzed on a monthly basis to identify areas of performance improvement and to redistribute existing units according to work program needs. Increasing performance and redistributing TWE mitigate the need for pursuing other more costly options to meet the TWE demands associated with increasing Transmission and Distribution work programs – namely, short term rentals and new asset acquisitions.

Utilization metrics also provide an important lens to assess Hydro One's TWE asset management efficacy. As illustrated in the 2019 Fleet Operation Benchmarking Report (see GSP, Section 4.3 Attachment 1), only 17% of Hydro One's on-road vehicles are considered to be operating at low mileage levels, while the industry average is 30%.[4] Moreover, in 2020, 32% of the lines of business requests for additional, short-term equipment were satisfied by redeploying low utilized equipment instead of the more costly external rental option.[5] While this demonstrates Hydro One's ability to effectively maximize usage of existing TWE, it is also important to recognize that better than average utilization (coupled with fleet optimization in recent years) means fewer low mileage vehicles are available for redeployment to meet work program demands.

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[3] Fleet Management Services has implemented a telematics system for more than 4,700 fleet vehicles (on-road only) and 1,000 small off-road equipment. Through integrated telecommunications, GPS and informatics systems leveraging satellite and cellular data, telematics provides the location of vehicles as well as live operation and performance data. It also serves as a Driver Behaviour Modification System by educating and informing drivers of any speeding habits, harsh driving events and idling statistics.
[4] Utilimarc, 2019 Fleet Operations Benchmarking Report (2020) – GSP Section, 4.3 Attachment 1, page 24
[5] Where required, external rentals are utilized for short term projects and work programs but have costs approximately 40% higher than owned equipment rates based on an internal assessment.

The helicopter fleet is maintained according to strict schedules dictated by the manufacturer and approved by Transport Canada based on hours flown between inspections. These inspections occur at 150 hour intervals and ensure that the helicopters remain airworthy and available to support work program execution. Upcoming maintenance events are closely monitored and individual helicopters are rotated throughout the province to maximize availability. Furthermore, whenever possible, major maintenance inspections (e.g. after 600 flight hours) that take 4-6 weeks to complete are scheduled to occur during slower periods of programmed work (typically November through January).

#### 4.2.2.3 ASSET LIFECYCLE

Fleet Management Services manages its assets through acquisition, maintenance, replacement and disposition to provide safe and reliable TWE that is available when and where needed to support Transmission and Distribution work programs. As further discussed below, preventative maintenance and service intervals help to reduce degradation and gather asset data; while asset mechanical condition and maintenance history, as well as age, kilometres, engine hours and cost per kilometre, are the primary criteria used to determine replacement needs.

Helicopter Services manages the life cycle maintenance and replacement of its fleet based on compliance with the manufacturer's recommended maintenance programme and Transport Canada regulatory requirements. Individual helicopters undergo regular inspection cycles from 100 hours to 5400 hours. The helicopters undergo a major inspection, teardown and rebuild every 12 calendar years, and are kept in service provided they remain airworthy.

**INSPECTION AND MAINTENANCE PROGRAM**

Fleet Management Services has developed a balanced maintenance model to efficiently service and repair equipment and minimize downtime. Preventative maintenance and service intervals help to reduce degradation and maximize the life of the asset. Table 5 below summarizes the maintenance and service intervals for TWE.

**Table 5 - Fleet Maintenance Service Interval Guidelines (Transport and Work Equipment)**

| Equipment Type | Lube, Oil, Filter | | | Dry Services | Type of work |
|---|---|---|---|---|---|
| | km | Engine Hours | Months | Months | |
| Light | 8,000 | - | 6 | N/A | • Service<br>• Annual Inspection |
| Light - dual wheels | - | 200 | 6 | 3 | • Service<br>• Annual Inspection<br>• Attachment Inspection |
| Heavy - Service Trucks, Compact Bucket trucks | - | 500 | 6 | 3 | • Service<br>• Annual Inspection<br>• Attachment Inspection |
| | Replace fuel Filter at every oil change with OEM Filter | | | | |
| Heavy – RBD and Bucket Trucks | - | 250-500 | 12 | 3 | • Service<br>• Annual Inspection<br>• Attachment Inspection |
| | Replace fuel Filter at every oil change | | | | |
| Miscellaneous | - | 250 | 12 | 3-6 | • Service<br>• Annual Inspection<br>• Attachment Inspection |

Work crews can arrange to have local mechanics provide service at their work sites or the asset can be transported to a centralized facility. There are over 45 provincial maintenance hubs that are strategically positioned throughout the province (shown in Figure 4 below) to provide high quality service and minimize response and travel time.

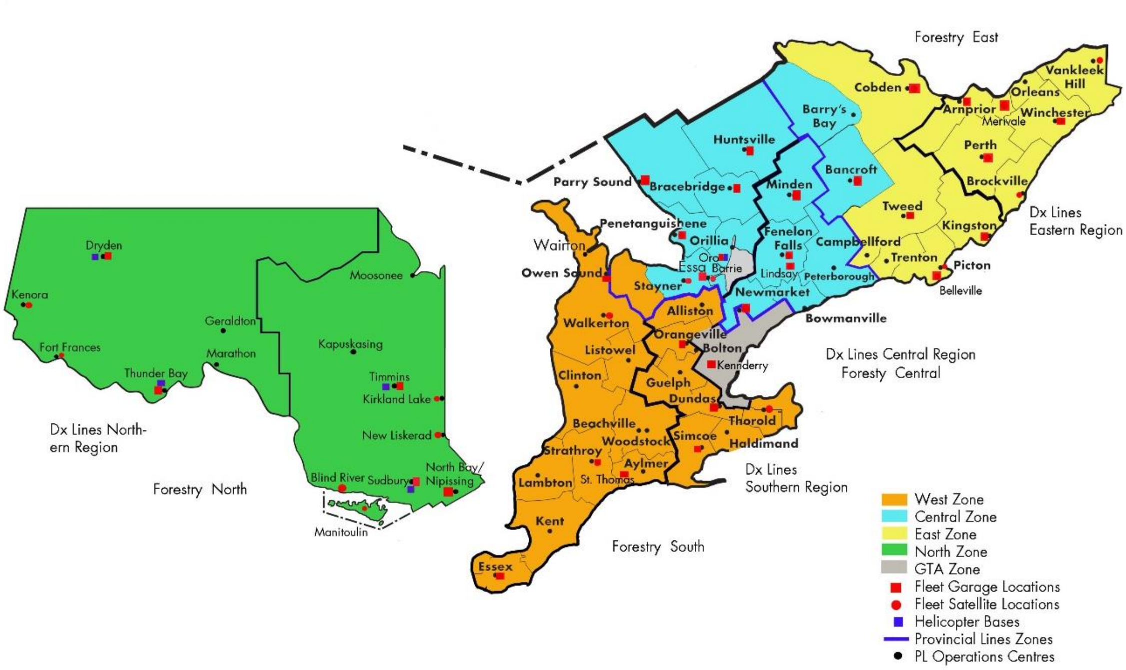


**Figure 4: Map of Fleet Garages and Helicopter Hangers**

Fleet Management Services employs specialized heavy duty mechanics that inspect and repair heavy, off-road and miscellaneous equipment. Hydro One's skilled technicians and their service trucks provide timely on-site field support for various nomadic work programs, such as vegetation control, new construction and off-road tower maintenance. As Motor Vehicle Inspection Stations licensed by the Ministry of Transportation, Hydro One's garages ensure that fleet vehicles are adequately maintained to ensure public safety, employee safety, and compliance with laws and regulations (including CSA 225, the *Ontario Highway Traffic Act*, and Commercial Vehicle Operator's Registration requirements).

For light duty vehicles, Hydro One outsources all inspections, services and repairs. This approach allows Hydro One technicians to focus on the inspection and repairs of the specialized hydraulic equipment. All external vendors must receive pre-approval from authorized personnel in Fleet Management Services prior to the commencement of any work.

As technicians monitor and assess the condition of TWE assets during inspections and routine maintenance, their findings are logged as maintenance history in a Garage Management System (GMS). Other information managed through the GMS includes internal labour, and inventory levels and warranty information. Fleet Management Services is in the process of improving the GMS, to be completed in 2021, which will allow for improved analytics, inventory management, work scheduling and warranty management. The maintenance program provides visibility to repairs and equipment downtime, which will assist in maximizing equipment availability and performance. Both internal and external service providers have access to relevant information through this automated management system, allowing for fact-based decision-making at all levels of the maintenance program.

Helicopter services has structured its operations to efficiently support the various lines of business, with four remote locations in northern Ontario and a main operating and maintenance base in southern Ontario, shown in Figure 4 above. All maintenance and operations activities are governed by federal regulations (Canadian Aviation Regulation) and the aircraft manufacturer's instructions and receive oversight from the regulator on an annual basis.

In addition, service intervals for Hydro One's helicopters (based on flight hours) guide the inspection and maintenance for the airframe, hydraulic servos, main gearbox, tail gearbox, engine, engine modules and fuel controls. Complete refurbishment of the hydraulic servos, main gearbox, tail gearbox engine modules and fuel controls are also completed based on the flight hours or age of the unit. Inspection cycles run on a 150hr / 300hr / 600hr / 12 year cycle with varying degrees of maintenance work required at each milestone.

**ASSET REPLACEMENT AND REFURBISHMENT**

To determine possible candidates for replacement, Fleet Management Services completes annual asset reviews to identify assets that have reached their ESL in terms of years or mileage (including engine hours, where applicable). Lines of business provide feedback on actual vehicle performance for any asset candidates identified for replacement. Mechanical assessments are also performed by Hydro One's specialized technicians to determine if the asset can be retained for an additional period of time or if the asset needs to be replaced based on the costs to maintain or repair the unit. In addition, Fleet Management Services considers equipment downtime and reliability, line of business operational needs, safety risk, and the procurement lead-time and availability of specialized equipment in making replacement decisions.

The TWE Replacement Program balances capital and operating expense exposure to maintain a safe, reliable and cost effective fleet. In this regard, it is imperative to evaluate and forecast capital spending requirements to minimize large fluctuations in spending levels and to stabilize long term capital investment, as discussed in GSP Section 4.11, G-GP-01. A reduction in capital spending in a given year is likely to eventually result in increased operating costs, which could ultimately result in increased equipment rates directly impacting the costs of work programs (rates are discussed in Exhibit C-09-03).

Helicopters are replaced on a case by case basis depending on utilization, condition of the aircraft and the cost of refurbishment. The strategy for the replacement of helicopters is designed to minimize the risks of equipment failure, emergency response time, work program repair time and costs, as well as environmental impacts. The helicopter types / models chosen in the replacement program will be purpose fit to support both current and future lines of business work activities. The current aircraft models (AS350) are the most widely used single engine aircraft in Canada and the newest variant of this aircraft provide additional engine performance and enhanced safety features. For some of the low level patrol work, it is anticipated that a next generation twin engine helicopter will be added to augment the fleet of single engine helicopters.

### 4.2.3 FACILITIES AND REAL ESTATE

#### 4.2.3.1 ASSET DESCRIPTION / PURPOSE

Hydro One’s Facilities and Real Estate (F&RE) manages sites and buildings located across the Province of Ontario that support administrative and service functions across the various Lines of Business and network system assets. F&RE assets are geographically distributed to align with the configuration and demands of Hydro One’s network and customers, as well as the diverse operational requirements of the various Lines of Business.

The sites and buildings managed by F&RE can be broadly divided into two main categories:

- Operational facilities – These include administrative centres, operation centres, maintenance/work centres, warehouses, maintenance garages, helicopter hangars and material storage yards. Operational facilities are key to ensuring a safe and productive working environment for Hydro One personnel, directly enabling each of the Lines of Business to accomplish their objectives, complete their core work programs and accommodate changes in their business and operating requirements.
- Network buildings – These include buildings and supporting infrastructure that house power system-related network equipment (e.g. protection and control equipment, batteries etc.). Network buildings are crucial to the ongoing safe, reliable and secure operation of the network equipment as they are integral to Hydro One's power system.

Notably, approximately 20% of the operational related facilities supporting Hydro One's transmission work program are located on the same site as the network buildings. These facilities are often configured to allow the co-occupancy of staff and network equipment, either as originally planned or through repurposing of space (e.g. conversion of control or legacy operating rooms).

#### 4.2.3.2 ASSET DEMOGRAPHICS AND CONDITION

**DEMOGRAPHICS**

Hydro One F&RE manages over 1,400 buildings, including over 1,000 network buildings across 352 transmission and 1,029 distribution sites, plus approximately 400 buildings across 135 operational facilities located throughout the province. All of these transmission and distribution related sites and facilities are owned by Hydro One, except for the facilities that are leased on approximately 45 sites.

The average age of the network buildings is approximately 62 years old, and their overall age demographic profile is illustrated below.

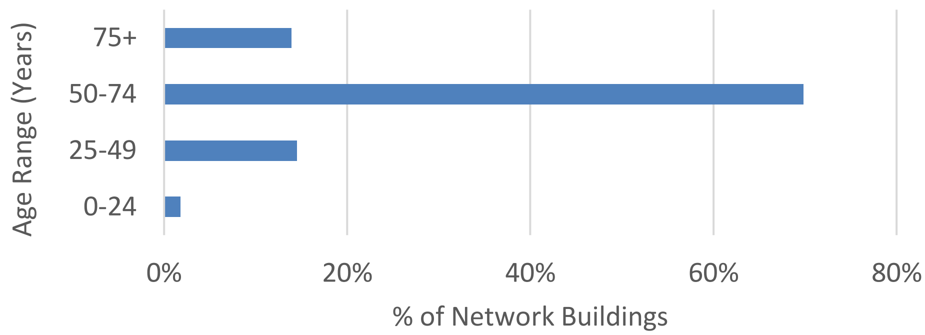


**Figure 5: Age Range of Network Buildings**

**CONDITION**

To effectively evaluate Hydro One's portfolio and understand the on-going condition of its assets (i.e. systems and structure), Hydro One conducts Building Condition Assessments (BCAs). The BCAs provide Hydro One with an understanding of the condition, performance of major building and site components to define the scope of work required at each facility to address deficiencies. BCAs are detailed engineering reviews of Hydro One's facilities conducted to ensure their effective management and maintenance. This allows for the appropriate prioritization of work based on needs/issues identified to meet lines of business requirements. In addition, Hydro One leverages BCA site visits to perform Virtual Location Surveys (VLSs) to obtain 3D views of facilities, which allow for improved visibility on the condition of our assets (see 4.2.3.3 below for more details).

BCAs document a range of factors, including environmental issues such as mold or water treatment upgrades, adequacy for work program and space demands, and security and safety concerns for employees and first responders. Once the BCA is completed, the overall average Facility Condition Index (FCI) score for each facility and overall site is determined. The FCI score is an industry standard measure used to compare relative building conditions over a specified time frame. Typically, buildings are assessed with an FCI score in a 5-year timeframe of facility maintenance. The calculation takes into account the cost of existing or deferred capital deficiencies within the next 5 years as a percentage of the current replacement value of the building.

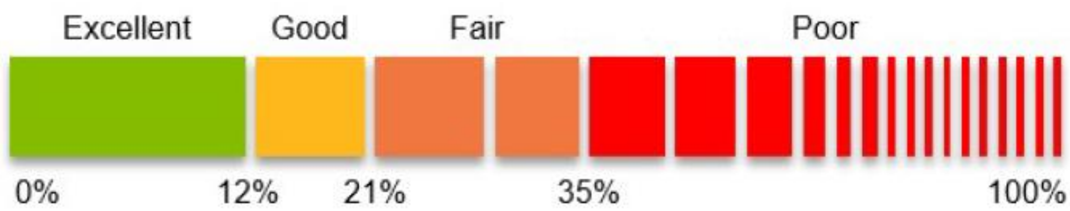


**Figure 6: FCI Index Scale**

As displayed in Figure 6, the lower the FCI score, the better the condition of the facility. As the FCI score rating increases/worsens, the facility is expected to experience an increased risk of component failure and operation and maintenance costs. BCAs are completed annually on a 5-year cycle by selecting a sample of the facility portfolio based on system criticality (i.e., operating voltage of the transmission station, designated forward command posts, and emergency preparedness impacts etc.). Figure 7 below shows a breakdown of condition category results based on the most recent FCI scores obtained. Without adequate capital investments, it is estimated that half of F&RE's assets will reach a poor FCI score by 2027.

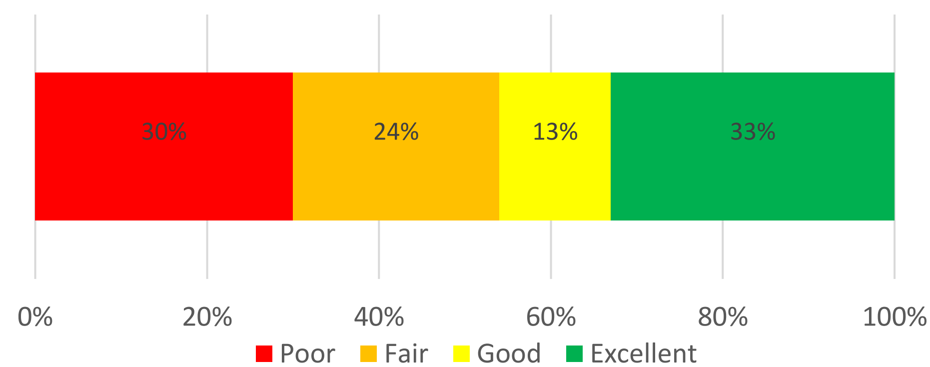


**Figure 7: Building FCI Results by Condition Category**

#### 4.2.3.3 ASSET LIFECYCLE

Hydro One's F&RE asset strategy is to maintain facilities in accordance with a lifecycle approach by conducting planned maintenance of key facility systems and infrastructure and undertaking inspections at an appropriate frequency to identify and trigger corrective maintenance.

**INSPECTION AND MAINTENANCE PRACTICES**

**Preventative Maintenance and Visual Inspections**

Hydro One's facilities maintenance program is mainly supported by preventative maintenance programs and BCAs at planned frequencies. Preventive maintenance practices (i.e. visual inspections and maintenance of essential equipment) help ensure facility assets are in acceptable operational condition, prevent equipment failure, and reduce health and safety risks.

Visual inspections are conducted at all the facilities (with frequencies ranging from monthly to annual) to monitor and optimize asset performance. Each facility and its major sub-systems (e.g., lighting, fire extinguishers, spill kits, eye wash stations, first aid kits and fences, etc.) are visually inspected on a monthly basis. Monthly or annual visual inspections are completed on the building envelope and site. Annual inspections address fire systems, building auxiliary systems, sewage system, roof, and foundation and floor pads. In addition to regularly scheduled inspections, Hydro One may carry out additional inspections after storms, earthquakes, fire, vandalism, or other notable incidents.

HVAC (heating, ventilation, and air conditioning) maintenance is typically done at transformer stations during spring start up and fall shut down as part of the switching between heating and cooling. Similarly, some of the Operating Centre and Admin offices under HVAC maintenance are performed twice per year. This routine maintenance aids to increase the life of the asset and improve operational efficiency.

Findings from preventative maintenance reports are reviewed and documented, and depending on the type of defects, either corrective work or a capital project is initiated.

**Building Condition Assessments (BCAs)**

As described in Section 4.2.3.2, BCAs provide Hydro One with comprehensive insight on a facility's condition to assist in developing capital plans. BCAs are site reviews from ground to roof level, evaluating the condition of all major systems (e.g. structure, exterior, mechanical, electrical, interior etc.). The BCAs are different from regular inspections as they follow the industry standard *ASTM E2018 Standard Guide for Property Condition Assessments: Baseline Property Condition Assessment Process*, which is based on operational and corporate requirements, regulatory requirements and general commercial standards commonly employed by the facilities management industry. The goal of this process is to obtain accurate, consistent and current condition data to enhance Hydro One's visibility and management of its F&RE portfolio. Hydro One outsources the execution of facility maintenance and inspections to BGIS Global Integrated Solution Canada LP (BGIS). As part of the BCAs, the risk impact and probability relating to major building components are assessed, where (i) impact is based on the building's criticality to Hydro One's operations and (ii) probability is based on the likelihood of risks materializing (including health and safety risks, which are considered critical).

In 2019, Hydro One began conducting VLSs which produce digital files containing: interactive panorama of interior spaces; digital floor plans of the areas surveyed; and photo galleries of the exterior buildings, elevations, table of building dimensions and location map. These surveys assist in capital planning as a valuable tool to help Facility Managers to maintain operational awareness and drive operational efficiencies. Specifically, VLSs help save employee resources by not having to travel to sites and are easily accessible to view on multiple occasions.

**ASSET REPLACEMENT**

In line with the F&RE asset strategy, the results from the preventative maintenance and BCAs either trigger corrective maintenance, capital renewal or replacement, or are documented and re-evaluated in future planning cycles.

The level of corrective maintenance performed at each site depends on a combination of factors, including whether the site is owned or leased, the remaining estimated life of the asset, and future operational requirements. There is an exception with respect to Hydro One's leased facilities, where some of the burden of capital repairs and/or replacements resides with the lessor, other than those specific to Hydro One's operations, such as tenant improvements.

Candidate renewal or replacement investments triggered from preventative maintenance and BCAs are further reviewed to ensure the overall lifecycle costs of the assets are minimized and to incorporate operational requirements, business needs and opportunities for further cost efficiencies. Some of these additional considerations include right-sizing the utilization of the facilities, reducing Hydro One's environmental footprint, and prioritizing investments in high risk assets, so as to support safe and efficient work execution and mitigate increasing costs/risks associated with end of life assets. For example, F&RE considers ways to invest in energy efficiency initiatives to reduce environmental impacts and lower operating costs over the long-term. These initiatives include, the Remote Command Centre pilot program to enhance operational efficiency, and supporting Hydro One's planned transitional to Electric Vehicle (EV) commercial fleet. Further details on these considerations and the process of prioritizing investments are discussed in GSP Section 4.7.3.1.

By effectively maintaining and maximizing the useful life of its assets, F&RE enables operational continuity and productivity by meeting the facility-related needs of various Lines of Business (each with distinct requirements for facility size, configuration and functions), providing adequate protection for high criticality electrical equipment, and ensuring a safe operating environment for employees and customers.

### 4.2.4 INFORMATION SOLUTIONS AND SYSTEM OPERATIONS

#### 4.2.4.1 ASSET DESCRIPTION / PURPOSE

Information Solutions is accountable for Information Technology (IT) and Security assets, and System Operations is accountable for the planning function for Operating Technology (OT)[6] assets. IT, OT and security assets enable Hydro One's Transmission and Distribution businesses to effectively perform day-to-day operations and meet customer service obligations.

**IT Assets**

IT systems refer to technology that supports cross-business capabilities, including: customer functions such as billing or external facing websites and applications; internal corporate functions such as finance and human resources; work and asset management functions such as work program planning, scheduling and execution, and asset details and condition reporting; and the underlying IT hardware, software and applications that are required to run these functions. IT systems include both IT hardware and IT software applications (including approximately 800 business software applications) that span across 140 office locations and data centres. IT hardware includes servers, enterprise data storage, computers (e.g. desktops, laptops, and tablets), printers and plotters, and telecommunication infrastructure (including switches and computer-telephony interfaces that support across the entire business). The reliability and security of these systems are crucial as they must be available to customers and to the personnel delivering Hydro One's business services to serve customers effectively.

**OT Assets**

OT systems comprise of physical hardware, operating tools and applications that directly enable the monitoring, control, and operations of the Transmission and Distribution power network through Hydro One's control centres. OT systems include: the Transmission and Distribution network management systems that provide tools to control, monitor and operate the transmission and distribution network, respectively; and the outage management system that

[6] Responsibilities for OT-related assets are shared between Information Solutions (build and run) and System Operations (planning).

provides tools for outage response and crew dispatch for efficient restoration. These systems are required to maintain compliance with regulatory standards, including the North American Electricity Reliability Corporation (NERC) reliability standards and the OEB's Transmission System Code, and encompass assets ranging from critical network applications to the supporting IT infrastructure, including data storage, computer servers, computer consoles, IT networks and operating systems.

**Security Assets**

Security assets protect Hydro One's Transmission and Distribution system assets as well as IT and OT systems from personnel, physical and cyber threats, and encompass a range of both hardware and applications. Physical security assets provide protection in the form of physical barriers, surveillance equipment, alerting and alarming technology, security lighting, intercoms, and access controls. Surveillance systems are operated using a dedicated Video Surveillance Telecom System (VSTS) to mitigate the risks of failure or tampering.

Physical access control systems (including card readers, door alarm monitoring and associated sensors) are used to trigger alerts in response to detected unauthorized access. These physical security assets ensure compliance with (i) NERC CIP-006 *Physical Security of Bulk Electric Systems (BES) Cyber Systems* which requires physical access control and monitoring of critical transmission station cyber assets within secured perimeters and (ii) NERC CIP-014 *Physical Security*, which requires specific minimum protection criteria at any transmission station, substation or associated primary control centre that that if rendered inoperable or damaged as a result of a physical attack could result in widespread instability, uncontrolled separation or cascading effects to the bulk energy system.

Hydro One also maintains cybersecurity assets, required for identification, protection, detection, response and recovery from cyber threats. These assets include intrusion detection/prevention equipment; authentication, authorization and accounting technology; electronic security perimeter equipment (firewalls); and log collection devices.

### 4.2.4.2 ASSET DEMOGRAPHICS AND PERFORMANCE

**DEMOGRAPHICS**

**IT Minor Fixed Assets**

Hydro One's IT Minor Fixed Assets (MFA) program accounts for the hardware and IT equipment that support the continued operation of Hydro One's Information Solution systems, which in turn serve the company's business operations and customers. The MFA program includes (i) core assets, such as servers and computers, as well as (ii) business telecom equipment, which transmits voice and business data required for the company to run business applications. This includes the network to connect end users to the various applications running from data centres. A summary of the hardware categorized within MFA is shown in Table 6 below.

**Table 6 - IT Minor Fixed Assets**

| Category | Description | Quantity | Average Age (Years) |
|---|---|---|---|
| IT Core Assets | Enterprise Physical Servers | 583 | 4.0 |
| | Desktop Computers | 1,195 | 5.4 |
| | Laptop Computers | 7,075 | 2.3 |
| | Tablets | 1,748 | 4.6 |
| | Printers and Plotters | 1,218 | 5.8 |
| | Volume of Enterprise Data Storage (TB) | 5,000 | 2 |
| IT Business Telecom Assets | Network Routers | 169 | 9.2 |
| | Network Switches | 604 | 7.1 |
| | Firewalls | 26 | 3.8 |
| | UPS Systems | 253 | 4 |
| | Cisco IP Phones | 9724 | 8 |
| | Wireless Access Points | 550 | 4.9 |
| | Load Balancers | 12 | 4.2 |

**IT Applications**

Hydro One has a large number of applications that are used to support and maintain business operations. One of Hydro One's most critical applications is its SAP Enterprise Resource Planning (ERP) software suite. Enterprise applications are large, complex systems that are used for core business functions, and make up the majority of the application architectural landscape. SAP is a central application that is used throughout the company with different modules supporting the management of assets (including their condition), investments, projects and work programs, inventory and warehousing, supply chain management, finance, time reporting, human resources, customer information and relationships, and billing. The SAP modules currently in use by Hydro One include:

- SAP APO (Advanced Planner and Optimization)
- SAP ARIBA and SAP Field Glass (Supply Chain Management)
- SAP BOBJ (Business Objects)
- SAP BODS (Business Object Data Service)
- SAP BPC (Business Planning and Consolidation)
- SAP BW (Business Warehouse)
- SAP Concur
- SAP CRM (Customer Relationship Management)
- SAP EAM (Enterprise Asset Management)
- SAP EHSM (Environment, Health, & Safety Management – Incident Management)
- SAP EP (Enterprise Portal)
- SAP FI/CO (Financial Accounting and Controlling)
- SAP GRC (Governance Risk and Compliance)
- SAP HCM (Human Capital Management)
- SAP Information Steward
- SAP IM (Investment Management)
- SAP ISU (Industry Specific Utilities, used for billing functions)
- SAP IQ (Intelligent Query)
- SAP MM (Material Management)
- SAP PI (Process Integration)
- SAP PM (Plant Maintenance)
- SAP PS (Project System)
- SAP SCM (Supply Chain Management)
- SAP SD (Sales and Distribution)
- SAP Solution Manager

- SAP Success Factors
- SAP WM (Warehouse Management)
- SAP Work Manager

Another example of a critical application managed by Information Solutions is the enterprise geographic information system (GIS) system. This system provides the geospatial connectivity view for the Transmission and Distribution network, which is used by many work processes and acts as the backbone for the Distribution Management System.

With respect to customer service focused technologies, Information Solutions manages the Computer Telephony Integration (CTI) technology platform that is the essential workforce management and work routing engine for the Hydro One contact centres. It allows Hydro One to forecast, schedule and manage staff, as well as ingest, route and report on customer-focused work from its SAP, email, telephone and website platforms. This allows Customer Service staff to respond to customer requests in a timely manner, and ensures that Hydro One is managing work in a responsible and balanced fashion. CTI is a core platform that can be leveraged for the rest of the enterprise for similar work functions in the future.

**OT Assets**

Assets within the OT group's domain are referred to as Common Operating Technology Infrastructure (COTI), which are managed separately from IT MFAs. COTI is required for critical network operating systems that are used to monitor and control the Bulk Electric System (BES). COTI assets are managed to meet the 24/7 reliability and cybersecurity needs of the system operations control room. A summary of the COTI hardware categories is provided in Table 7 below.

**Table 7 - Operating Common Information Technology Infrastructure**

| Category | Description | Quantity | Average Age (Years) |
|---|---|---|---|
| OT Assets | Enterprise Physical Servers | 284 | 2.6 |
| | Desktop Computers | 477 | 2.3 |
| | Laptop Computers | 188 | 2.6 |
| | Volume of Enterprise Data Storage (TB) | 2000 | 3.5 |
| | Network Routers | 160 | 3.9 |
| | Network Switches | 267 | 4.8 |
| | Firewalls | 92 | 4.2 |
| | Load Balancers | 8 | 2.9 |

An example of a critical application managed within the OT domain is the Network Management System (NMS). This system is used to control switching operations and alarm monitoring at Hydro One's control centres - the Integrated System Operations Centre (ISOC) and the Back-Up Ontario Grid Control Centre (BUOGCC). The NMS is vital for the safe, efficient and reliable operation of Hydro One power system assets, work protection of field staff, as well as the reliability of the overall northeast grid.

**Security Assets**

Security assets protect Hydro One’s power system and business operations from personnel, physical and cybersecurity threats. The use of access roles, segregation of duties, protected passwords and multi-factor authentication systems prevent unauthorized access and keep a robust audit trail of system access and user actions. Security applications also include data monitoring and retention, data loss prevention and cyber vulnerability assessment and penetration testing applications. These cybersecurity assets, along with the personnel and physical applications play an integral role in protecting Hydro One’s power system assets, business functions and customer information and provide efficient response and recovery in the event of a security threat.

Hydro One’s central physical security monitoring systems across the province are dependent on centralized virtual server infrastructure comprising over 25 IT servers and appliances. The physical security systems reside on the dedicated Video Surveillance Telecom System (VSTS) network that enables continual connectivity and monitoring of 145 facilities and encompasses over 700 networking assets (including switches, routers and firewalls). Physical barrier security assets can range from protecting facilities' perimeters through fencing, gating and barriers to providing protection of critical assets from tampering or malicious damage. In addition, physical access control systems trigger alerts in response to detected unauthorized access. Hydro One also maintains cybersecurity assets, required for identification, protection, detection, response and recovery from cyber threats.

A summary of Hydro One's security hardware assets can be seen in Table 8 below.

**Table 8 - Security Hardware Asset Summary**

| Description | Quantity | Average Age (Years) |
|---|---|---|
| Access Control Equipment | 1521 | 2.8 |
| Access Control – Peripherals[1] | 3289 | 2.8 |
| Automated Gates | 69 | 5.5 |
| Cameras | 1468 | 5.8 |
| Perimeter Lighting Systems | 6 | 1.7 |
| Intercoms | 134 | 5.4 |
| Sensors | 6463 | 6.0 |
| Video Surveillance Telecom System Networking Assets | 715 | 5.5 |
| Virtual Servers, Hosts and Storage Infrastructure | 25 | 3.0 |
| Cyber Collection Devices | 39 | 1 |
| Network inspectors and analyzers | 7 | 2 |

[1]*Peripherals include items such as batteries, lock boxes, card readers, and invertors.*

**PERFORMANCE**

The main asset performance measurement utilized within Information Solutions is system uptime. This represents the total available time that a system was available to end users to allow continued business operations. Issues affecting physical data center, network connections, or the application software may result in potential downtime to the end user and impact business performance.

When an application is placed into service, the required system availability is assessed based on criticality to business operations. As part of the application's lifecycle management, it is monitored and maintained to achieve the desired availability level.

Applications within IT Operations that are critical to Hydro One have historically been assigned a Support Level (SL) designation when placed in service, either SL-1 or SL-2 rating. These applications are required 24 hours per day, 7 days a week, 365 days per year. GIS and SAP are examples of SL-1 applications based on their overall importance to manage and maintain the grid and customer billing functions. . As shown in Table 9 below, the actual availability for SL-1 and SL-2 applications exceeded their expected system availability in 2020.

**Table 9 - Uptime Expectations by IT Support Level**

| Support Level | Expected System Availability | Minimum System Availability | 2020 Actual System Availability |
|---|---|---|---|
| SL-1 | 99.91% | 99.53% | 99.98% |
| SL-2 | 97.30% | 95.25% | 99.98% |

Similarly in OT Operations, critical applications are identified when being placed in service. Critical OT systems have a target uptime of 99.95%. In 2020 the actual uptime of such systems, including NMS, DMS (Distribution Management System), ORMS (Outage Response Management System), and IVCT (Integrated Voice Communications Technology), was 99.99%.

### 4.2.4.3 ASSET LIFECYLE

**IT AND OT HARDWARE**

To assess hardware condition and need for replacement, Hydro One follows industry standard practice of an asset lifecycle management approach, which aims to ensure that vendor support is available and decrease the likelihood and impact of asset failure. Hardware asset replacement or upgrade decisions account for factors based on software lifecycles, vendor upgrade and supportability schedules, business and customer requirements, and experience with similar equipment. Large enterprise applications (e.g. Microsoft) may also increase hardware requirements, which can in turn increase the need for asset refresh.

In general, replacement of IT hardware is planned every three to five years. This is consistent with industry practices outlined by leading technology analytic organizations including Gartner. This timeline also aligns with information received from vendors around product support agreements and end of sale announcements, and is consistent with the fact that hardware maintenance costs typically increase materially after four to five years of in-serve life. Further details on IT asset replacement plans can be found in GSP Section 4.11, G-GP-05.

For OT hardware, the lifecycle of the individual components vary and require replacement at different intervals. While computing systems are capable of providing acceptable services over their lifespan (up to 5 years in some cases), end of life systems are likely to exhibit slower processing capability when handling complex electric grid operations, state estimation and simulation exercises, which are fundamental to reliable and safe grid operations. In addition, the expiry of vendor support means that performance issues or failures that arise may not be readily resolvable. According to original equipment manufacturer recommendations, such complex systems and tools need to be replaced on a lifecycle approach in order to ensure the availability of critical spares. Further details on OT asset replacement can be found in GSP Section 4.11, G-GP-12.

The purchase and replacement of MFAs are completed to meet the growing demand for IT services and devices across the company, address potential capacity and processing limitations, and address devices that are end of life. Replacement of hardware is typically done based on device age and also factors in applications that may be running on the hardware. Where possible, equipment may be upgraded or enhanced to extend the asset's useful life and meet business demands.

**IT & OT APPLICATIONS**

IT and OT software applications are managed through a lifecycle program similar to hardware. A number of considerations are factored into determining whether an application should be replaced or upgraded, including:

- ability to maintain vendor support, and required upgrade support schedule;
- age (lifecycle) of the existing application and the costs of maintaining aging systems;
- customer and lines of business technology functionality/capability requirements;
- legislative changes or market driven initiatives, including evolving security requirements;
- complexity, cost and duration of the upgrade process;
- potential impact to the business (e.g. tolerance for downtime);
- risk, dependencies and potential impacts to other applications; and
- integration and interoperability with other applications.

As an example, in preparation of SAP ending support of the current platform, Hydro One is performing a multi-year transformation of its SAP landscape to the newer supported landscape. Currently, Hydro One uses SAP version R3, which SAP will not support beyond 2027. As a result, Hydro One is upgrading each of its modules to the most current SAP version (S4/HANA). Due to the complexities involved with the large SAP landscape, Hydro One is taking a phased replacement approach based on consultation with SAP, industry peers, and industry specialists. The SAP SCM (Supply Chain Management) function has been moved from SAP R3 ERP to SAP ARIBA and SAP Field Glass, and the SAP HR module is currently being moved to the SAP S4/HANA Success Factor module. Additional modules that will be converted during the JRAP period include:

- Finance related modules such as the SAP FI/CO (Financial Accounting and Controlling), SAP Treasury Management, SAP Analytics, SAP BW (Business Warehouse), SAP BPC (Business Planning and Consolidation) and SAP EHSM (Environment, Health and Safety Management) are being upgraded to SAP S4/HANA, as described in GSP Section 4.11, G-GP-06.
- Customer and billing related modules such as SAP CRM and SAP ISU are being converted to SAP S4/HANA, as described in GSP Section 4.11, G-GP-07.

- Work and asset management related modules, including SAP PM (Plant Maintenance), SAP MM (Material Maintenance), SAP WM (Warehouse Maintenance), SAP SD (Sales and Distribution), SAP PS (Project Systems), and SAP IM (Investment Management), are being upgraded to SAP S4/HANA, as described in GSP Section 4.11, G-GP-08.

To assess the need for COTI applications upgrade or replacement, Hydro One considers factors that include vendor support and equipment compliance with cybersecurity requirements. Due to the required reliability to maintain critical network operating systems for managing the electric grid, the primary driver of OT asset lifecycle management is maintaining vendor support to lower support costs and decreasing likelihood of failure. Further details on OT asset replacement plans can be found in GSP Section 4.11, G-GP-12.

A summary of identified system application investments across IT and OT that include new functionality, replace or upgrade end of life applications, and focus on meeting compliance needs can be found in the following Investment Summary Documents:

<u>Information Technology Application Investments:</u>

- GSP Section 4.11, G-GP-05 – IT Services Enablement
- GSP Section 4.11, G-GP-06 – Corporate Services Enablement
- GSP Section 4.11, G-GP-07 – Customer Service Technology Enablement
- GSP Section 4.11, G-GP-08 – Work and Asset Management Enablement

<u>Operating Technology Application Investments:</u>

- GSP Section 4.11, G-GP-16 - Network Management System Investments
- GSP Section 4.11, G-GP-17 - Outage Response Management System Upgrade
- GSP Section 4.11, G-GP-18 - Distribution Management System Upgrade

**SECURITY**

Security assets are managed with a philosophy that a failure would result in high-consequences, due to the required dependence on the reliability of these critical systems for the security, control, and reliability of Hydro One facilities and assets. Hydro One must maintain compliance with NERC CIP physical security standards. Security assets may reach operational obsolescence due to technology limitations, end of manufacturer support (including the ability to obtain ongoing security patches and firmware updates) and where such assets no longer integrate effectively with present-day security monitoring systems. The typical useful life of security assets is between five to ten years, which some exceptions. These lifecycles are based on the factors noted above, and align with industry standards.

Cybersecurity assets and any physical or personnel security assets that require vendor supported technology follow the same methodology as IT and OT assets. They are considered end of life when they are no longer vendor supported. Vendor support is essential for these systems, as inoperability would leave Hydro One vulnerable to security breaches with potential cascading impacts on its Transmission and Distribution network and its IT and OT systems. Further details on security asset replacement plans can be found in GSP Section 4.11, G-GP-09, G-GP-10 and G-GP-11.

**OTHER CONSIDERATION FACTORS**

Effective vendor support ensures that the assets can be fixed and/or upgraded expeditiously in the event of malfunction or failure. The serious risks of continuing to run applications after their vendor support expires include:

- disruptions to critical systems that support or directly interact with customers, adversely impacting customer service and satisfaction;
- interruptions to systems that facilitate compliance with regulatory requirements, potentially resulting in non-compliance;
- frequent and/or prolonged service outages that would directly impact the job performance and productivity of staff; and
- higher operating costs to support and service these applications internally.

As described in GSP Section 4.7.3.3, Information Solutions works with the lines of business to assess what technological capabilities are required to achieve specific business outcomes. To ensure that these investments are prudent and maximize value to the company, Information Solutions follows a set of architectural principles for all applications, which focus on functional and cost efficiency and factored into upgrade or replacement determinations. Examples include:

- Rationalizing applications wherever possible to reduce the total number of applications supported and lower support costs.
- Exploring the potential of existing applications to be used for additional business needs, reducing the number of different technologies and increase speed that outcomes are achieved.
- Identifying areas of improvements in performance or over/under utilization that either need to be upgraded or potentially replaced with newer technologies.
- Minimizing customization by investing in commercial-off-the-shelf applications and maintaining applications within a vendor-supported lifecycle to ensure continued functionality and maximum longevity. Custom applications are migrated to commercial-off-the-shelf solutions wherever possible to minimize development, integration and maintenance costs.

Beyond the need to comply with NERC CIP standards, Hydro One's overall security strategy is assessed against National Institute of Standards and Technology (NIST) Cybersecurity Framework (CSF). The CSF is voluntary guidance, based on existing standards, guidelines, and practices for organizations to better manage and reduce cybersecurity risk. Using self-assessments that are reviewed and validated by third party vendors, Hydro One evaluates the capabilities of its security programs and practices to gain an understanding of current performance and to help inform how investments can improve Hydro One's security posture. Examples of Hydro One's planned security investments can be found in GSP Section 4.11, G-GP-10 and GSP Section 4.11, G-GP-11.

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# SECTION 4.3 – GSP – BENCHMARKING AND OTHER STUDIES

Benchmarking studies and third party assessments help inform Hydro One of the condition of its assets and how to effectively and efficiently manage those assets. The undertaking of these studies and reports also present Hydro One with the opportunity to demonstrate continuous improvement by different means: comparison to self; comparison to others; and unit cost trending analysis.

To support the GSP, Hydro One has commissioned the following third-party studies:

1. 2019 Fleet Operations Benchmarking Report - Utilimarc
2. Fleet Lifecycle Study - Utilimarc
3. Enterprise IT Spending and Staffing Benchmark – Gartner

Details on the selected vendors and Hydro One's RFP process are provided under SPF Section 1.3.

Additional third party and internal studies correspond to other aspects of the Application and are discussed elsewhere, as indicated below:

- The Benchmarking and Productivity Research for Hydro One Networks' Joint Rate Application is discussed in Exhibit A-04-01;
- the review of the Productivity Framework is discussed in SPF Section 1.4;
- Capital Performance Report (Internal Report) is an attachment to GSP Section 4.9;
- the benchmarking of corporate costs and administrative functions is discussed in Exhibit E-04-02;
- the comparison of common corporate costs capitalization with utilities in Ontario, Canada and USA is discussed in Exhibit C-08-02; and
- the Compensation Cost Benchmarking Study is discussed in Exhibit E-06-01.

## 4.3.1 2019 FLEET OPERATIONS BENCHMARKING REPORT - UTILIMARC

### 4.3.1.1 STUDY OVERVIEW

Hydro One engaged Utilimarc to benchmark various aspects of Fleet Management Services' operations (i.e., 2019 fleet costs, fleet unit information, fleet utilization and high-level staffing) against a group of North American utility comparators. This is the first time a study like this has been performed regarding Fleet Management Services' operations to understand its relative standing and obtain insight on industry standards and best practices, which is also consistent with the OEB's expectation to expand Hydro One's suite of benchmarking studies from the last Distribution application.

Utilimarc employed a standardized comparison method to compare Hydro One's performance to a group of comparators. For example, Utilimarc applied its defined cost categories to each company in the study, by creating a standard unit classification based on the VIN decoded information, unit attachment/hydraulic information and type of work performed.

### 4.3.1.2 SUMMARY OF BENCHMARKING FINDINGS AND RECOMMENDATIONS

**Table 1 - Key Study Findings**

| # | Key Study Findings | Study Reference |
|---|---|---|
| 1 | **Cost Per Vehicle Equivalency (VE):** a comparison of all on-road vehicles on a cost per VE basis for the 2019 calendar year (where VE is a weighting metric assigned to each individual asset in a fleet based on expected repair hours of an asset). Hydro One is 12.01% lower than the participant average for 2019 and is in the second quartile. | Section 2.2a - page 14 |
| 2 | **Cost Per Unit:** a comparison of all on-road vehicles on a cost per unit basis for the 2019 calendar year. Hydro One is 1.88% lower than the participant average for 2019 and is in the second quartile. | Section 2.2b - page 16 |
| 3 | **Cost Per Kilometer:** a comparison of all on-road vehicles on a cost per kilometer basis for the 2019 calendar year. Hydro One is 26.75% lower than the participant average and is in the first quartile. | Section 2.2c - page 18 |
| 4 | **All Units - Average Age:** In comparing the 2019 Hydro One data to that of the Utilimarc participants, it can be seen that Hydro One is younger for the “LIGHT” and “MISC POE and TRAILERS” equipment types but older for the “HEAVY” and “OFF ROADS” equipment types. For the “LIGHT” equipment type, Hydro One’s annual mileage averages over 5,000 kilometers higher than the participant average. For the “HEAVY” equipment type, Hydro One’s annual mileage averages over 3,000 kilometers higher than the participant average. | Section 3.1 – pages 20, 21 |
| 5 | **All Vehicles - Low Mileage (Kilometer) Percentage:** a comparison of the percentage of all vehicles for the 2019 calendar year that are considered “low mileage” (i.e., an unit’s annual mileage is less than 50% of the internal average annual mileage for the specific class of vehicles). Hydro One has the lowest percentage of low mileage vehicles (17.49%) out of the group, which is 13.03% below the participant average. In addition, Hydro One runs 5,000 more kilometers on average than its peers. | Section 4.1 page 24 |

In the three main cost comparison categories for on-road vehicles (Cost per VE, Cost per Unit and Cost per Kilometer), Hydro One’s standing is better than the participant average. In terms of asset age, Hydro One’s fleet is average relative to the comparator group. Based on the low mileage vehicle percentage comparison, Hydro One leads all comparators with the lowest percentage of low mileage vehicles, even though Hydro One has an annual average mileage that is 5,000 km more than its comparators. This demonstrates that relative to its comparators, Hydro One’s vehicles are on average driven further each year (which puts the vehicles under additional stress and can shorten their lifespan) and are utilized to a higher extent across the fleet (i.e., thus resulting in a small percentage of low mileage vehicles and less room for further increasing existing vehicle utilization).

This study was commissioned to identify where Hydro One fleet is positioned in relation to its comparators in terms of operating costs and does not have any recommendations. As shown by the key findings in Table 1, while Hydro One currently performs well relative to industry, it is important to note that operating costs lag capital investments. As discussed in GSP Section 4.3.2, the overall cost of ownership is highly dependent on capital spend. When vehicles are run beyond their optimal lifespan, downtime and maintenance costs increase. Without an increase in capital investments to replace the older and high mileage equipment (particularly where they are highly utilized assets from year to year), there will inevitably be an increased pressure on operating costs.

## 4.3.2 FLEET LIFECYCLE STUDY – UTILIMARC

### 4.3.2.1 STUDY OVERVIEW

Hydro One engaged Utilimarc to conduct a benchmarking study to review its current lifecycle management and recommend the optimal time for replacing various classes of fleet assets. This is the first time Hydro One has undertaken a study of this kind, which is also consistent with the OEB's expectation to expand Hydro One's suite of benchmarking studies from the last Distribution application.

Using Hydro One's historic data and practices, Utilimarc modeled future ownership and maintenance costs to determine the lifecycle approach that achieves the lowest total costs over the life of the assets by vehicle class. In addition, Utilimarc presented three funding scenarios to demonstrate the relationship between replacement pacing and overall cost of ownership:

- Full Funding Scenario – Utilimarc's derived capital requirement assuming assets are replaced based on its recommended lifecycle approach (these recommendations are provided below in Section 4.3.1.2, Table 4).
- Proposed Funding Scenario – Hydro One's planned capital requirement for the next seven years.
- Historic Funding Scenario – assumes capital funding in line with Hydro One's 2021-2022 capital funding levels for fleet.

The 9 vehicle classes that Utilimarc used in the study are presented below in Table 2. These are the top 9 rates classes for Hydro One and represent 80% of its annual fleet operating spend.

**Table 2 - Vehicle Class Description**

| Utilimarc Vehicle Class | Description |
|---|---|
| Pickup – Class 2a | A ½ Ton Pickup |
| Pickup – Class 2b | A ¾ Ton Pickup |
| Pickup – Class 3 | A 1 Ton Pickup |
| Pickup – Class 4+ | All other bigger pickup |
| Bucket Truck – Class 7 | A truck with an insulated aerial lift attachment and side cabinets that is 42’ |
| Bucket Truck – Class 8 | A truck with an insulated aerial lift attachment and side cabinets that is 55’ |
| Digger Derrick - Class 8 | Large truck with a digger derrick |
| Tracked Unit – Mounted | Larger than a Bobcat, with Mounted Equipment (Buckets, Diggers, Cranes, etc.) |
| Forestry Bucket | A truck with an insulated aerial lift attachment used for Forestry Work |

### 4.3.2.2 SUMMARY OF BENCHMARKING FINDINGS AND RECOMMENDATIONS

**Table 3 - Key Study Findings**

| # | Key Study Findings | Study Reference |
|---|---|---|
| 1 | **Full Funding Scenario:** Over the 2023 to 2027 period with full funding levels over 600 units are replaced per year which results in:<br>• Maintenance costs decreasing from $62.7M in 2022 to $59.4M in 2027<br>• Out of life units (i.e. exceeding their optimal lifespan) decreasing from 1,923 in 2022 to 1,379 in 2027.<br>• Average age decreasing from 10.02 years in 2022 to 8.38 years in 2027. | Section 3.2 P.12 |
| 2 | **Proposed Funding Scenario:** Over the 2023 to 2027 period with proposed funding levels over 500 units are replaced per year which results in:<br>• Maintenance costs increasing marginally from $62.7M in 2022 to $63.2M in 2027.<br>• Out of life units decreasing from 1,923 in 2022 to 1,827 in 2027.<br>• Average age decreasing slightly from 10.02 years in 2022 to 9.14 years in 2027. | Section 3.2 p.12 |

| Full Funding | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $72,528,470 | $73,676,100 | $74,307,240 | $75,281,180 | $78,360,770 |
| Units Replaced | 253 | 258 | 656 | 650 | 642 | 614 | 652 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $61,609,180 | $60,940,330 | $60,351,240 | $59,777,660 | $59,377,860 |
| Annual Ownership | $34,798,810 | $33,225,780 | $39,753,910 | $45,203,070 | $49,754,950 | $53,627,540 | $57,256,690 |
| Total | $95,374,500 | $95,959,670 | $101,363,100 | $106,143,400 | $110,106,200 | $113,405,200 | $116,634,500 |
| Out of Life | 1,582 | 1,923 | 1,834 | 1,785 | 1,689 | 1,462 | 1,379 |
| Avg Age | 9.77 | 10.02 | 9.46 | 9.11 | 8.81 | 8.64 | 8.38 |

| Proposed Funding | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $58,751,660 | $60,020,550 | $60,663,270 | $61,543,910 | $63,694,290 |
| Units Replaced | 253 | 258 | 554 | 556 | 549 | 551 | 556 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $62,506,600 | $62,643,440 | $62,844,990 | $63,017,950 | $63,166,600 |
| Annual Ownership | $34,798,810 | $33,225,780 | $37,439,450 | $41,045,210 | $44,099,020 | $46,744,460 | $49,271,810 |
| Total | $95,374,500 | $95,959,670 | $99,946,050 | $103,688,700 | $106,944,000 | $109,762,400 | $112,438,400 |
| Out of Life | 1,582 | 1,923 | 1,936 | 1,981 | 1,978 | 1,814 | 1,827 |
| Avg Age | 9.77 | 10.02 | 9.70 | 9.52 | 9.38 | 9.26 | 9.14 |

<table>
<tr>
<td>3</td>
<td>
Historic Funding Scenario: Over the 2023 to 2027 period with historic funding levels over 250 units are replaced per year which results in:
<ul>
<li>Maintenance costs increasing from $62.7M in 2022 to $76.5M in 2027.</li>
<li>Out of life units increasing from 1,923 in 2022 to 3,299 in 2027.</li>
<li>Average age increasing from 10.02 years in 2022 to 11.90 years in 2027.</li>
</ul>
<table>
<tr><th>Historic Funding</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th><th>2025</th><th>2026</th><th>2027</th></tr>
<tr><td>Annual Capital</td><td>$26,238,742</td><td>$26,580,590</td><td>$27,112,210</td><td>$27,701,380</td><td>$28,255,400</td><td>$28,820,510</td><td>$29,396,920</td></tr>
<tr><td>Units Replaced</td><td>253</td><td>258</td><td>258</td><td>259</td><td>259</td><td>259</td><td>259</td></tr>
<tr><td>Annual Maintenance</td><td>$60,575,690</td><td>$62,733,890</td><td>$65,272,360</td><td>$68,014,560</td><td>$70,813,710</td><td>$73,641,950</td><td>$76,474,390</td></tr>
<tr><td>Annual Ownership</td><td>$34,798,810</td><td>$33,225,780</td><td>$31,999,780</td><td>$31,090,460</td><td>$30,450,240</td><td>$30,035,920</td><td>$29,809,580</td></tr>
<tr><td>Total</td><td>$95,374,500</td><td>$95,959,670</td><td>$97,272,150</td><td>$99,105,020</td><td>$101,264,000</td><td>$103,677,900</td><td>$106,284,000</td></tr>
<tr><td>Out of Life</td><td>1,582</td><td>1,923</td><td>2,232</td><td>2,574</td><td>2,861</td><td>2,989</td><td>3,299</td></tr>
<tr><td>Avg Age</td><td>9.77</td><td>10.02</td><td>10.37</td><td>10.75</td><td>11.14</td><td>11.53</td><td>11.90</td></tr>
</table>
</td>
<td>Section 3.2 p.13</td>
</tr>
<tr>
<td>4</td>
<td>
Changes in maintenance cost occur in line with changes in staffing or outsourcing. Assuming current outsourcing practices, the following table shows the increase in labor demand that would be required under the Historic Funding scenario compared to the Proposed Funding scenario. Additionally, there is uncertainty when projecting maintenance cost beyond the range of data that is available. The Historic Funding scenario has Hydro One retaining vehicles longer than they ever have. In this situation, increases in maintenance cost may be underrepresented.
<table>
<tr><th>Labor Hour Increase (Assuming Historic Funding)</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th><th>2025</th><th>2026</th><th>2027</th></tr>
<tr><td>Internal</td><td>-</td><td>-</td><td>9,238</td><td>17,588</td><td>25,582</td><td>33,438</td><td>41,063</td></tr>
<tr><td>External</td><td>-</td><td>-</td><td>6,689</td><td>12,736</td><td>18,525</td><td>24,213</td><td>29,735</td></tr>
<tr><td>Total</td><td>-</td><td>-</td><td>15,927</td><td>30,324</td><td>44,107</td><td>57,651</td><td>70,799</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Estimated Technician Increase</td><td>-</td><td>-</td><td>6.60</td><td>12.56</td><td>18.27</td><td>23.88</td><td>29.33</td></tr>
<tr><td>Percent Technician Increase</td><td>-</td><td>-</td><td>5%</td><td>10%</td><td>15%</td><td>20%</td><td>24%</td></tr>
</table>
</td>
<td>Section 3.2 p. 13</td>
</tr>
</table>

Based on the three scenarios, in order to keep the population of out of life assets at a manageable level and to prevent significant escalations in maintenance costs, the projections indicate that an increase in annual capital investment is needed to replace more units than historical capital funding levels allow.

If historical capital funding levels are continued through 2027, the population of out of life assets as a percentage of overall fleet is modelled to increase from 22% in 2021 to 47% in 2027. The average age is also projected to increase under the Historical Funding scenario, as these levels do not provide sufficient funding to replace a manageable quantity of aging units. As noted in Key Finding #4 in Table 3, this increase in age correlates to an escalation in maintenance costs, maintenance labour and equipment downtime.

**Table 4 - Recommendations from the Fleet Lifecycle Study**

| # | Recommendations | Study Reference |
|---|---|---|
| 1 | This table shows the lifecycle recommendations for Hydro One's top 9 vehicle classes, which represent around 80% of Hydro One's annual fleet spend.<br><br>Pickup - Class 2a - 8 years<br>Pickup - Class 2b – 8 years<br>Pickup – Class 3 – 7 years<br>Pickup – Class 4+ - 10 years<br>Bucket Truck – Class 7 – 6 years<br>Bucket Truck - Class 8 – 11 years<br>Digger Derrick – Class 8 – 14 years<br>Tracked Unit – Mounted – 14 years<br>Forestry Bucket – 14 years | Section 3.1 p.11 |

Fleet Management Services has adopted Utilimarc's recommended lifecycle for the top 9 asset classes to minimize their overall lifecycle costs (as reflected in GSP, Section 4.2). Fleet Management Services will use the recommended lifecycle when allocating and prioritizing capital investments among its asset classes, along with the other criteria discussed in GSP Section 4.7.

Fleet Management Services is seeking the Proposed Funding level (as shown in Table 3) for the planning period, because it is a balanced approach that maintains the population of out of life assets as well as annual maintenance cost at a relatively flat level through to the end of 2027. Further details on the investments planned for 2023-2027 are provided in GSP Section 4.11, G-GP-01.

### 4.3.3 ENTERPRISE IT SPENDING AND STAFFING BENCHMARK – GARTNER

#### 4.3.3.1 STUDY OVERVIEW

Consistent with the OEB's directive regarding benchmarking in the last Distribution decision[1], Hydro One has continued its Enterprise IT Benchmarking with Gartner Inc. This updated study assessed Hydro One's 2019 enterprise level IT spending and staffing to provide insights relative to industry comparators and to identify areas where action may be needed to optimize IT budget and investment in line with Hydro One's strategic and operational priorities.

#### 4.3.3.2 SUMMARY OF BENCHMARKING FINDINGS AND RECOMMENDATIONS

The results of Gartner's benchmarking studies provide a key input for Hydro One's IT investment planning. Based on the recommendations made in the prior 2016 study by Gartner, Hydro One has implemented the following changes:

- To optimize enterprise computing and storage costs, and increase server virtualization, Hydro One has implemented a new private cloud data centre that replaces physical servers.
- The materiality threshold for IT capital expenditures has been lowered from $2M to $0.5M to better align with the practices of industry peers.
- Starting in 2020, Hydro One has begun transforming the organizational design of its IT division to create a high performing staffing structure that more effectively enables business and optimizes the value of investments. This new structure aims to identify and remove potential redundancies between retained staff and the outsourced service provider.

For the updated 2020 study, Gartner assessed Hydro One's enterprise IT spending and staffing based on 2019 fiscal year data. The study report is provided in Section 4.3.4 Attachments. Summaries of the key findings and recommendations are presented below in Table 5 and Table 6, respectively.

[1] EB-2017-0049 Decision and Order, Appendix 2 Summary of OEB Directives

1 **Table 5 - Key Findings for the Gartner Enterprise IT Spending and Staffing Benchmark**

| # | Key Study Findings | Study Reference |
|---|---|---|
| 1 | Hydro One's 2019 IT Spending as a percentage of revenue was 3.9% compared to an average of 3.4% for the Peer Group, and 4.9% of operating expenditures compared to 4.7% for the Peer Group. This was largely due to increased capital investment in digital capabilities. | Pages 4; 15; 16 |
| 2 | In 2019, Hydro One allocated 31% of IT Spending to "change the business" activities (17% Grow and 14% Transform), representing a 90% increase since the previous 2016 Gartner study. This indicates a significant level of investment by Hydro One in digital capabilities and aligns with the increase in capital expenditures ($55M in 2015 vs $115M in 2019). | Pages 4; 22 |
| 3 | IT Spending per Employee was $28,366 in 2019, 17% less than the Peer Group average. | Pages 5; 17 |
| 4 | Hydro One relies much more heavily on Outsourcing (59% of IT spend in 2019) than the Peer Group (17%). | Pages 5; 20; |
| 5 | Enterprise Computing and End User Computing consume a much larger % of IT Spend than the Peer Group and Utility Industry averages.[2] This further emphasizes the need to evaluate the outsourcing agreements for these areas. | Page 5 |
| 6 | The overall allocation to Applications spending is less than the Peer Group average and similar to the Utility Industry average. Compared to 2015, Hydro One allocated a smaller proportion of IT spending and staffing towards Applications, which is somewhat unusual for a period of transformation. | Page 5 |

[2] "Peer Group" consists of 8 North American organizations in the utility industry (electricity generation, transmission and distribution) with comparable revenue to Hydro One; "Utility Industry" consists of 114 utilities around the globe.

**Table 6 - Recommendations from the Gartner Enterprise IT Spending and Staffing Benchmark**

| # | Recommendations | Study Reference |
|---|---|---|
| 1 | Hydro One needs to continuously evaluate the appropriate level of IT Spending and areas of focus required to support corporate wide objectives. | Page 15 |
| 2 | Hydro One should continue to evaluate IT investments that will enable all staff to serve customers, improve productivity and reduce costs across the business. | Page 17 |
| 3 | Due to the size of this spend (including Hydro One's contract with Inergi), value for money and market price analyses should be conducted as part of the negotiations in future outsourcing contracts. Hydro One should also seek to improve service and innovation from providers. | Page 20 |
| 4 | Use the Run, Grow and Transform categorizations to help communicate the funding needed for business transformation and the cost to maintain legacy business models. Divide ”Run” spending by business outcome metrics (or business capabilities) to show per unit-cost productivity improvement, with the related volumes, to better show its value to the enterprise. | Page 22 |
| 5 | Given the gap to Peer and Industry averages and significant real dollar increases in Enterprise Computing and User Computing spend, these areas should be examined further for cost optimization opportunities. | Page 23 |

There are two main themes in the recommendations from Gartner – appropriate IT investment levels and value of outsourcing arrangement, which are further discussed below. Also discussed below is a noteworthy industry insight from the Gartner report regarding the shift toward cloud solutions, which directly impacts Hydro One’s IT solutions and investment approach.

**Appropriate IT Investment Levels**

(*Recommendations 1, 2, 4, and 5 from Table 6*)

Hydro One is continuously evaluating the levels of IT investments. The ISD team collaborates closely with other lines of business to identify their strategic, multi-year technological capability requirements to achieve business outcomes and address capability gaps. Similar or overlapping needs from different lines of business are grouped and all investments are examined in terms of optimizing lifecycle management costs to maximize use of existing systems and line up system end of life with future/planned enhancements (refer to Section 4.7 for further details). Investment plans are refreshed annually reflecting their alignment to the run, grow and transformative impacts to Hydro One and adjusting to the changes within the business and industry. Anticipated business outcomes are detailed within business cases elaborating on the business outcomes being achieved such as productivity, risk reduction, safety, etc. ensuring that value for money is being achieved.

The “gap” in Recommendation 5 refers to the fact that approximately 47% (or $117M) of Hydro One’s 2019 IT spend was dedicated to enterprise and end user computing, whereas the Peer Group and Utility Industry only dedicated approximately 21% and 25% of their spend, respectively, to these areas. In comparison, Hydro One’s 2015 spend in these areas was 39% (or $76M). This increase in spend and the difference relative to comparator groups stemmed from Hydro One’s focus on investing in back-end infrastructure in 2019. This spending on infrastructure was required to support future transformational investments in application modernization and rationalization. Now that Hydro One has improved infrastructure to support more applications, Hydro One’s IT investments are expected to shift towards higher spend in applications, which more closely aligns with Peer and Industry spending profiles.

As discussed in GSP Section 4.10, Hydro One has embarked on a transformative reorganization of the Information Services Division to maximize value to the business and customers. Hydro One is adopting agile delivery teams aligned with the line of business that they support in order to ensure:

1. better business alignment by improving collaboration and interaction points through autonomous groups called “Pods”;
2. appropriate prioritization of sustainment (run) versus enhancement (grow and transform) work;
3. faster product delivery in smaller, more frequent incremental investments;
4. improved quality in leveraging new development and support methodologies; and
5. appropriate enterprise alignment through financial and technology governance.

The Pod groups will continue to leverage services, as required, from internal and external providers such as the existing third party service provider.

**Value of the Current Outsourcing Relationship**

(*Recommendation 3 from Table 6*)

The IT industry has evolved significantly over the last 20 years since Hydro One originally sourced IT work to its third party service provider. The acceleration of technology, delivery/support methodologies and cloud computing has changed the fundamentals of that original IT delivery arrangement. As a result, Hydro One has changed its sourcing and delivery strategy. Effective March 1, 2021, Hydro One entered into a new arrangement with Capgemini for a reduced scope of information technology services. The remaining portion of information technology services that were previously delivered by third parties were transitioned into Hydro One to be self-performed (for additional information on the Capgemini contract, please refer to Exhibit E-05-01).

The agreement with Capgemini achieves lower rates for project resources, a lower fee commitment, and a lowered total cost of ownership to Hydro One. The structure of this agreement provides Hydro One with detailed rate cards which increases transparency to the resources, skillsets, and overall value being delivered, and permits benchmarking of these rate cards to help ensure Hydro One is receiving the appropriate value for money. To improve services delivered from the partner, the contract also provides an increased number of contractual service levels that the partner must meet in sustaining existing solutions or as it relates to delivering project services.

**Technology Shift**

(*Industry Insight and response to Finding 2 from Table 5*)

The Gartner report states:

> *Applications and Infrastructure are increasingly cloud-based, creating an escalating shift away from more traditional capital-based models to operational funding. There can be unanticipated or overlooked operating budget increases as a result of SaaS and IaaS contracts. The resultant shift from capital expenditure (CapEx) to operating expenditure (OpEx) can cause budgetary and cost management pressures.* [3,4]

With the shift to cloud by many service providers and the adoption of agile delivery methodologies, Hydro One has developed a strategy for technology modernization and application rationalization to maximize value from its IT investments. The main components of this strategy are as follows:

- Invest in core technologies that provide the greatest flexibility to leverage diverse resources such as private/public clouds and existing on-premise solutions.
- Digitize the business by leveraging technologies that reduce investment costs, eliminate/reduce repetitive tasks, promote reuse and increase the speed of deployment, and thus value realization by the business.
- To help ensure maximum IT investment value realization, Hydro One is launching an Application and Product portfolio assessment. Following the Gartner methodology called "TIME" (Tolerate, Invest, Migrate and Eliminate), Hydro One will collect the necessary data points such as application costs, business fitness and technical fitness for all IT assets. The information will help identify opportunities to reduce the application landscape (eliminate), change the existing investments (invest) or move (migrate) the investment to

[3] Gartner, Enterprise IT Spending and Staffing Benchmark (April 16, 2020) – GSP Section 4.3 Attachment 3, Strategic Considerations, page 21.
[4] IaaS stands for Infrastructure as a Service and SaaS stands for Software as a Service.

another technology such as cloud. All of these actions lead to either risk reduction, cost reduction or new business value which in turn drives value for customers.

- All investments will consider the total cost of ownership for the various deployment options (on-premise, cloud or hybrid) in order to achieve the best value for ratepayers and balance impact on operating and capital expenditures.

### 4.3.4 ATTACHMENTS: BENCHMARKING STUDIES

| Attachment | Study /Assessment Report |
|---|---|
| 1 | 2019 Fleet Operations Benchmarking Report - Utilimarc |
| 2 | Fleet Lifecycle Study - Utilimarc |
| 3 | Enterprise IT Spending and Staffing Benchmark – Gartner |

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# 2019 Fleet Operations Benchmarking Report %

## Hydro One

Provided by Utilimarc (

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## 1.0 - General Report Methodology

Utilimarc's Benchmarking application uses Hydro One Networks Inc.'s (Hydro One) fleet costs, fleet unit information, fleet utilization, and high-level fleet staffing information to compare its unique fleet to that of the other study participants. Each fleet of the participants listed below makes up the participant values and averages showcased in this report.

- American Electric Power
- Alliant
- Ameren-AIC
- Ameren-Missouri
- Arizona Public Service
- Austin Energy
- Avista
- BC Hydro
- BHE-PacifiCorp
- Chelan County PUD
- Coned
- Consumers Energy
- DTE Energy
- Duke Energy-Carolinas East
- Duke Energy-Carolinas West
- Duke Energy-Florida
- Duke Energy-Midwest
- El Paso Electric
- Exelon-BG&E
- Exelon-ComEd
- Exelon-PECO
- Exelon-PHI
- Florida Power and Light
- Hydro One
- Indianapolis P&L
- JEA
- LADWP
- LGE-KU-Kentucky
- LGE-KU-Louisville
- Northwestern
- Oncor
- Pacific Gas and Electric
- Portland General
- Public Service Enterprise Group
- San Diego Gas & Electric
- Southern California Edison
- Salt River Project
- Tennessee Valley Authority
- WEC-Integrys
- WEC-We Energies
- Xcel Energy

Utilimarc focuses on providing standardized comparisons to accurately showcase how a unique fleet compares to its peers. Below is a list of a few examples of the Utilimarc standardization methods:

- **Fleet Cost Breakouts:** For high-level comparisons, it is important to understand the full costs of a fleet and know what all the companies in the participant list are including. Utilimarc defines its own cost categories and applies its definition to each company in the benchmark study.
- **Fleet Cost Conversion:** For the US companies, the cost data in this report is converted utilizing an annual conversion rate for the data year from US dollars to Canadian dollars. The conversion rates used are: 2017 = 0.740741, 2018 = 0.77101, and 2019 = 0.7538.
- **Fleet Unit Classification:** Utilimarc has over 100 unique unit classifications that are used for each client to ensure that similar units are being compared for a class specific comparison. (See glossary for detailed class code information.). Each of the class codes is defined based on type of asset, VIN decoded information, unit attachment/hydraulic information, and type of work performed. Utilizing all these inputs allows Utilimarc to breakout the same cab and chassis into different class codes like Bucket Trucks, Stake Trucks, and Service Trucks.

## 2.0 - Hydro One High-Level Cost Comparison Results

Within the benchmark analysis, there are a variety of metrics to compare a company to its peers. The most popular way to compare fleets is through a cost comparison for all units and all vehicles (only on-road). In section 2.1 and 2.2, there will be comparisons to showcase the full fleet data based on Per Vehicle Equivalency (VE), Per Unit, and Per Kilometer or Litre.

- **Cost per VE:** This is Utilimarc's preferred way to compare unique fleets at a high level. VE or Vehicle Equivalency is a weighting metric assigned to each individual asset in a fleet based on expected repair hours of an asset. For example, a Bucket Truck – Class 8 will have a higher VE value than a Sedan – Compact. The use of the VE allows for Utilimarc to remove some of the uniqueness of each fleet being compared by accounting for the makeup of each fleet.

- **Cost per Unit:** This cost comparison shows the average cost per unit in the fleet.

- **Cost per Kilometer or Litre:** This cost comparison is useful to factor in each fleet's unique utilization. The report compares all vehicles on a per kilometer basis and all units (vehicles, power operated equipment, trailers, etc.) on a per litre basis. The reason why per litre was chosen for all units was to try to account for the fuel consumption of the power operated equipment.

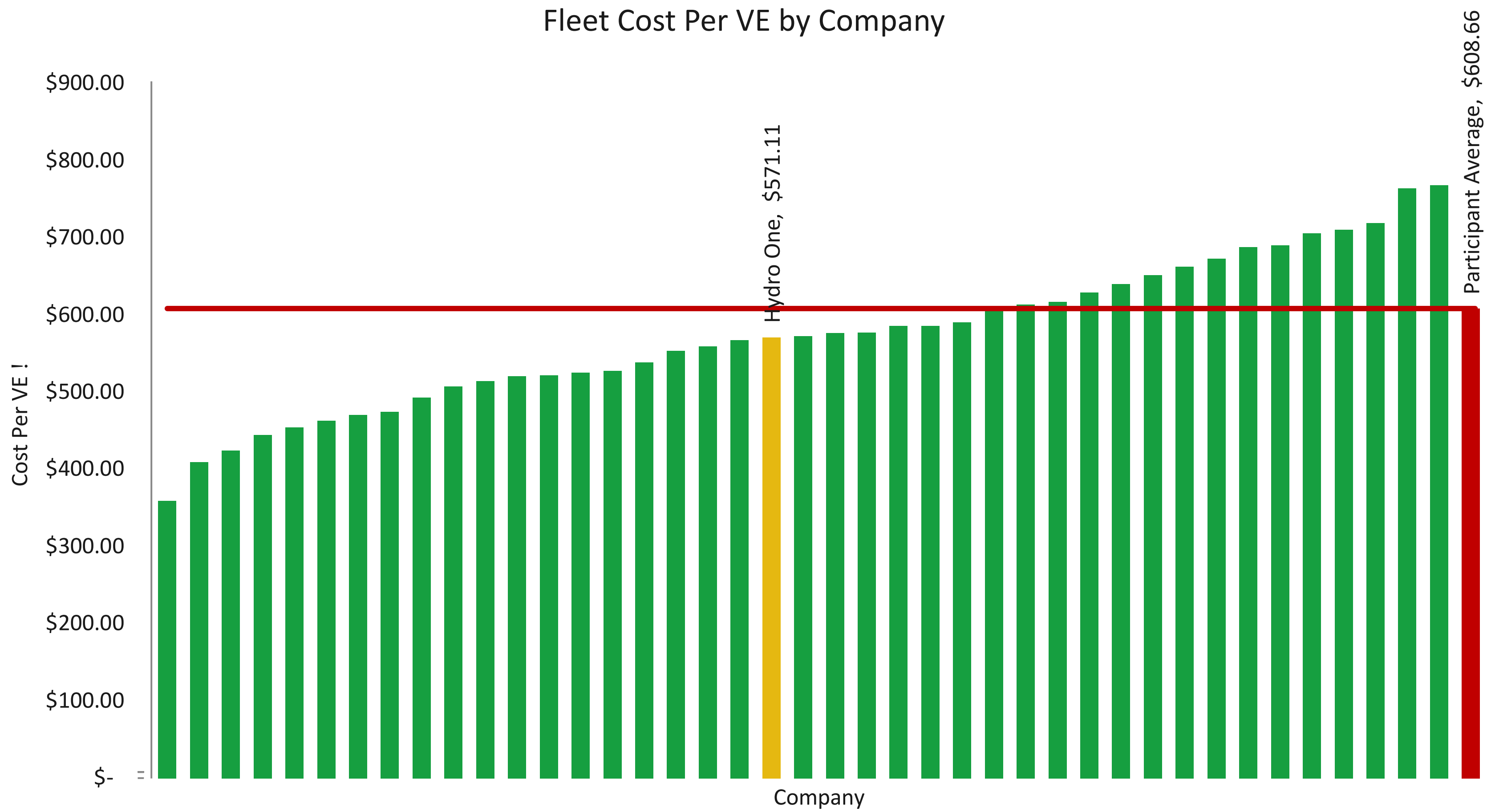
## 2.1 - All Units Cost Comparison

Section 2.1 showcases the cost comparison results for all units (on-road vehicles, power operated equipment, trailers, and misc. equipment) on a cost per VE, cost per unit, and cost per litre basis. Below is the Hydro One quartile performance for each cost distribution in the 2019 calendar year.

- **Cost per VE:** 2nd Quartile
- **Cost per Unit:** 3rd Quartile
- **Cost per Litre:** 2nd Quartile

For additional information on each cost distribution, see sections 2.1a – 2.1c.

## 2.1a - Cost per VE




The above graph shows a comparison of all units on a cost per VE basis for the 2019 calendar year. Hydro One is 6.17% lower than the participant average for 2019 and is in the second quartile.

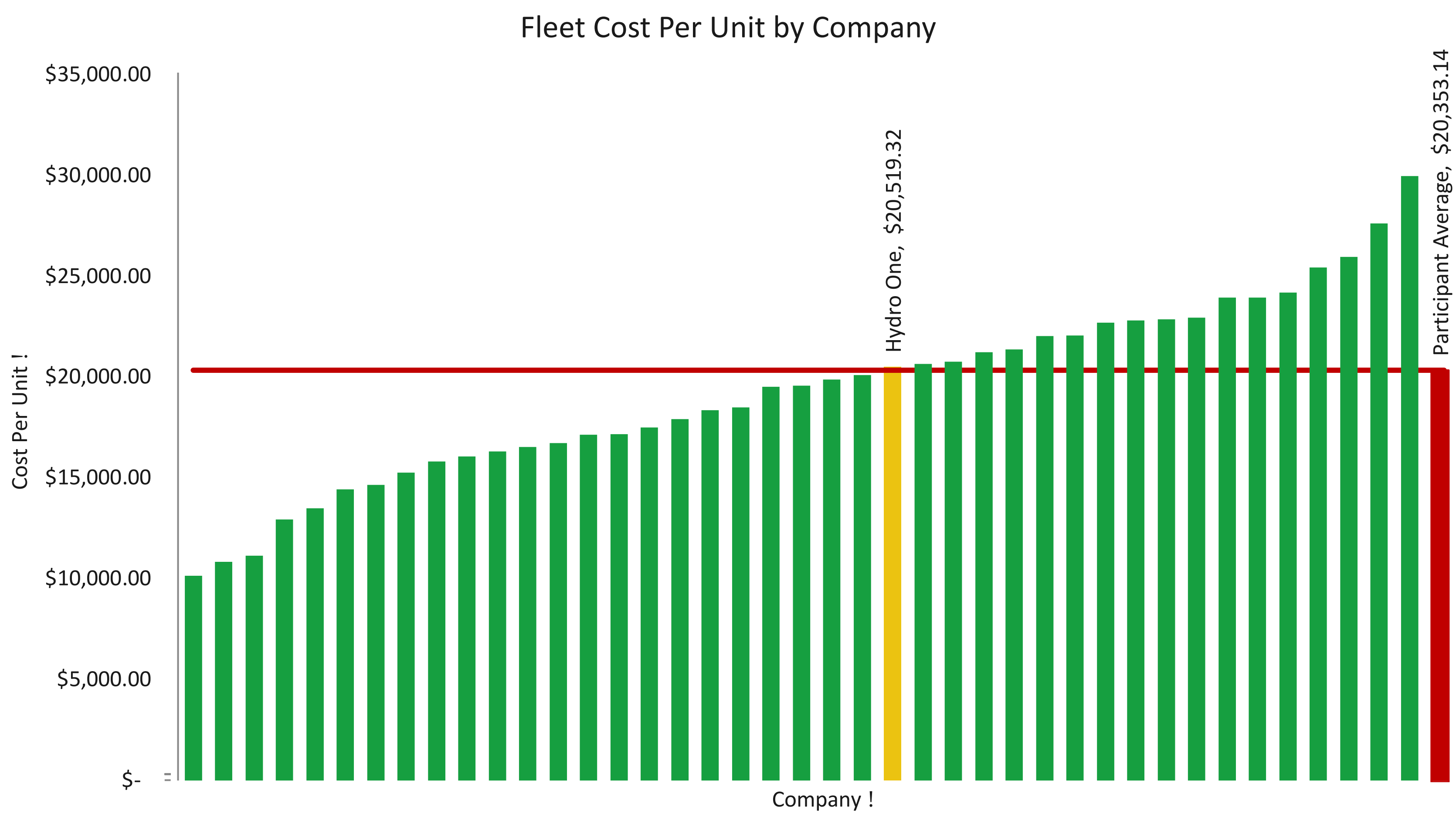
## 2.1a - Cost per VE (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per VE basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants. !

| Cost Per VE by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $182.86 | $198.58 | $207.34 | $251.31 |
| Operating (Net Fuel) | $183.90 | $190.63 | $205.81 | $206.09 |
| Fuel | $83.11 | $106.00 | $94.45 | $91.02 |
| Support | $60.44 | $58.46 | $63.49 | $60.24 |
| **Fleet Total Cost** | **$510.31** | **$553.67** | **$571.09** | **$608.66** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 2nd Quartile | 3rd Quartile | 2nd Quartile |

## 2.1b - Cost per Unit




The above graph shows a comparison of all units on a cost per unit basis for the 2019 calendar year. Hydro One is 0.82% higher than the participant average for 2019 and is in the third quartile.

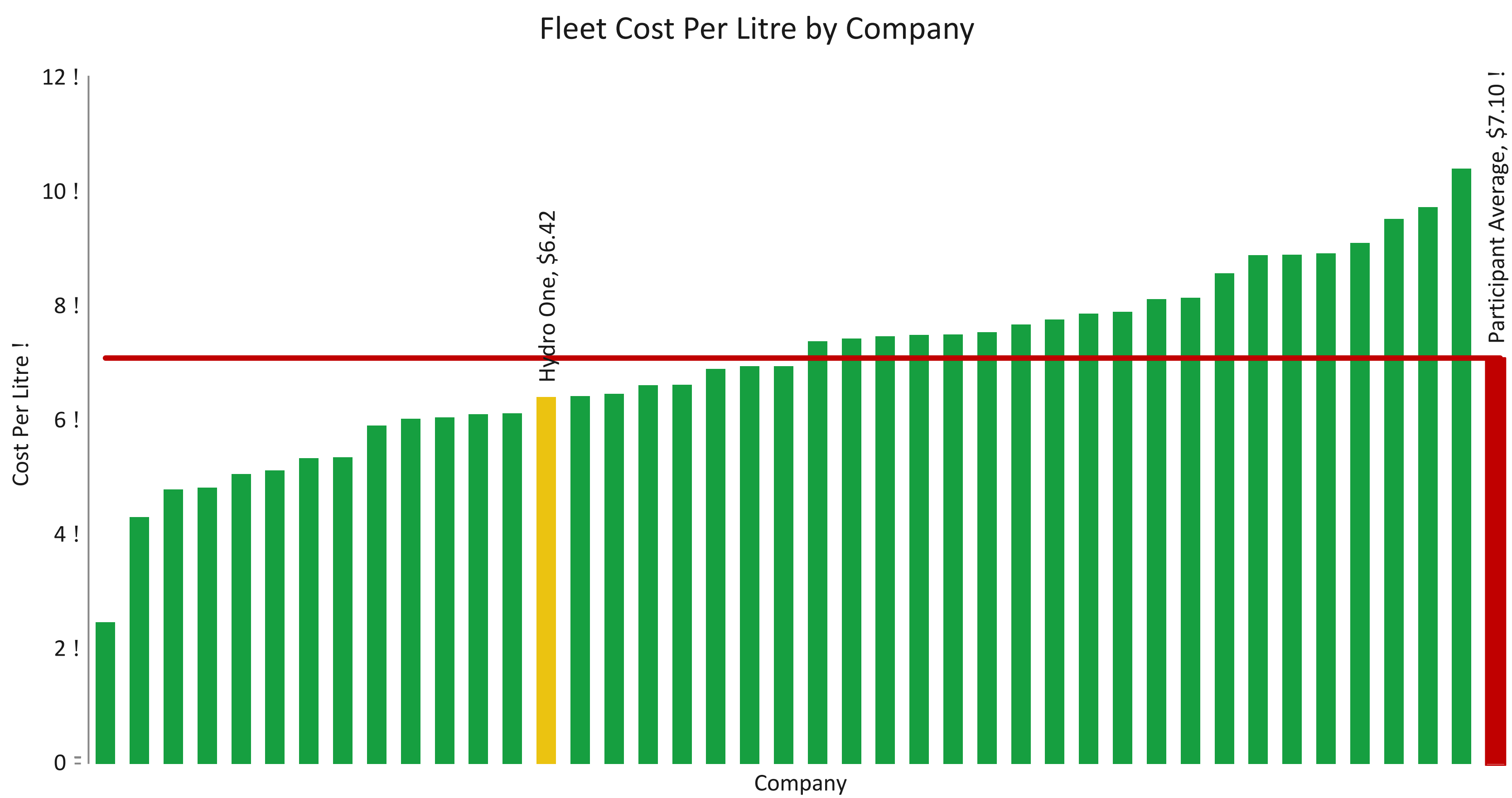
## 2.1b - Cost per Unit (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per unit basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants. !

| Cost Per Unit by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $6,619.89 | $7,148.99 | $7,449.36 | $8,403.63 |
| Operating (Net Fuel) | $6,657.69 | $6,862.54 | $7,394.81 | $6,891.58 |
| Fuel | $3,008.42 | $3,815.83 | $3,393.74 | $3,043.63 |
| Support | $2,188.27 | $2,104.47 | $2,281.41 | $2,014.30 |
| **Fleet Total Cost** | **$18,474.27** | **$19,931.83** | **$20,519.32** | **$20,353.14** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 3rd Quartile | 3rd Quartile | 3rd Quartile |

## 2.1c - Cost per Litre




The above graph shows a comparison of all units on a cost per litre basis for the 2019 calendar year. Hydro One is 9.58% lower than the participant average for 2019 and is in the second quartile.

## 2.1c - Cost per Litre (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per litre basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants. !

| Cost Per Litre by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $2.34 | $2.18 | $2.33 | $2.93 |
| Operating (Net Fuel) | $2.35 | $2.10 | $2.31 | $2.40 |
| Fuel | $1.07 | $1.17 | $1.06 | $1.06 |
| Support | $0.77 | $0.65 | $0.72 | $0.70 |
| **Fleet Total Cost** | **$6.53** | **$6.10** | **$6.42** | **$7.09** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 3rd Quartile | 2nd Quartile | 2nd Quartile |

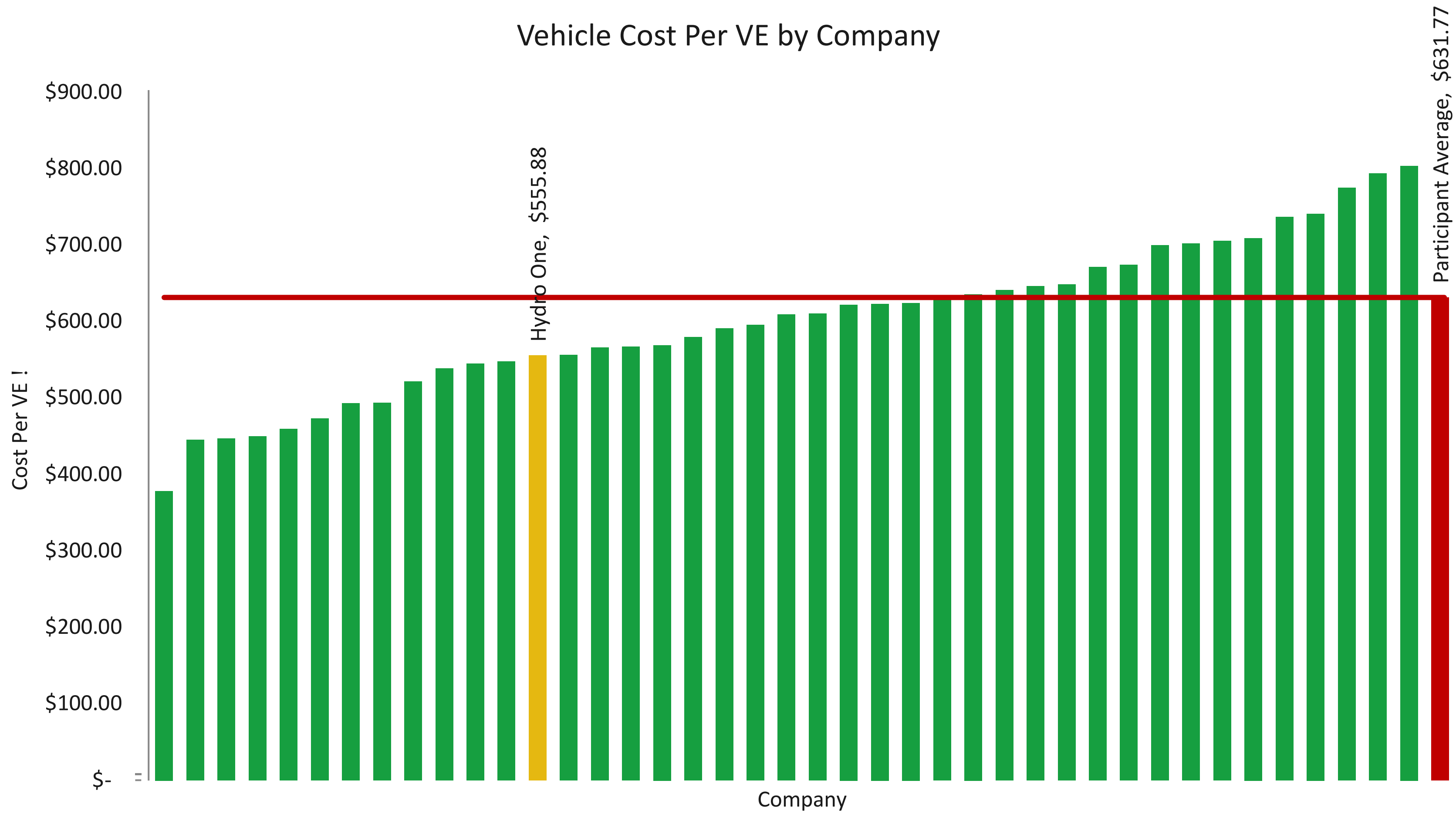
## 2.2 - All Vehicles Cost Comparison

Section 2.2 showcases the cost comparison results for all on-road vehicles on a cost per VE, cost per unit, and cost per kilometer basis. Below is the Hydro One quartile performance for each cost distribution in the 2019 calendar year.

- **Cost per VE:** 2$^{nd}$ Quartile
- **Cost per Unit:** 2$^{nd}$ Quartile
- **Cost per Kilometer:** 1$^{st}$ Quartile

For additional information on each cost distribution, see sections 2.2a – 2.2c.

## 2.2a - Cost per VE




The above graph shows a comparison of all on-road vehicles on a cost per VE basis for the 2019 calendar year. Hydro One is 12.01% lower than the participant average for 2019 and is in the second quartile.

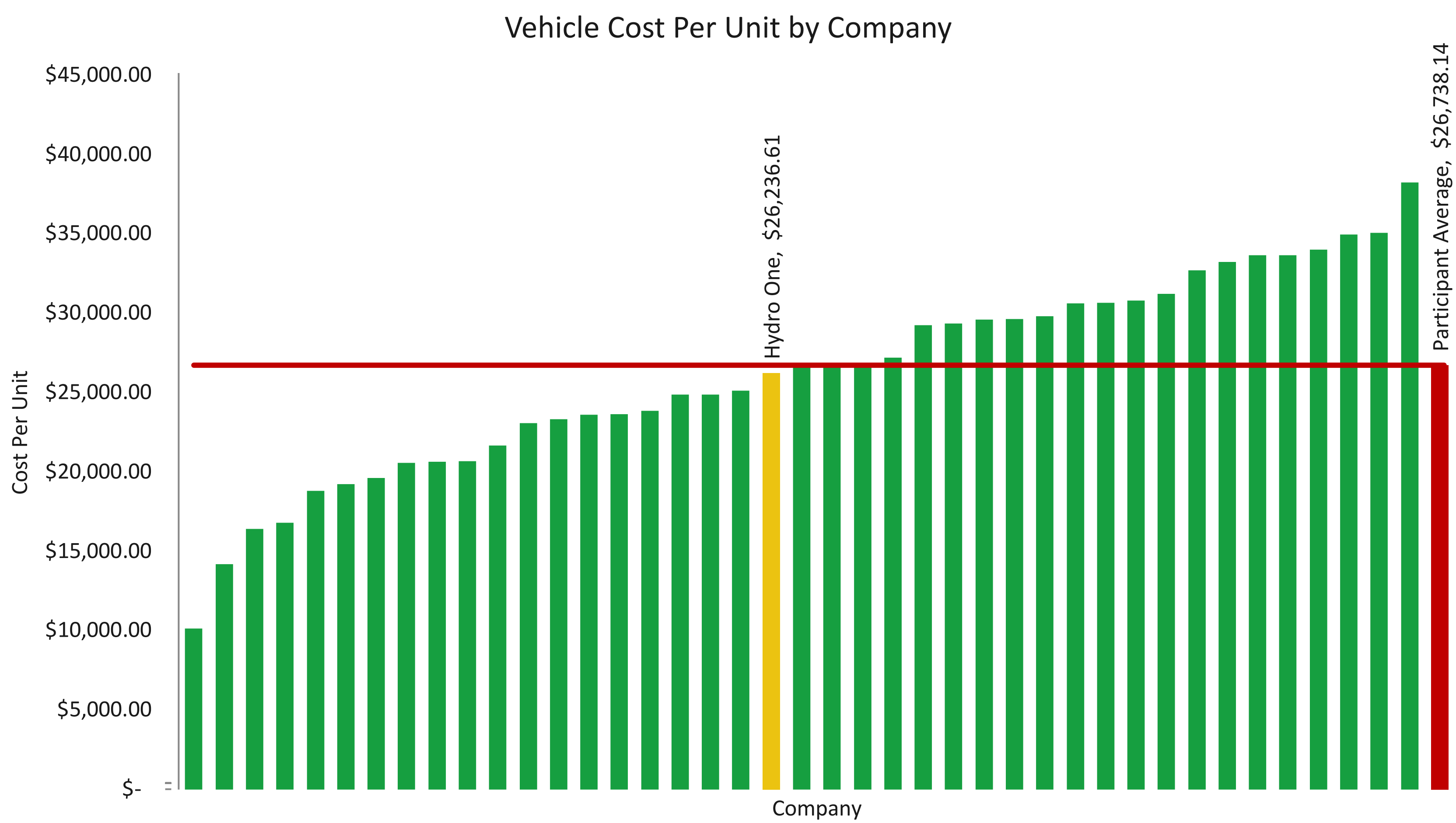
## 2.2a - Cost per VE (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per VE basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants. !

| Cost Per VE by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $158.23 | $173.08 | $184.32 | $256.26 |
| Operating (Net Fuel) | $163.31 | $172.57 | $187.16 | $206.30 |
| Fuel | $105.38 | $133.90 | $120.89 | $108.76 |
| Support | $60.44 | $58.46 | $63.49 | $60.44 |
| **Fleet Total Cost** | **$487.36** | **$538.01** | **$555.86** | **$631.76** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | $2^{nd}$ Quartile | $2^{nd}$ Quartile | $2^{nd}$ Quartile |

## 2.2b - Cost per Unit




The above graph shows a comparison of all on-road vehicles on a cost per unit basis for the 2019 calendar year. Hydro One is 1.88% lower than the participant average for 2019 and is in the second quartile.

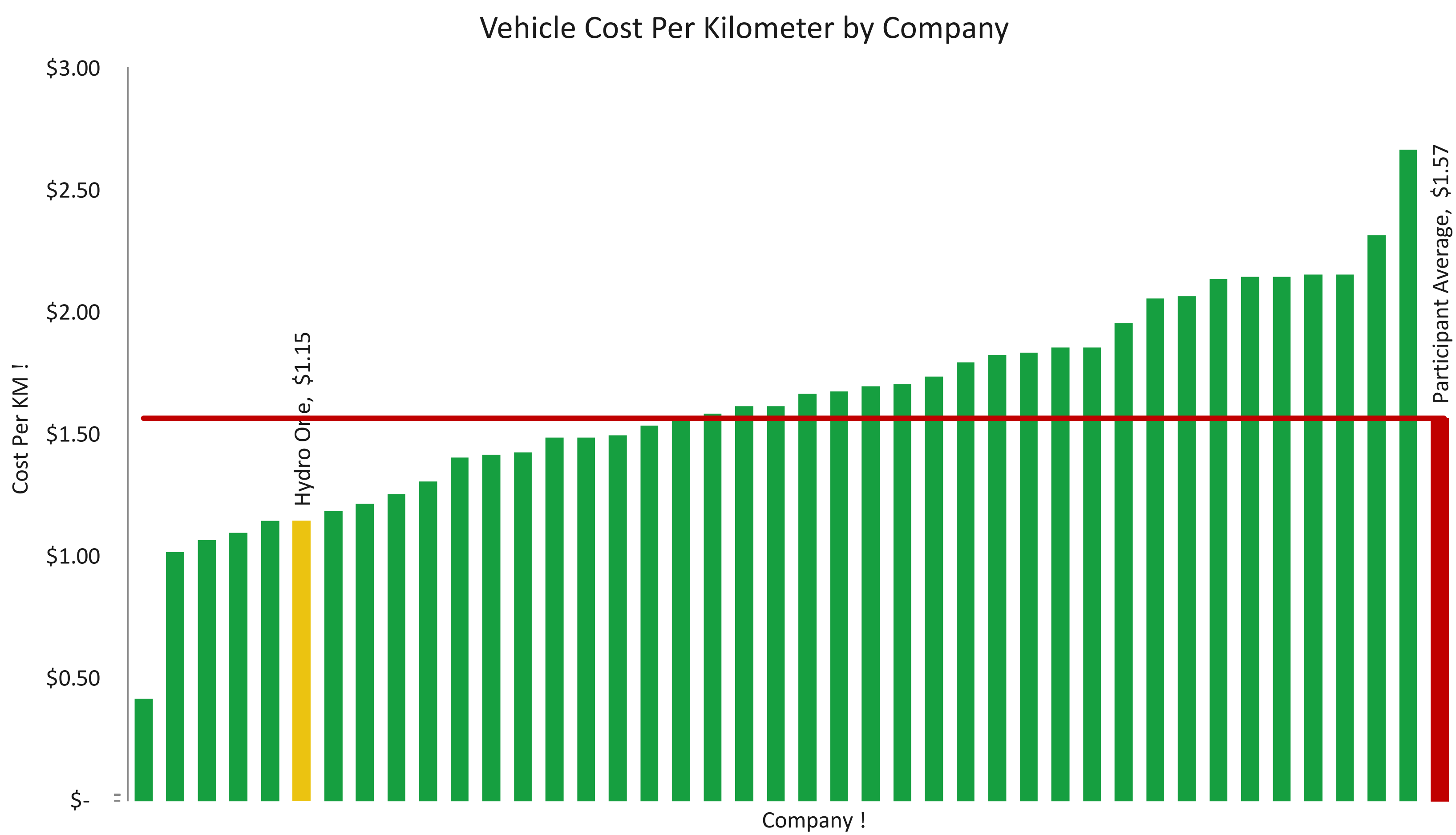
## 2.2b - Cost per Unit (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per unit basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants. !

| Cost Per Unit by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $7,719.02 | $8,172.67 | $8,699.85 | $10,845.72 |
| Operating (Net Fuel) | $7,966.59 | $8,148.38 | $8,833.39 | $8,731.36 |
| Fuel | $5,140.37 | $6,322.59 | $5,706.35 | $4,602.98 |
| Support | $2,948.53 | $2,760.31 | $2,997.02 | $2,558.09 |
| **Fleet Total Cost** | **$23,774.51** | **$25,403.95** | **$26,236.61** | **$26,738.15** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 2nd Quartile | 2nd Quartile | 2nd Quartile |

## 2.2c - Cost per Kilometer $




The above graph shows a comparison of all on-road vehicles on a cost per kilometer basis for the 2019 calendar year. Hydro One is 26.75% lower than the participant average and is in the first quartile.

## 2.2c - Cost per Kilometer (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per kilometer basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants.

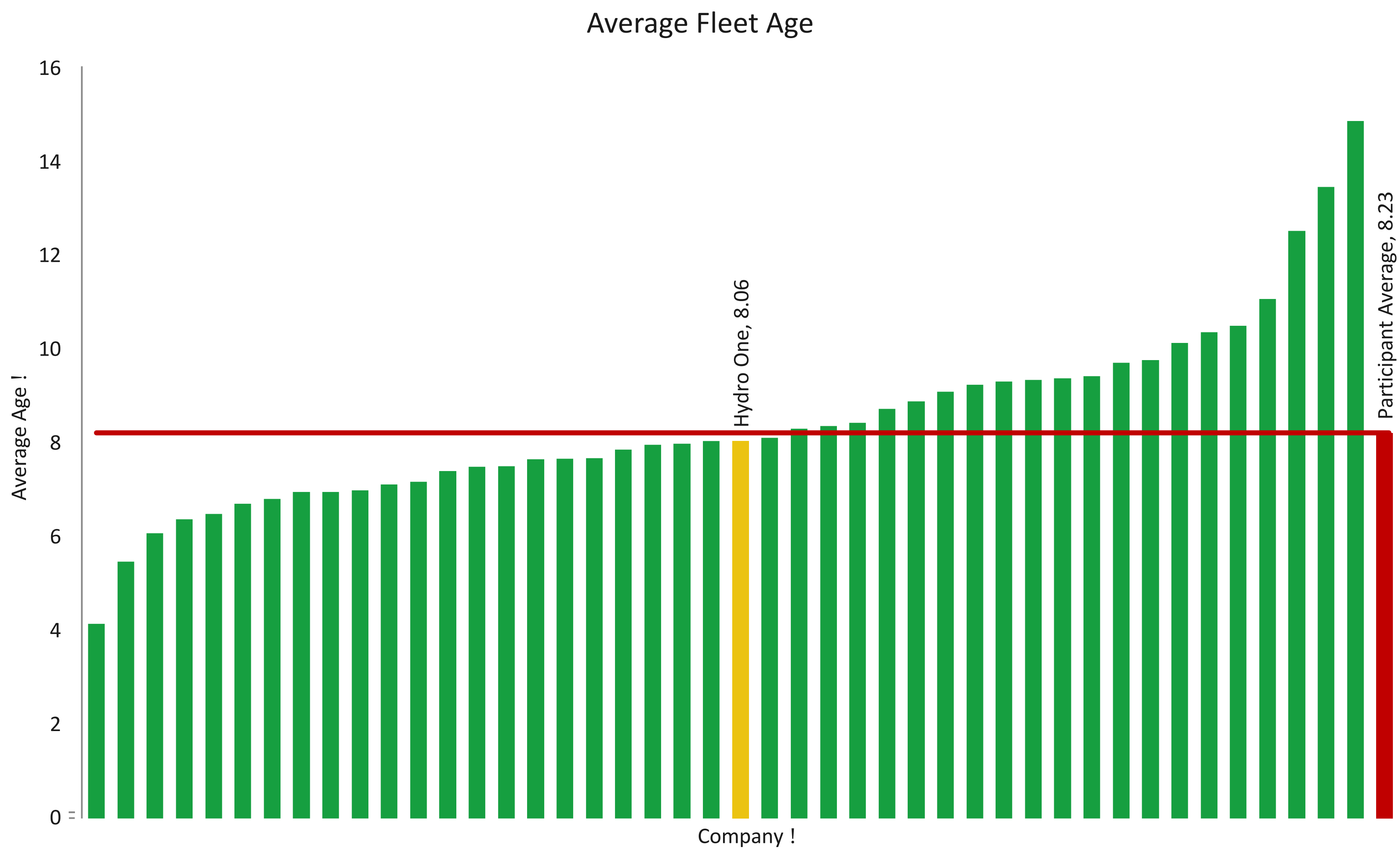
| Cost Per Kilometer by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $0.35 | $0.35 | $0.38 | $0.64 |
| Operating (Net Fuel) | $0.36 | $0.35 | $0.38 | $0.52 |
| Fuel | $0.23 | $0.27 | $0.25 | $0.27 |
| Support | $0.13 | $0.12 | $0.13 | $0.15 |
| **Fleet Total Cost** | **$1.07** | **$1.09** | **$1.14** | **$1.58** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 1st Quartile | 1st Quartile | 1st Quartile |

For class specific analysis on a cost per kilometer level, see the appendix (section 7) of this report. !

## 3.0 - Hydro One Fleet Age Comparison Results

### 3.1 - All Units – Average Age Comparison




The above graph shows a comparison of the average age of all units for the 2019 calendar year. Hydro One is 2.07% younger than the participant average and is in the second quartile.

## 3.1 - All Units – Average Age Comparison (Continued)

The table below shows certain fleet statistics by Hydro One equipment types. To standardize the analysis across the participant list, each Utilimarc class code was first assigned to a Hydro One equipment type then applied to all the units of the Utilimarc benchmark participants. (See glossary for class code mapping.)

| 2019 | Hydro One | | | Utilimarc Participants | | |
|---|---|---|---|---|---|---|
| **Equipment Type** | **Quantity of TWE Fleet (%)** | **Average Age (Years)** | **Average Annual Mileage (KM)** | **Quantity of TWE Fleet (%)** | **Average Age (Years)** | **Average Annual Mileage (KM)** |
| LIGHT | 39.8% | 5.31 | 24,944 | 40.0% | 6.09 | 18,364 |
| HEAVY | 19.3% | 8.29 | 18,563 | 25.6% | 6.98 | 15,048 |
| OFF ROADS | 5.0% | 10.73 | N/A | 5.1% | 8.25 | N/A |
| MISC POE and TRAILERS | 35.9% | 10.61 | N/A | 28.7% | 12.06 | N/A |
| OTHER | 0.0% | 0 | N/A | 0.6% | 15.56 | N/A |

In comparing the 2019 Hydro One data above to that of the Utilimarc participants, it can be seen that Hydro One is younger for the “LIGHT” and “MISC POE and TRAILERS” equipment types but older for the “HEAVY” and “OFF ROADS” equipment types. For the “LIGHT” equipment type, Hydro One’s annual mileage averages over 5,000 kilometers higher than the participant average. For the “HEAVY” equipment type, Hydro One’s annual mileage averages over 3,000 kilometers higher than the participant average.

## 4.0 - Low Mileage and Low Litre Unit Comparisons

This section focuses on the percentage of on-road vehicles and off-road equipment that are considered “low mileage” or “low litre” units. There are a variety of ways to quantify the utilization of a unit, including annual mileage, annual litre consumption, annual engine hours, and annual days used. This section uses the annual mileage for on-road vehicles and annual litre consumption for off-road units for the benchmark utilization comparison. Though engine hours and days used are considered more accurate, these measurements require telematics data to accurately capture, something that is not widely provided within the benchmark analysis.

## 4.1 - All Vehicles – Low Mileage (Kilometers) Percentage Comparison

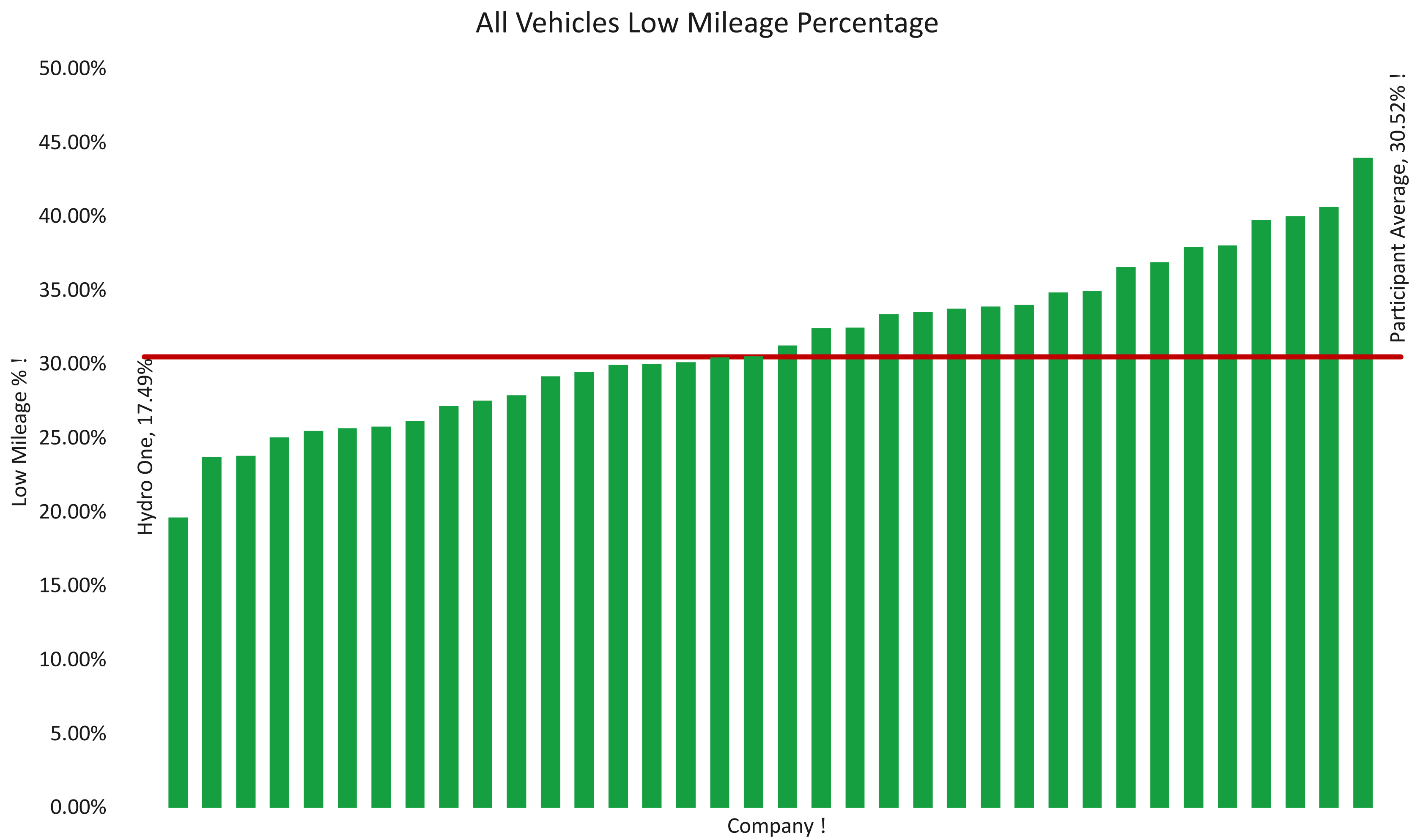
Utilimarc defines a low mileage unit as a unit that had an annual mileage of less than 50% of the internal average annual mileage for the specific class of vehicles. For example, take a class of vehicles that run on average 10,000 kilometers annually. A low mileage unit in this class would be a unit running less than 5,000 kilometers in a year (10,000 * 50%).

Each company within the participant list will have their own unique low mileage threshold (50% *Average Annual Mileage) based on the average annual mileage of their internal on-road vehicles. Thus, each unit counted as a low mileage unit is only a low mileage unit for that company. A company with a higher average annual mileage will need to meet a higher utilization threshold than the industry.

Though we are counting the number of individual units that are considered under-utilized in the industry, Utilimarc has decided to focus on the percentage of units within a class of vehicles that are considered low mileage units to improve comparisons by accounting for the size of a fleet.

See the next page for the Hydro One 2019 all vehicles low mileage (kilometers) percentage comparison.

## 4.1 - All Vehicles – Low Mileage (Kilometers) Percentage Comparison (Continued) $




The above graph shows a comparison of the low mileage percentage of all vehicles for the 2019 calendar year. Hydro One is the first bar in the comparison at only 17.49% of the vehicles being low mileage units which is 13.03% below the participant average. In addition to having the lowest percentage in this graph, Hydro One runs 5,000 more kilometers on average than it's peers.

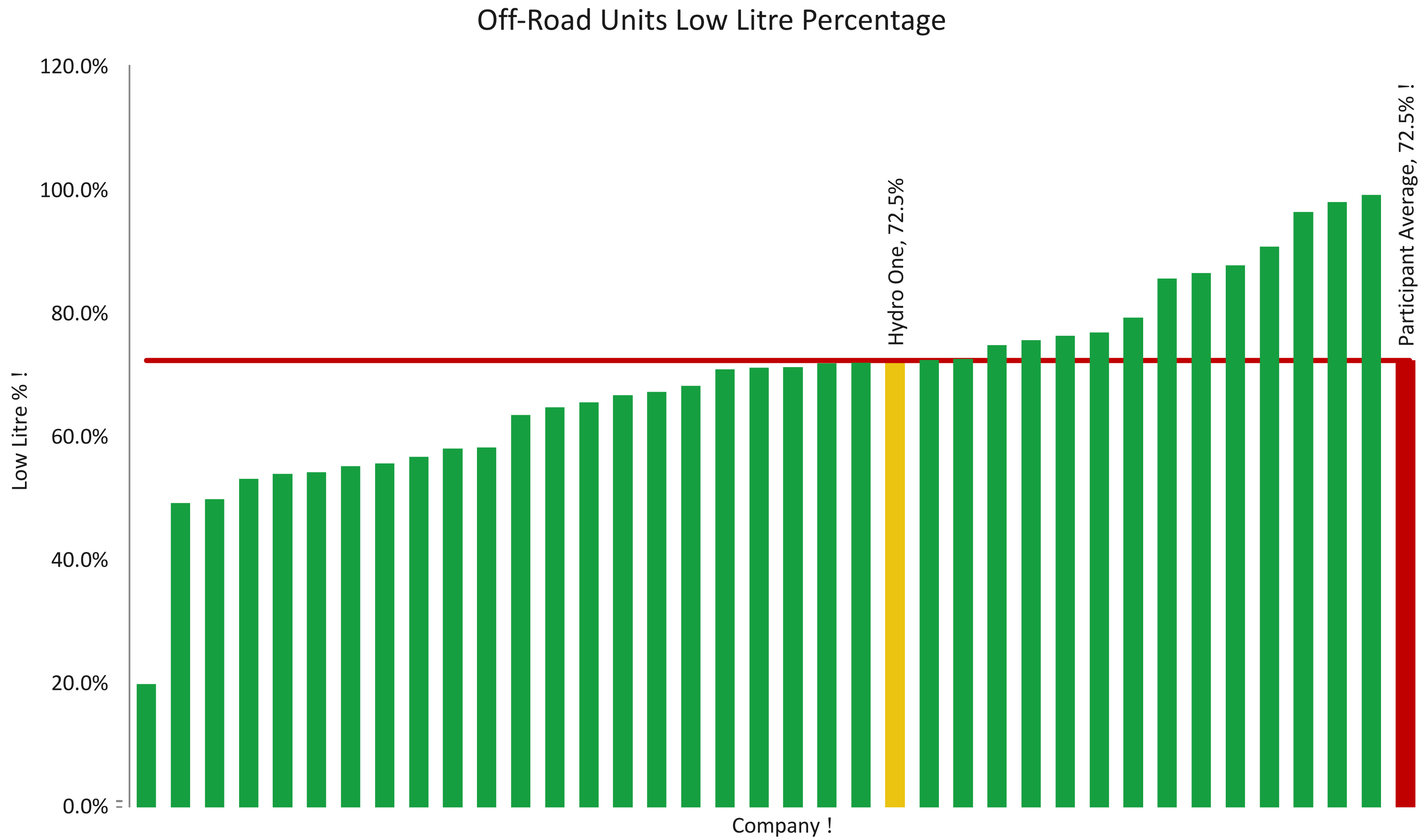
 

## 4.2 - Off-Road Units – Low Litre Percentage Comparison

This section focuses on litre consumption for the off-road units because the underlying data is the most likely to be tracked (compared to other metrics) by the companies in the benchmark study. The same general methodology as described for the on-road vehicles is used with the only change being to focus on low litre consumption during the year instead of low mileage.

See the next page for the Hydro One 2019 off-road units low litre percentage comparison.

## 4.2 - Off-Road Units – Low Litre Percentage Comparison (Continued)




The above graph shows a comparison of the percentage of off-road units that are considered "low litre" for the 2019 calendar year. (See glossary for details on which classes make up the off-road units.) Hydro One (72.5%) is in-line with the participant average low litre percentage (72.5%) and is in the third quartile. It is noteworthy that not all companies track the litre consumption at a unit level for off-road units.

## 5.0 - Corporate Trends

This section focuses on high-level fleet trends around fleet costs and fleet mix. For each of the following charts, the Hydro One's information is listed for the past 3 years as a percent of total while the participant information is the most recent calendar year data (2019).

### 5.1 - Financial Breakout

The chart below shows cost information by Hydro One requested cost categories. (See the glossary for the mappings of Utilimarc cost categories into the Hydro One defined categories.) In comparing the Depreciation % of Hydro One to that of the participants, it is noteworthy that Hydro One has a higher ratio of owned versus leased/rental units compared to its peers.

| Description | 2017 % | 2018 % | 2019 % | 2019 Participant % |
|---|---|---|---|---|
| Operations & Repairs | 53.9% | 52.5% | 53.8% | 49.9% |
| Fuel Costs | 16.5% | 19.0% | 16.8% | 14.7% |
| Depreciation | 29.1% | 28.2% | 28.8% | 22.1% |
| External Fleet Rentals/Leased | 0.5% | 0.4% | 0.6% | 13.3% |
| **Total** | **100.0%** | **100.0%** | **100.0%** | **100.0%** |

### 5.2 - Fleet Mix Breakout

The chart below shows the fleet mix make-up by the Hydro One requested unit types. (See the glossary for the mappings of Utilimarc class codes into the Hydro One defined unit types.) Hydro One has a smaller percentage of LIGHT, HEAVY, and OFF ROADS equipment than the participants but more MISC POE and Trailers.

| By Type | 2017 % | 2018 % | 2019 % | 2019 Participant % |
|---|---|---|---|---|
| LIGHT | 38.1% | 38.3% | 39.8% | 40.0% |
| HEAVY | 19.1% | 19.8% | 19.3% | 25.6% |
| OFF ROADS | 5.2% | 5.1% | 5.0% | 5.1% |
| MISC POE and Trailers | 37.7% | 36.8% | 35.9% | 28.7% |
| OTHER | 0.0% | 0.0% | 0.0% | 0.6% |
| **Total** | **100.0%** | **100.0%** | **100.0%** | **100.0%** |

# 6.0 - Glossary

## 6.1 - Definitions

Throughout this report there are a variety of terms used. Some of these terms are defined by Utilimarc while others were defined by Hydro One. Section 6.1a provides definition on Utilimarc terms and 6.1b provides definitions on Hydro One defined terms. Hydro One definition was used in conjunction with a Utilimarc definition to ensure standardization in the comparisons.

### 6.1a - Utilimarc Definitions

- **Units:** A general term for a vehicle, trailer or piece of power operated equipment. It is the object for which data is collected and attributed.
- **Vehicle:** A unit that operates over the road.
- **Power Operated Equipment (POE):** A unit that operates off road, including backhoes, skid steers, generators, etc.
- **Other:** A unit other than a vehicle, trailer or POE. (Ex. Misc. attachments not that are not attached to a parent unit.)

- **Total Cost:** The sum of ownership, operating (net fuel), fuel, and support cost (each defined below).
- **Ownership Cost:** The sum of all leasing, rental, interest, licensing, and depreciation expenses.
- **Operating Cost (Net Fuel):** The sum of all company mechanic labor, contract mechanic labor, and parts.
- **Fuel Cost:** The sum of all company fuel expenses.
- **Support Cost:** The sum of all expenses related to management and support staff, facilities cost, and shop supplies.

- **Quartile:** Utilimarc uses the quartile value to compare each company to the industry in a variety of metrics. Each annual comparison of the industry will have 4 quartiles. The 1$^{st}$ quartile is the best performing companies in the comparison and the 4$^{th}$ quartile is the worst performing companies in the comparison.
- **Vehicle Equivalency (VE):** A weighting factor based on expected labor hour requirements.

- **Low Mileage Units:** A low mileage unit ran less than 50% of the internal average mileage for the calendar year.
- **Low Litre Units:** A low litre unit ran less than 50% of the internal average litre consumption for the calendar year.

### 6.1b - Hydro One Definitions $

- **LIGHT:** Light duty on-road vehicles. See section 6.2 for more information.
- **HEAVY:** Heavy duty on-road vehicles. See section 6.2 for more information.
- **OFF ROADS:** Off-road equipment that are driven. See section 6.2 for more information.
- **MISC POE and Trailers:** Power operated equipment not included in the OFF ROADS group plus trailers. See section 6.2 for more information.
- **OTHER:** General catch all for misc. Utilimarc class codes that are not typically tracked or utilized by Hydro One. See section 6.2 for more information.
- **Operations & Repairs:** Contains the Utilimarc cost categories of Licensing, Mechanic, Support Labor, Parts, Vendor, Interest, and Other Costs.
- **Fuel Costs:** Contains the Utilimarc cost category of fuel expense.
- **Depreciation:** Contains the Utilimarc cost category of depreciation expense.
- **External Fleet Rentals/Leased:** Contains the Utilimarc cost category of lease expense.

## 6.2 - Utilimarc Class Codes $

In the table below is a list of all the Utilimarc class codes utilized in the benchmark analysis. For this report, Hydro One requested that some of the Utilimarc class codes be grouped into Hydro one-specific categories. These groupings are used throughout the report and are listed below.

| Utilimarc Class Code | Utilimarc Class Name | Utilimarc Category | Hydro One Type |
|---|---|---|---|
| 3 | Sedan - Unassigned | Vehicle | Light |
| 3.1 | Sedan - Compact | Vehicle | Light ) |
| 3.2 | Sedan - Midsize | Vehicle | Light ) |
| 3.3 | Sedan - Fullsize | Vehicle | Light ) |
| 3.4 | Sedan - Hybrid | Vehicle | Light ) |
| 3.5 | Sedan - Electric | Vehicle | Light ) |
| 4 | Police | Vehicle | Light ) |
| 4.1 | Police - Marked Squad Sedan | Vehicle | Light ) |
| 4.2 | Police - Marked Squad SUV | Vehicle | Light ) |
| 4.3 | Police - Unmarked Sedan | Vehicle | Light ) |
| 4.4 | Police - Unmarked SUV | Vehicle | Light ) |
| 4.5 | Police - Light Vans | Vehicle | Light ) |
| 4.6 | Police - Heavy Vans | Vehicle | Heavy ) |
| 4.7 | Police - Motorcycles | Vehicle | Light ) |
| 5 | Passenger Van | Vehicle | Heavy ) |
| 6 | Pickup - Unassigned | Vehicle | Light ) |
| 6.1 | Pickup - Class 1 | Vehicle | Light ) |
| 6.21 | Pickup - Class 2a | Vehicle | Light ) |
| 6.22 | Pickup - Class 2b | Vehicle | Light ) |
| 6.3 | Pickup - Class 3 | Vehicle | Light ) |
| 6.4 | Pickup - Class 4+ | Vehicle | Heavy ) |
| 10 | SUV - Unassigned | Vehicle | Light ) |
| 10.1 | SUV - Compact | Vehicle | Light ) |

| Utilimarc Class Code | Utilimarc Class Name | Utilimarc Category | Hydro One Type |
|---|---|---|---|
| 10.2 | SUV - Midsize | Vehicle | Light |
| 10.3 | SUV - Fullsize | Vehicle | Light |
| 11 | Van - Unassigned | Vehicle | Light |
| 11.1 | Van - Class 1 | Vehicle | Light |
| 11.21 | Van - Class 2a | Vehicle | Light |
| 11.22 | Van - Class 2b | Vehicle | Light |
| 11.3 | Van - Class 3 | Vehicle | Light |
| 11.4 | Van - Class 4+ | Vehicle | Heavy |
| 12 | Cube/Step Van | Vehicle | Heavy |
| 12.1 | Cube Van | Vehicle | Heavy |
| 12.2 | Step Van | Vehicle | Heavy |
| 13 | Dump Truck - Unassigned | Vehicle | Heavy |
| 13.4 | Dump Truck - Class 4 | Vehicle | Heavy |
| 13.5 | Dump Truck - Class 5 | Vehicle | Heavy |
| 13.6 | Dump Truck - Class 6 | Vehicle | Heavy |
| 13.7 | Dump Truck - Class 7 | Vehicle | Heavy |
| 13.8 | Dump Truck - Class 8 | Vehicle | Heavy |
| 14 | Service Truck - Unassigned | Vehicle | Heavy |
| 14.2 | Service Truck - Class 2 | Vehicle | Light |
| 14.3 | Service Truck - Class 3 | Vehicle | Light |
| 14.4 | Service Truck - Class 4 | Vehicle | Heavy |
| 14.5 | Service Truck - Class 5 | Vehicle | Heavy |
| 14.6 | Service Truck Class 6+ | Vehicle | Heavy |
| 15 | Stake Truck | Vehicle | Heavy |
| 16 | Bucket Truck - Unassigned | Vehicle | Heavy |
| 16.5 | Bucket Truck - Class 5 | Vehicle | Heavy |
| 16.6 | Bucket Truck - Class 6 | Vehicle | Heavy |
| 16.7 | Bucket Truck - Class 7 | Vehicle | Heavy |
| 16.8 | Bucket Truck - Class 8 | Vehicle | Heavy |
| 17 | Non-Insulated Bucket Truck | Vehicle | Heavy |
| 18 | Transmission Bucket Truck | Vehicle | Heavy |

| Utilimarc Class Code | Utilimarc Class Name | Utilimarc Category | Hydro One Type |
|---|---|---|---|
| 19 | Digger Derrick - Unassigned | Vehicle | Heavy |
| 19.7 | Digger Derrick - Class 7 | Vehicle | Heavy |
| 19.8 | Digger Derrick - Class 8 | Vehicle | Heavy |
| 20 | Tanker | Vehicle | Heavy |
| 21 | Semi-Tractor | Vehicle | Heavy |
| 22 | Crane - Unassigned | Vehicle | Heavy |
| 22.1 | Crane - On Road | Vehicle | Heavy |
| 22.2 | Crane - On Road, Articulating | Vehicle | Heavy |
| 24 | Pressure Digger (Legacy) | Vehicle | Heavy |
| 25 | Track Unit - Unmounted | POE | Off-Roads |
| 26 | Track Unit - Mounted | POE | Off-Roads |
| 27 | Directional (Horizontal) Drill Unit | POE | Misc POE And Trailers |
| 28 | Crane - Off Road | POE | Off-Roads |
| 30 | Frontend Loader & Backhoe | POE | Off-Roads |
| 31 | Skid-steer - Unassigned | POE | Off-Roads |
| 31.1 | Skid-steer - Light | POE | Off-Roads |
| 31.2 | Skid-steer - Heavy | POE | Off-Roads |
| 32 | Dozer | POE | Off-Roads |
| 33 | Trencher - Unassigned | POE | Off-Roads |
| 33.1 | Trencher - Walk-Behind | POE | Off-Roads |
| 33.2 | Trencher - Light | POE | Off-Roads |
| 33.3 | Trencher - Medium | POE | Off-Roads |
| 33.4 | Trencher - Heavy | POE | Off-Roads |
| 34 | Loader - Unassigned | POE | Off-Roads |
| 34.1 | Loader - Light | POE | Off-Roads |
| 34.2 | Loader - Medium | POE | Off-Roads |
| 34.3 | Loader - Heavy | POE | Off-Roads |
| 35 | Excavator - Unassigned | POE | Off-Roads |
| 35.1 | Excavator - Mini | POE | Off-Roads |
| 35.2 | Excavator - Light | POE | Off-Roads |
| 35.3 | Excavator - Medium | POE | Off-Roads |

| Utilimarc Class Code | Utilimarc Class Name | Utilimarc Category | Hydro One Type |
|---|---|---|---|
| 35.4 | Excavator - Heavy | POE | Off-Roads |
| 38 | Compactor Equipment | POE | Off-Roads |
| 39 | Tensioner/Puller | POE | Misc POE And Trailers |
| 40 | Brush Chipper | POE | Misc POE And Trailers |
| 41 | Welder | POE | Misc POE And Trailers |
| 42 | Air Compressor | POE | Misc POE And Trailers |
| 43 | ATV/Utility Cart | POE | Misc POE And Trailers |
| 43.1 | ATV | POE | Misc POE And Trailers |
| 43.2 | Utility Cart | POE | Misc POE And Trailers |
| 44 | Backyard Mobile Equipment | POE | Off-Roads |
| 45 | Generators | POE | Misc POE And Trailers |
| 48 | Mobile Aerial Platform | POE | Misc POE And Trailers |
| 49 | Forklift | POE | Misc POE And Trailers |
| 50 | Motor Grader | POE | Off-Roads |
| 51 | Pressure Washer | POE | Misc POE And Trailers |
| 52 | Off Road Tractor with Equipment | POE | Off-Roads |
| 53 | Mower - Unassigned | POE | Off-Roads |
| 53.1 | Mower - Push | POE | Off-Roads |
| 53.2 | Mower - Riding Reel | POE | Off-Roads |
| 53.3 | Mower - Riding Deck | POE | Off-Roads |
| 54 | Sweeper - Unassigned | POE | Off-Roads |
| 54.1 | Sweeper - Sidewalk | POE | Off-Roads |
| 54.2 | Sweeper - Street | POE | Off-Roads |
| 55 | Mobile Substation | Other | Other |
| 99 | Misc. - Unassigned | Other | Other |
| 99.1 | Misc. - Vehicle | Vehicle | Heavy |
| 99.2 | Misc. - POE | POE | Misc POE And Trailers |
| 99.3 | Misc. - Attachments | Other | Other |
| 99.4 | Misc. - Tools | Other | Other |
| 100 | Trailers | Trailer | Misc POE And Trailers |
| 101 | Scraper | POE | Off-Roads |

| Utilimarc Class Code | Utilimarc Class Name | Utilimarc Category | Hydro One Type |
|---|---|---|---|
| 102 | Bus | Vehicle | Heavy |
| 102.1 | Bus - Passanger | Vehicle | Heavy ) |
| 102.2 | Bus - Articulating | Vehicle | Heavy ) |
| 102.3 | Bus - Paratransit | Vehicle | Heavy ) |
| 103 | Fire Truck - Unassigned | Vehicle | Heavy ) |
| 103.1 | Fire Truck - Ladder | Vehicle | Heavy ) |
| 103.2 | Fire Truck - Platform | Vehicle | Heavy ) |
| 103.3 | Fire Truck - Pumper | Vehicle | Heavy ) |
| 103.4 | Fire Truck - Quint | Vehicle | Heavy ) |
| 103.5 | Fire Truck - Support Vehicle | Vehicle | Heavy ) |
| 103.6 | Fire Truck - Boat | Vehicle | Misc POE And Trailers ) |
| 103.7 | Fire Truck - Rescue | Vehicle | Heavy ) |
| 104 | Tow Truck | Vehicle | Heavy ) |
| 105 | Vacuum Truck | Vehicle | Heavy ) |
| 106 | Cable Pulling Truck | Vehicle | Heavy ) |
| 107 | Washer Truck (Legacy) | Vehicle | Heavy ) |
| 108 | Refuse Truck - Unassigned | Vehicle | Heavy ) |
| 108.1 | Refuse Truck - Front Loader | Vehicle | Heavy ) |
| 108.2 | Refuse Truck - Side Loader | Vehicle | Heavy ) |
| 108.3 | Refuse Truck - Rear Loader | Vehicle | Heavy ) |
| 108.4 | Refuse Truck - Recycle | Vehicle | Heavy ) |
| 108.5 | Refuse Truck - Roll-Off | Vehicle | Heavy ) |
| 109 | Aerial Cable Placer | Vehicle | Heavy ) |
| 110 | Ambulance | Vehicle | Heavy ) |
| 111 | Delivery Truck (Legacy) | Vehicle | Heavy ) |
| 112 | Plow Truck | Vehicle | Heavy ) |

# 7.0 - Appendix

In addition to the high-level fleet to fleet comparisons, the benchmark includes the comparison of specific classes of vehicles to one another. This section focuses on the top 5 vehicle classes that were the most expensive for Hydro One in the 2019 calendar year.

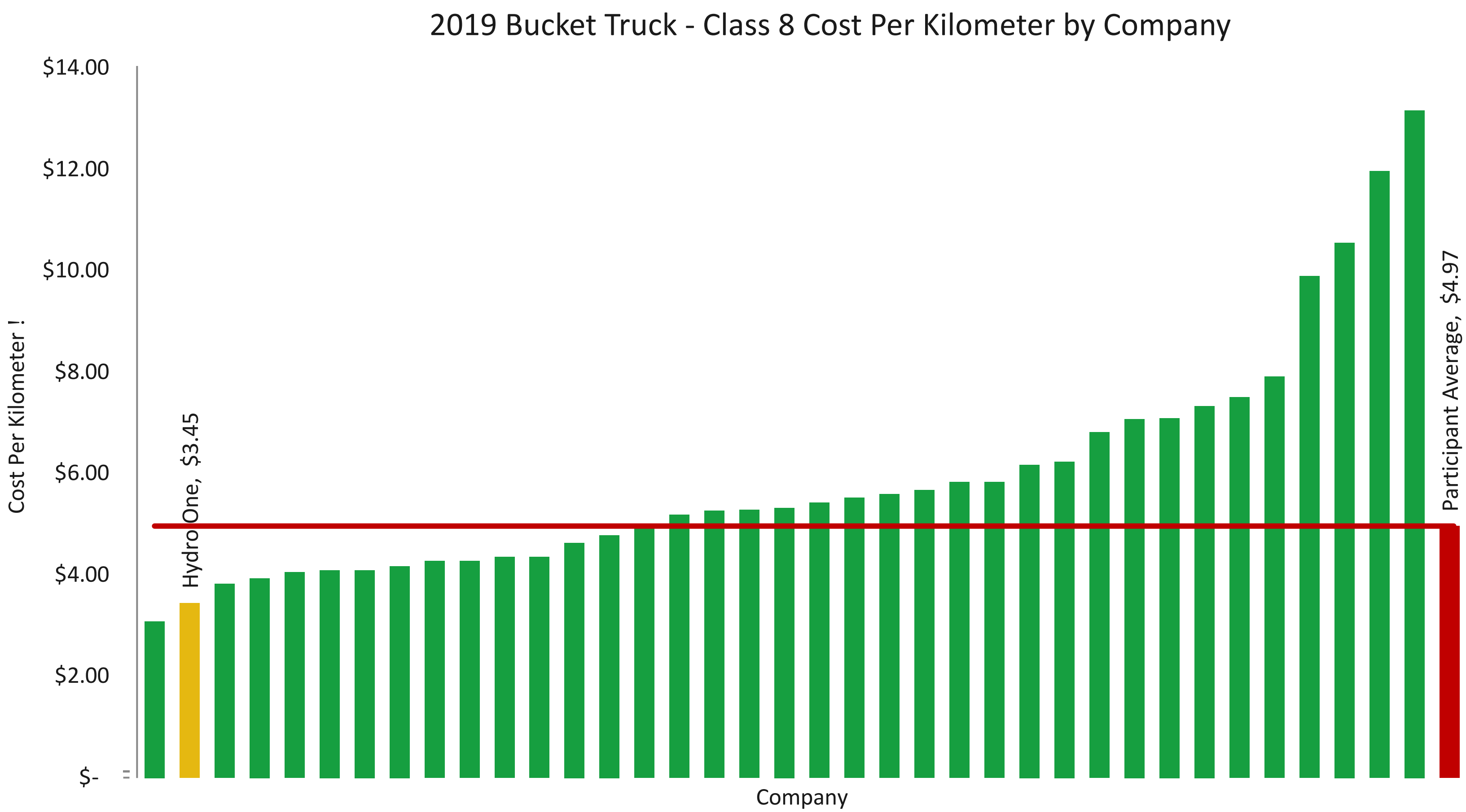
## 7.1 – Cost per Kilometer Class Specific Comparison

Below is a list of the 5 vehicle class codes that are highlighted and the quartile performance on a cost per kilometer basis:

- **Bucket Truck – Class 8:** 1st Quartile
- **Pickup – Class 2b:** 1st Quartile
- **Digger Derrick – Class 8:** 1st Quartile
- **Pickup – Class 2a:** 1st Quartile
- **Pickup – Class 4+:** 2nd Quartile

For additional information on each cost distribution, see sections 7.1a – 7.1e. The format of this sections 7.1a – 7.1e will be similar to that of the high-level comparison results in section 2 but will be filtered down to one Utilimarc class code per graph and table.

## 7.1a - Bucket Truck – Class 8




The above graph shows a comparison of the bucket truck – class 8 vehicles on a cost per kilometer basis for the 2019 calendar year. Hydro One is 30.58% lower than the participant average for 2019 and in the first quartile.

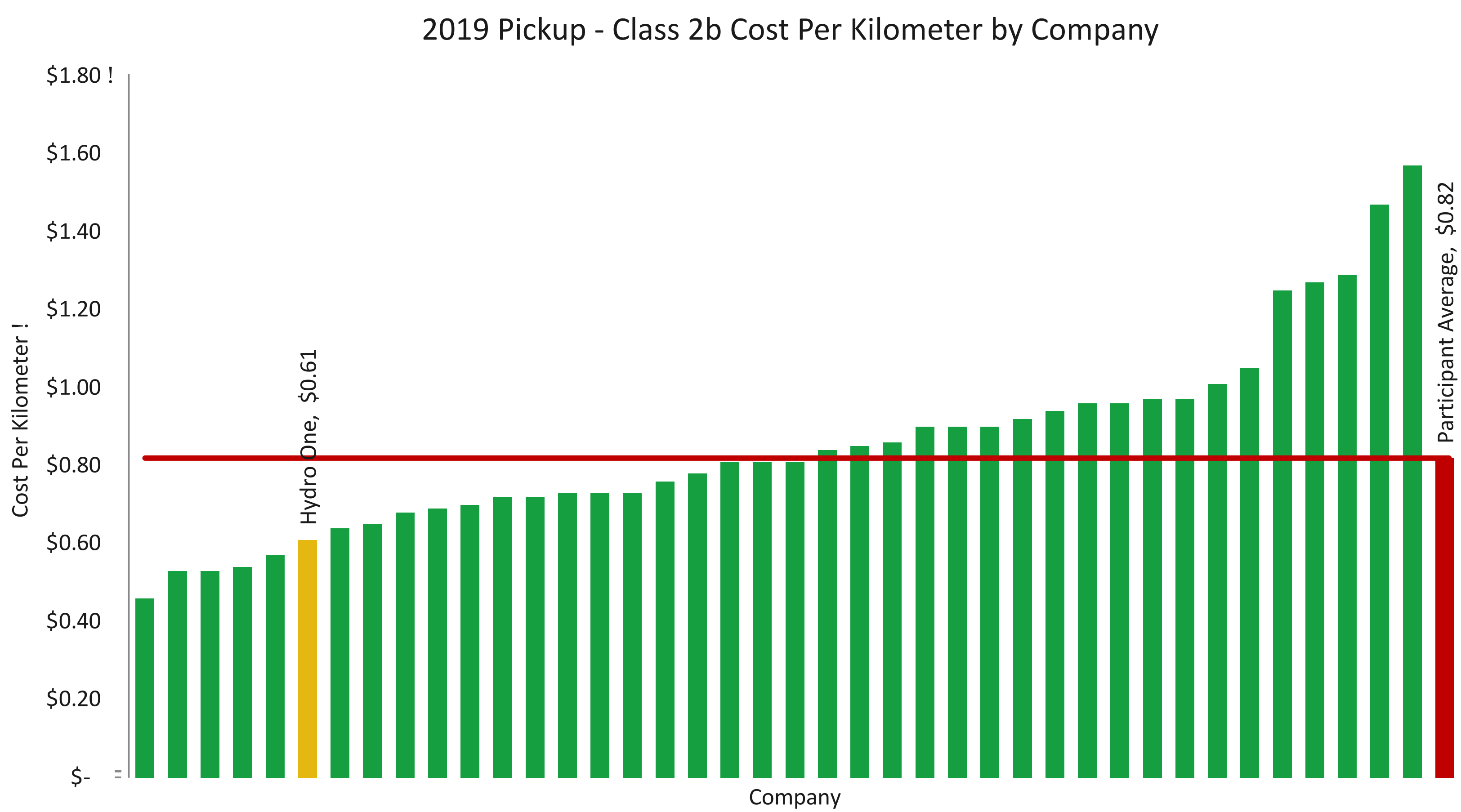
## 7.1a - Bucket Truck – Class 8 (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per kilometer basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants.

| Cost Per Kilometer by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $1.04 | $1.09 | $1.13 | $2.08 |
| Operating (Net Fuel) | $1.28 | $1.30 | $1.34 | $1.75 |
| Fuel | $0.43 | $0.54 | $0.48 | $0.57 |
| Support | $0.49 | $0.47 | $0.49 | $0.57 |
| **Fleet Total Cost** | **$3.25** | **$3.41** | **$3.45** | **$4.97** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 1st Quartile | 1st Quartile | 1st Quartile |

## 7.1b - Pickup – Class 2b




The above graph shows a comparison of the pickup – class 2b vehicles on a cost per kilometer basis for the 2019 calendar year. Hydro One is 25.61% lower than the participant average for 2019 and in the first quartile.

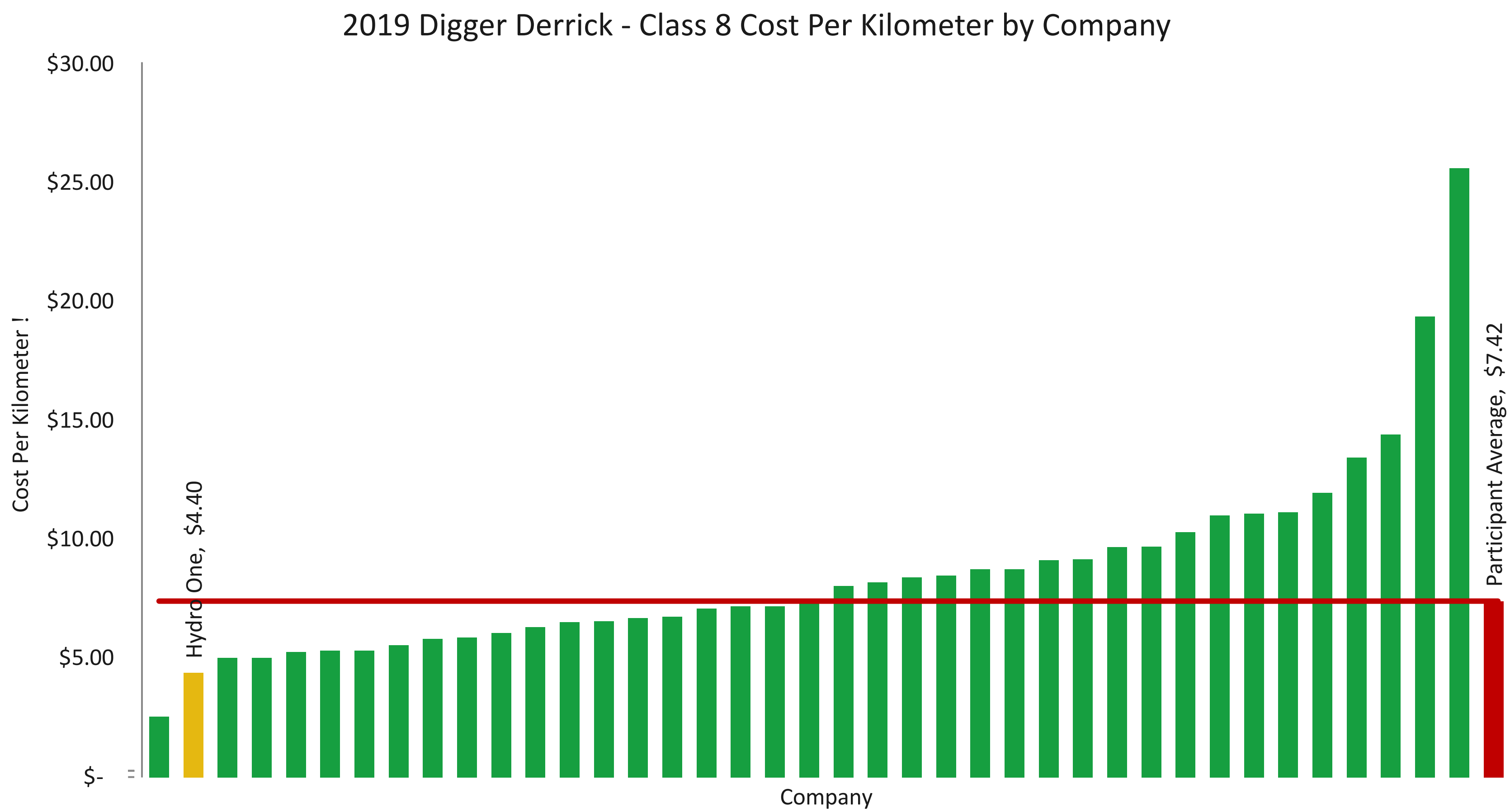
## 7.1b - Pickup – Class 2b (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per kilometer basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants.

| Cost Per Kilometer by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $0.15 | $0.18 | $0.17 | $0.29 |
| Operating (Net Fuel) | $0.13 | $0.14 | $0.16 | $0.24 |
| Fuel | $0.20 | $0.25 | $0.23 | $0.23 |
| Support | $0.04 | $0.04 | $0.05 | $0.07 |
| **Fleet Total Cost** | **$0.53** | **$0.61** | **$0.61** | **$0.82** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 1st Quartile | 1st Quartile | 1st Quartile |

### 7.1c - Digger Derrick – Class 8




The above graph shows a comparison of the digger derrick – class 8 vehicles on a cost per kilometer basis for the 2019 calendar year. Hydro One is 40.70% lower than the participant average for 2019 and is in the first quartile.

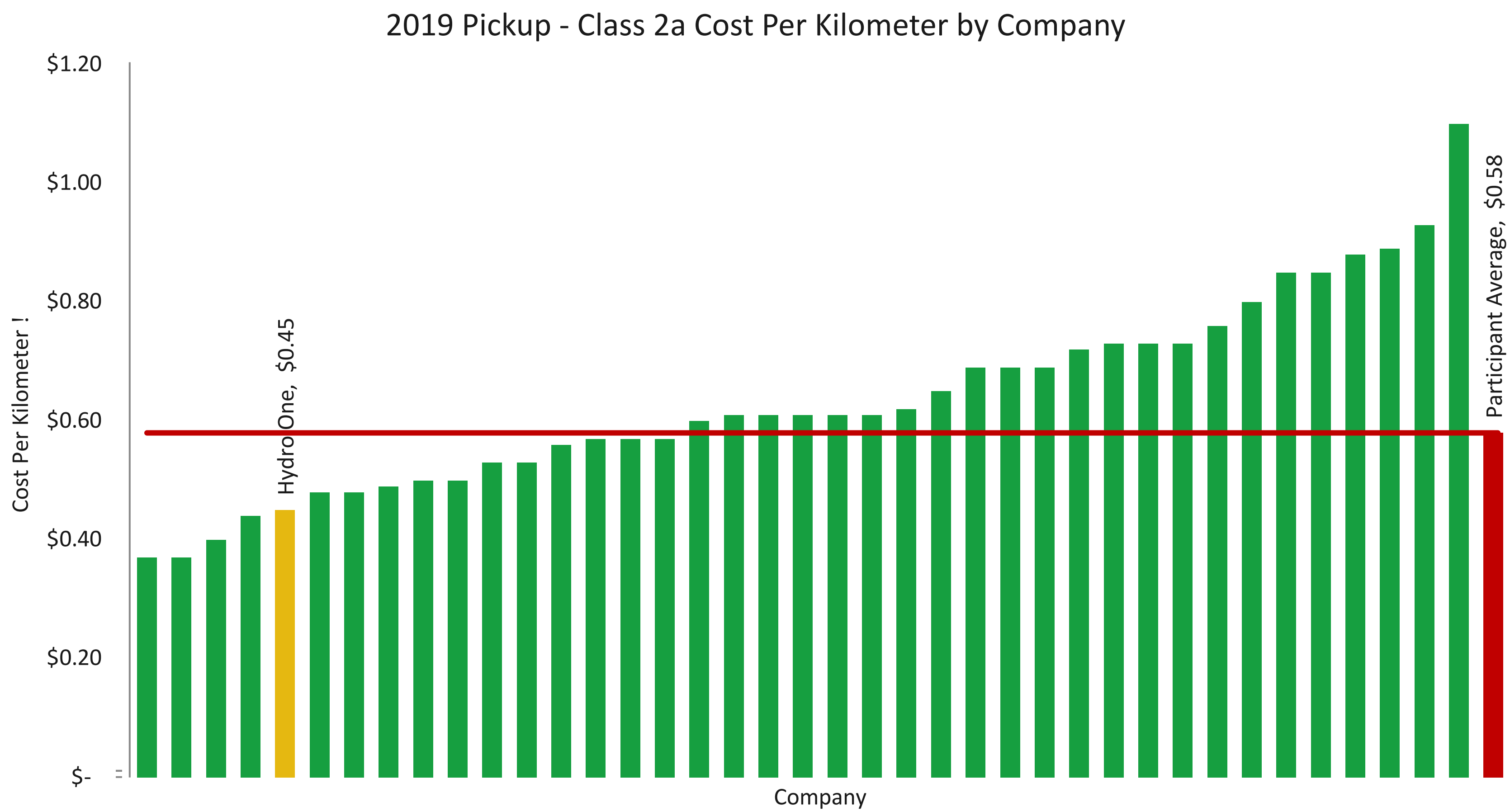
## 7.1c - Digger Derrick – Class 8 (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per kilometer basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants.

| Cost Per Kilometer by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $1.48 | $1.45 | $1.57 | $3.38 |
| Operating (Net Fuel) | $1.51 | $1.65 | $1.76 | $2.67 |
| Fuel | $0.43 | $0.56 | $0.54 | $0.64 |
| Support | $0.53 | $0.49 | $0.53 | $0.73 |
| **Fleet Total Cost** | **$3.96** | **$4.15** | **$4.40** | **$7.42** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 1st Quartile | 1st Quartile | 1st Quartile |

## 7.1d - Pickup – Class 2a




The above graph shows a comparison of the pickup – class 2b vehicles on a cost per kilometer basis for the 2019 calendar year. Hydro One is 22.41% lower than the participant average for 2019 and is in the first quartile.

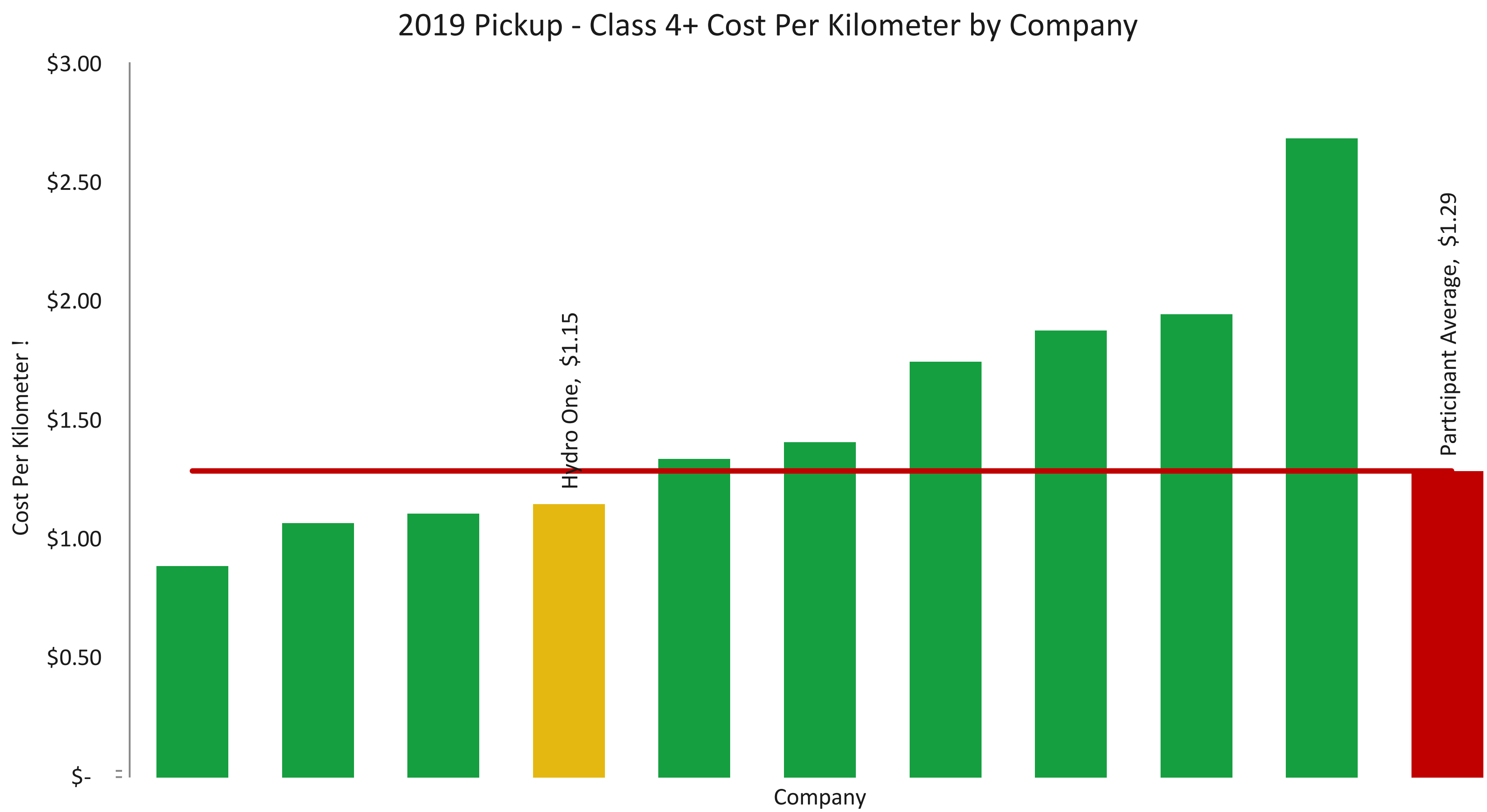
### 7.1d - Pickup – Class 2a (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per kilometer basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants.

| Cost Per Kilometer by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $0.16 | $0.17 | $0.17 | $0.24 |
| Operating (Net Fuel) | $0.08 | $0.09 | $0.09 | $0.15 |
| Fuel | $0.15 | $0.17 | $0.15 | $0.16 |
| Support | $0.04 | $0.04 | $0.04 | $0.04 |
| **Fleet Total Cost** | **$0.43** | **$0.45** | **$0.45** | **$0.58** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 1st Quartile | 2nd Quartile | 1st Quartile |

### 7.1e - Pickup – Class 4+




The above graph shows a comparison of the pickup – class 4+ vehicles on a cost per kilometer basis for the 2019 calendar year. Hydro One is 10.85% lower than the participant average for 2019 and is in the second quartile.

## 7.1e - Pickup – Class 4+ (Continued)

The table shown below shows the Hydro One cost trend over the past 3 calendar years on a cost per kilometer basis broken out into Utilimarc defined cost categories. The last column of the table shows the value for all the 2019 benchmark study participants.

| Cost Per Kilometer by Category | 2017 | 2018 | 2019 | 2019 Participant Average |
|---|---|---|---|---|
| Ownership | $0.32 | $0.38 | $0.36 | $0.50 |
| Operating (Net Fuel) | $0.40 | $0.36 | $0.40 | $0.38 |
| Fuel | $0.28 | $0.32 | $0.32 | $0.32 |
| Support | $0.16 | $0.14 | $0.08 | $0.08 |
| **Fleet Total Cost** | **$1.17** | **$1.21** | **$1.15** | **$1.29** |

| By Year | 2017 | 2018 | 2019 |
|---|---|---|---|
| **Hydro One Quartile Performance** | 3rd Quartile | 2nd Quartile | 2nd Quartile |

UTILIMARC®
turning data into knowledge

# Hydro One Fleet Lifecycle Study &

January 19, 2021 '

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## 1.0 - Introduction

The Utilimarc Vehicle Replacement Module (VRM) mathematically determines when fleet assets should be replaced. The VRM uses data regarding a utility's historic cost/practices to predict future ownership and maintenance cost and determines the lifecycle approach that is expected to achieve the lowest total cost over the life of the asset. This calculation is built on the following variables:

- Historic Maintenance Cost (including Parts, Labor, Outside Vendors)
- Historic Utilization
- Historic Acquisition Cost and Residual Value
- Current Acquisition Cost

This report presents the result the VRM methodology applied to data from Hydro One Networks Inc. (Hydro One). The result is a set of class specific, standard lifecycles for Hydro One's top vehicle classes (representing around 80% of the company's annual fleet spend).

## 2.0 - Methodology

### 2.1 - Annualized Total Cost

For each vehicle class in this study, Utilimarc applied the VRM to determine what lifecycle approach achieves the lowest cost to own and maintain an average asset over its lifetime. This is done by calculating the *annualized total cost* for each potential approach. Annualized total cost is the estimated sum of all ownership and maintenance cost over the course of an asset's life, divided by the number of years the unit is in service. Minimizing annualized total cost ensures the lowest total cost over the life of the asset. As an example, the table below shows the annualized cost for the possible lifecycles of an Industry light duty pickup truck.

| Replacement Age | Annualized Total Cost | Deviation |
|---|---|---|
| 1 | $5,964 | 12.3% |
| 2 | $5,759 | 8.4% |
| 3 | $5,598 | 5.4% |
| 4 | $5,476 | 3.1% |
| 5 | $5,390 | 1.5% |
| 6 | $5,337 | 0.5% |
| 7 | $5,313 | 0.0% |
| 8 | $5,316 | 0.1% |
| 9 | $5,345 | 0.6% |
| 10 | $5,397 | 1.6% |
| 11 | $5,472 | 3.0% |
| 12 | $5,567 | 4.8% |
| 13 | $5,682 | 7.0% |
| 14 | $5,816 | 9.5% |

Building on the same example, below are three theoretical vehicle replacement scenarios over a 14-year financial period:

> Scenario 1: A fleet manager plans to replace this vehicle every year. The annualized cost of this replacement strategy is $5,946. Over the 14-year period, this replacement strategy will cost 14 x $5,946 = $83,244.
>
> Scenario 2: A fleet manager plans to replace this vehicle every seven years. The annualized cost of this replacement strategy is $5,313. Over the 14-year period, this replacement strategy will cost 14 x $5,313 = $74,382.
>
> Scenario 3: A fleet manager plans to replace this vehicle every fourteen years. The annualized cost of this replacement strategy is $5,816. Over the 14-year period, this strategy will cost 14 x $5,816 = $81,424

The table below summarizes the calculations in the previous example.

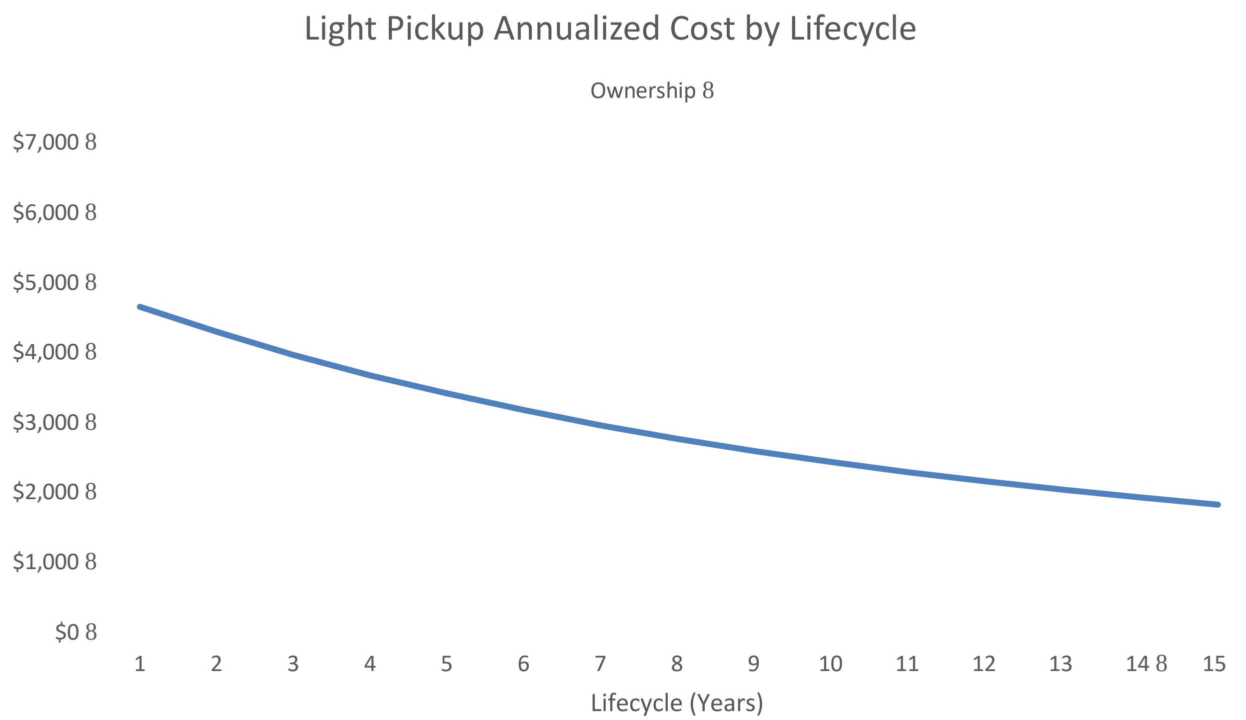
| | Chosen Replacement Age | Financial Period (Years) | Annualized Cost | Total Cost for Financial Period |
|---|---|---|---|---|
| Scenario 1 | 1 | 14 | $5,946 | $83,244 |
| Scenario 2 | 7 | 14 | $5,313 | $74,382 |
| Scenario 3 | 14 | 14 | $5,816 | $81,424 |

Scenario 2, the scenario with the minimal annualized total cost, achieves the lowest total cost of ownership over the life of the vehicle. Utilimarc recommends replacing units within 1.0% of the true lowest cost of ownership. This provides a window for replacement, highlighted in green on the previous page, where deviating from the recommended lifecycle has limited impact cost.

## 2.2 - Modeling Ownership Cost

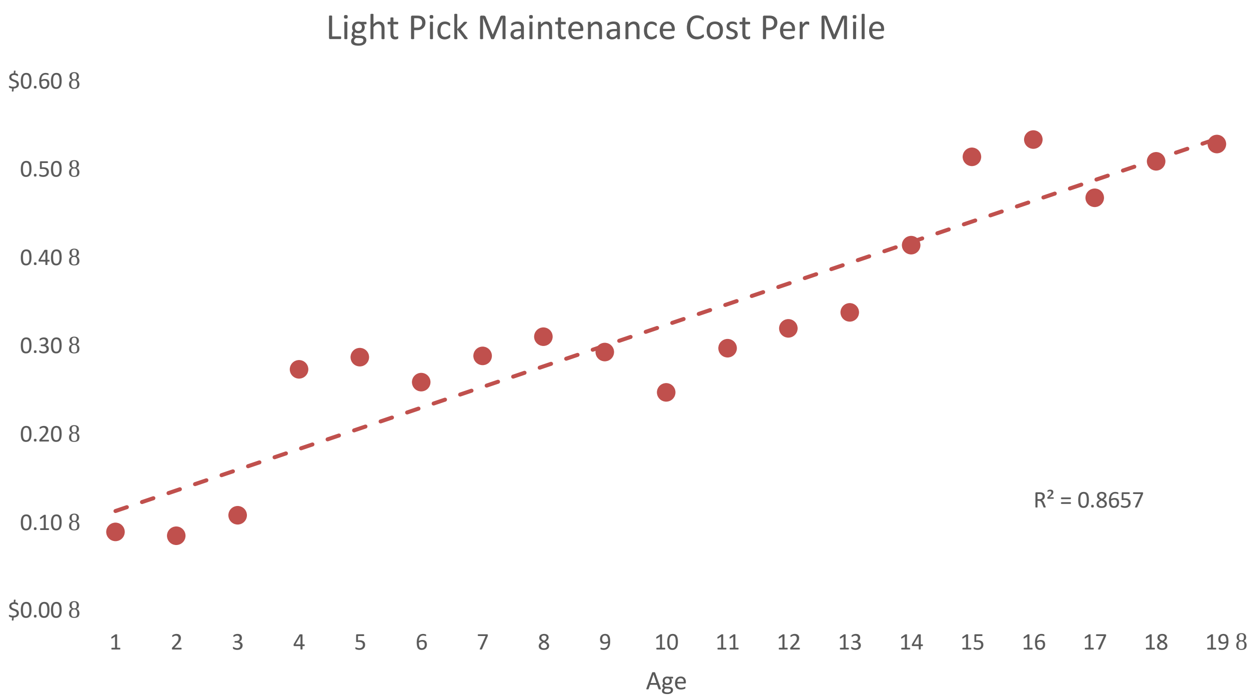
The VRM uses an exponential decay model to project the ownership cost of an asset over its lifetime. Each asset is assumed to lose 18%-23% of its current book value every year as a cost of depreciation. This decay rate is established based on historical auction information from Hydro One and from utility companies across the industry. *Annualized Ownership Cost* is calculated by taking the cumulative sum of each year of depreciation for the asset and dividing by the number of years the asset is in service. Continuing the example from the previous section, the graph below shows the annualized ownership cost for an average light pickup truck for each potential lifecycle option.



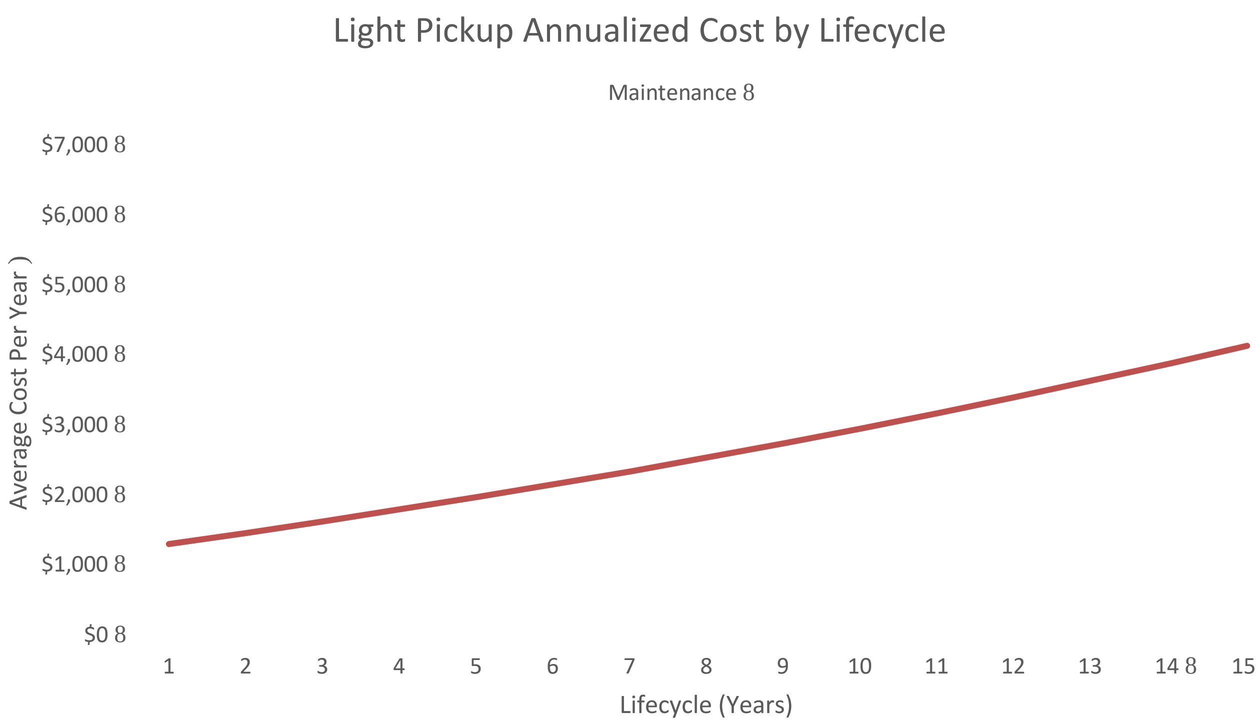

 

## 2.3 - Modeling Maintenance Cost

The VRM uses a linear regression model to project the maintenance cost of an asset over its lifetime. These class specific models are built using historical, maintenance cost per mile data from Utilimarc's database. In the graph below, the red dots represent the average historical maintenance cost per mile for a light pickup truck by age. The red dashed line represents the linear regression model used to estimate the maintenance cost of an average pickup. The linear regression model helps predict the increase the cost of maintenance associated with running older vehicles.

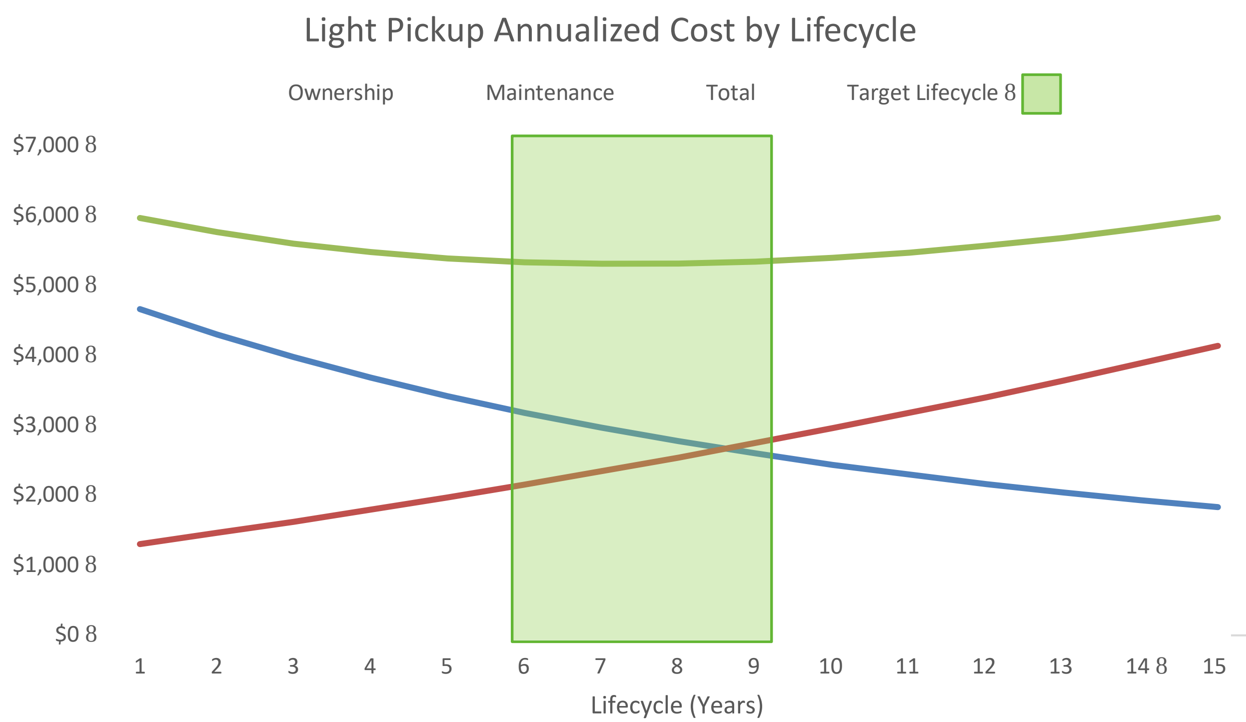


*Annualized Maintenance Cost* is calculated by taking the cumulative sum of each year of maintenance cost for the asset and dividing by the number of years the asset is in service. The graph below shows the annualized maintenance cost for an average light pickup truck, based on the linear regression model and a calculated average annual mileage.



### 2.4 - Modeling Annualized Total Cost

Annualized total cost is calculated by taking the sum of annualized maintenance and ownership cost. The graph below shows the annualized total cost for a light duty pickup truck. The target lifecycle is indicated by a green shaded zone. This is a visual representation of the table from pg. 18 and demonstrates how the model identifies each lifecycle.



## 2.5 - Assumptions

Below are key assumptions underpinning the VRM calculations:

- Inflation is included on all future costs, set to 2%.
- Annual mileage is assumed to be consistent among all vehicles of a given class. No adjustments in annual mileage are made based on the vintage of the unit.
- No adjustments are made to anticipate future increases or decreases in fleet size.
- In section 3.2, default lifecycles, provided by Hydro One, are used for any class not modeled in section 3.1.

## 3.0 - Results Summary

### 3.1 - Lifecycle Summary

This table shows the lifecycle recommendations for Hydro One's top 9 vehicle classes, which represent around 80% of Hydro One's annual fleet spend. The table also provide class average annual kilometer drive, fuel consumption and purchases price based on Hydro One's historic data.

| Class | Count | Annual Km | Annual Liters | Purchase Prices | Rec. Lifecycle |
|---|---|---|---|---|---|
| Pickup - Class 2a | 1,133 | 25,435 | 3,587 | $33,830 | 8 |
| Pickup - Class 2b | 1,193 | 25,328 | 5,263 | $39,536 | 8 |
| Pickup - Class 3 | 209 | 26,830 | 6,328 | $42,383 | 7 |
| Pickup - Class 4+ | 329 | 18,867 | 5,220 | $84,223 | 10 |
| Bucket Truck - Class 7 | 54 | 50,033 | 18,288 | $300,000 | 6 |
| Bucket Truck - Class 8 | 398 | 20,200 | 8,600 | $350,000 | 11 |
| Digger Derrick - Class 8 | 264 | 13,752 | 6,294 | $369,248 | 14 |
| Track Unit - Mounted | 133 | 367 | 800 | $649,497 | 14 |
| Forestry Bucket | 249 | 12,500 | 5,800 | $315,000 | 14 |

## 3.2 - Projections

This table shows the effects of three capital funding scenarios on a variety of fleet metrics over the next seven years. The first two years (2021-2022) in each scenario are locked based on currently expected funding levels. Funding in the remaining five years (2023-2027) is determined as follows:

- The Full Funding scenario represents Utilimarc's derived capital requirement consistent with the lifecycle policy above.
- The Proposed Funding scenario represents Hydro One's planned capital requirement for the next seven years.
- The Historic Funding scenario assumes capital funding in line with the first two years (2021-2022) of capital funding levels.

| **Full Funding** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $72,528,470 | $73,676,100 | $74,307,240 | $75,281,180 | $78,360,770 |
| Units Replaced | 253 | 258 | 656 | 650 | 642 | 614 | 652 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $61,609,180 | $60,940,330 | $60,351,240 | $59,777,660 | $59,377,860 |
| Annual Ownership | $34,798,810 | $33,225,780 | $39,753,910 | $45,203,070 | $49,754,950 | $53,627,540 | $57,256,690 |
| Total | $95,374,500 | $95,959,670 | $101,363,100 | $106,143,400 | $110,106,200 | $113,405,200 | $116,634,500 |
| Out of Life | 1,582 | 1,923 | 1,834 | 1,785 | 1,689 | 1,462 | 1,379 |
| Avg Age | 9.77 | 10.02 | 9.46 | 9.11 | 8.81 | 8.64 | 8.38 |

| **Proposed Funding** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $58,751,660 | $60,020,550 | $60,663,270 | $61,543,910 | $63,694,290 |
| Units Replaced | 253 | 258 | 554 | 556 | 549 | 551 | 556 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $62,506,600 | $62,643,440 | $62,844,990 | $63,017,950 | $63,166,600 |
| Annual Ownership | $34,798,810 | $33,225,780 | $37,439,450 | $41,045,210 | $44,099,020 | $46,744,460 | $49,271,810 |
| Total | $95,374,500 | $95,959,670 | $99,946,050 | $103,688,700 | $106,944,000 | $109,762,400 | $112,438,400 |
| Out of Life | 1,582 | 1,923 | 1,936 | 1,981 | 1,978 | 1,814 | 1,827 |
| Avg Age | 9.77 | 10.02 | 9.70 | 9.52 | 9.38 | 9.26 | 9.14 |

| Historic Funding | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $27,112,210 | $27,701,380 | $28,255,400 | $28,820,510 | $29,396,920 |
| Units Replaced | 253 | 258 | 258 | 259 | 259 | 259 | 259 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $65,272,360 | $68,014,560 | $70,813,710 | $73,641,950 | $76,474,390 |
| Annual Ownership | $34,798,810 | $33,225,780 | $31,999,780 | $31,090,460 | $30,450,240 | $30,035,920 | $29,809,580 |
| Total | $95,374,500 | $95,959,670 | $97,272,150 | $99,105,020 | $101,264,000 | $103,677,900 | $106,284,000 |
| Out of Life | 1,582 | 1,923 | 2,232 | 2,574 | 2,861 | 2,989 | 3,299 |
| Avg Age | 9.77 | 10.02 | 10.37 | 10.75 | 11.14 | 11.53 | 11.90 |

Changes in maintenance cost occur in line with changes in staffing or outsourcing. Assuming current outsourcing practices, the following table shows the increase in labor demand that would be required under the Historic Funding scenario compared to the Proposed Funding scenario. Additionally, there is uncertainty when projecting maintenance cost beyond the range of data that is available. The Historic Funding scenario has Hydro One retaining vehicles longer than they ever have. In this situation, increases in maintenance cost may be underrepresented.

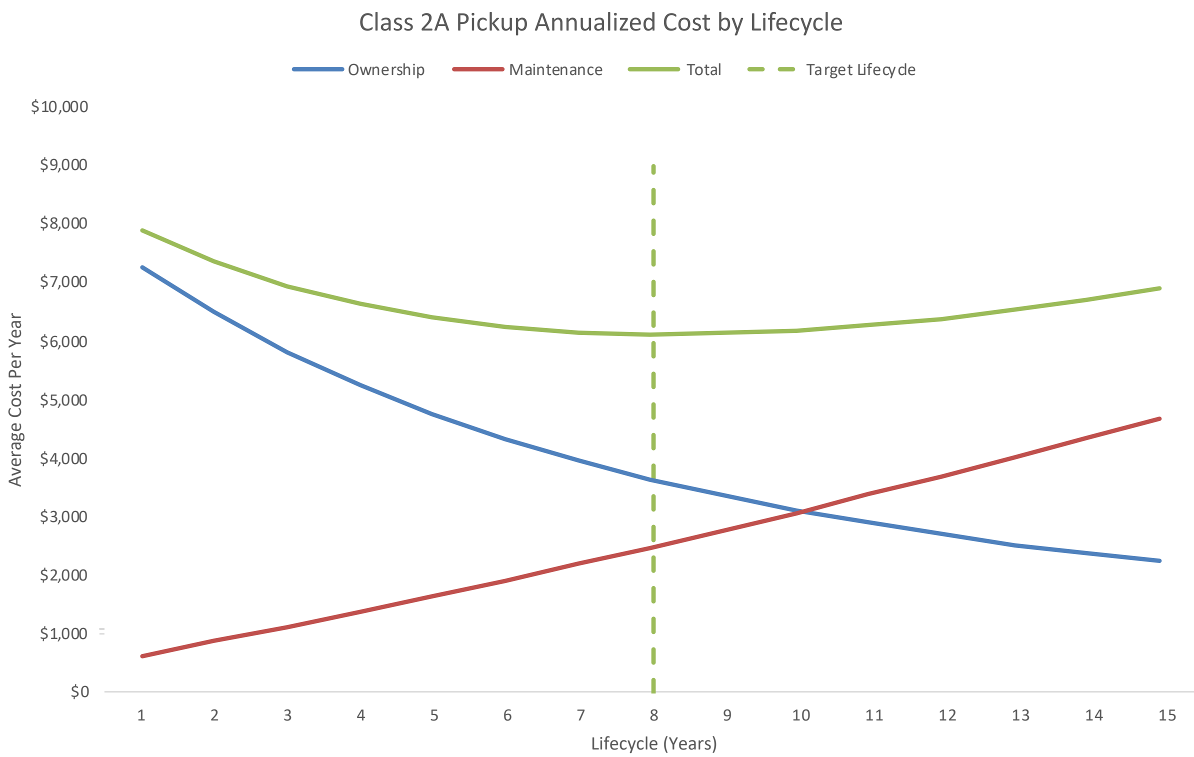
| Labor Hour Increase (Assuming Historic Funding) | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Internal | - | - | 9,238 | 17,588 | 25,582 | 33,438 | 41,063 |
| External | - | - | 6,689 | 12,736 | 18,525 | 24,213 | 29,735 |
| **Total** | **-** | **-** | **15,927** | **30,324** | **44,107** | **57,651** | **70,799** |
| | | | | | | | |
| Estimated Technician Increase | - | - | 6.60 | 12.56 | 18.27 | 23.88 | 29.33 |
| Percent Technician Increase | - | - | 5% | 10% | 15% | 20% | 24% |

# 4.0 - Class Results

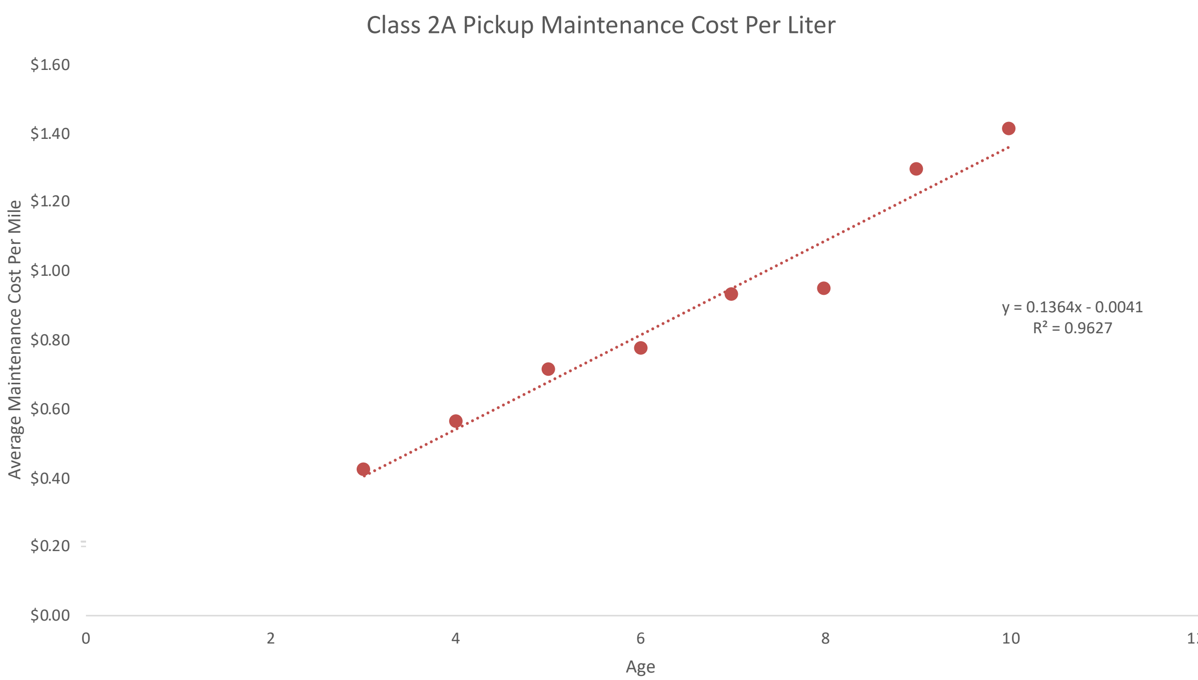
## 4.1 - Pickup - Class 2a

| Inputs | |
|---|---|
| Lifecyle | 8.00 |
| Purchase Price | $33,830 |
| Residual | $2,479 |
| Inflation Rate | 2% |
| Average Annual Liters | 3,587 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $7,259.87 | $627.44 | $7,887.32 | 29.2% |
| 2 | $6,480.89 | $873.18 | $7,354.07 | 20.5% |
| 3 | $5,813.35 | $1,125.39 | $6,938.74 | 13.7% |
| 4 | $5,239.32 | $1,384.21 | $6,623.54 | 8.5% |
| 5 | $4,743.95 | $1,649.80 | $6,393.75 | 4.7% |
| 6 | $4,314.89 | $1,922.30 | $6,237.19 | 2.2% |
| 7 | $3,941.91 | $2,201.87 | $6,143.78 | 0.6% |
| 8 | $3,616.46 | $2,488.66 | $6,105.12 | 0.0% |
| 9 | $3,331.43 | $2,782.84 | $6,114.26 | 0.1% |
| 10 | $3,080.84 | $3,084.57 | $6,165.41 | 1.0% |
| 11 | $2,859.71 | $3,394.02 | $6,253.72 | 2.4% |
| 12 | $2,663.84 | $3,711.35 | $6,375.19 | 4.4% |
| 13 | $2,489.69 | $4,036.76 | $6,526.45 | 6.9% |
| 14 | $2,334.29 | $4,370.41 | $6,704.70 | 9.8% |
| 15 | $2,195.12 | $4,712.49 | $6,907.61 | 13.1% |
| 16 | $2,070.04 | $5,063.17 | $7,133.21 | 16.8% |
| 17 | $1,957.22 | $5,422.67 | $7,379.89 | 20.9% |
| 18 | $1,855.13 | $5,791.16 | $7,646.29 | 25.2% |
| 19 | $1,762.43 | $6,168.85 | $7,931.28 | 29.9% |
| 20 | $1,678.00 | $6,555.94 | $8,233.94 | 34.9% |



Class 2A Pickup Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$10,000
$9,000
$8,000
$7,000
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
Average Cost Per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lifecycle (Years)

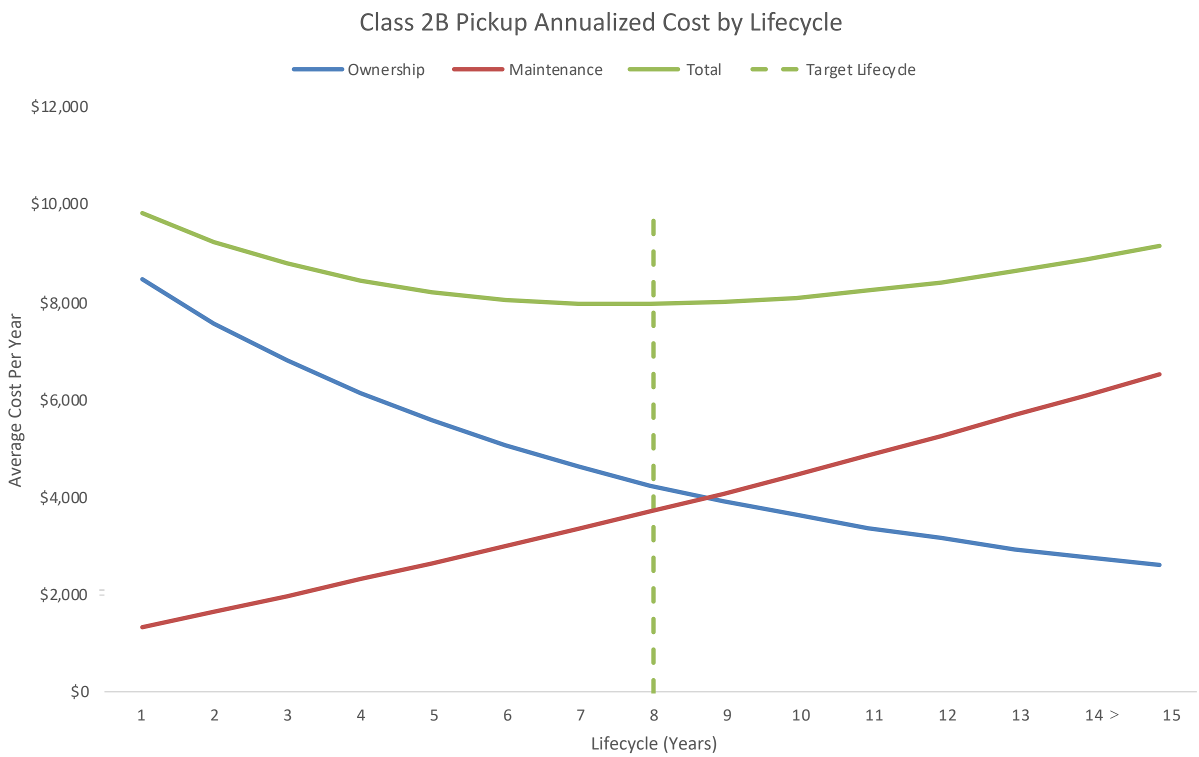



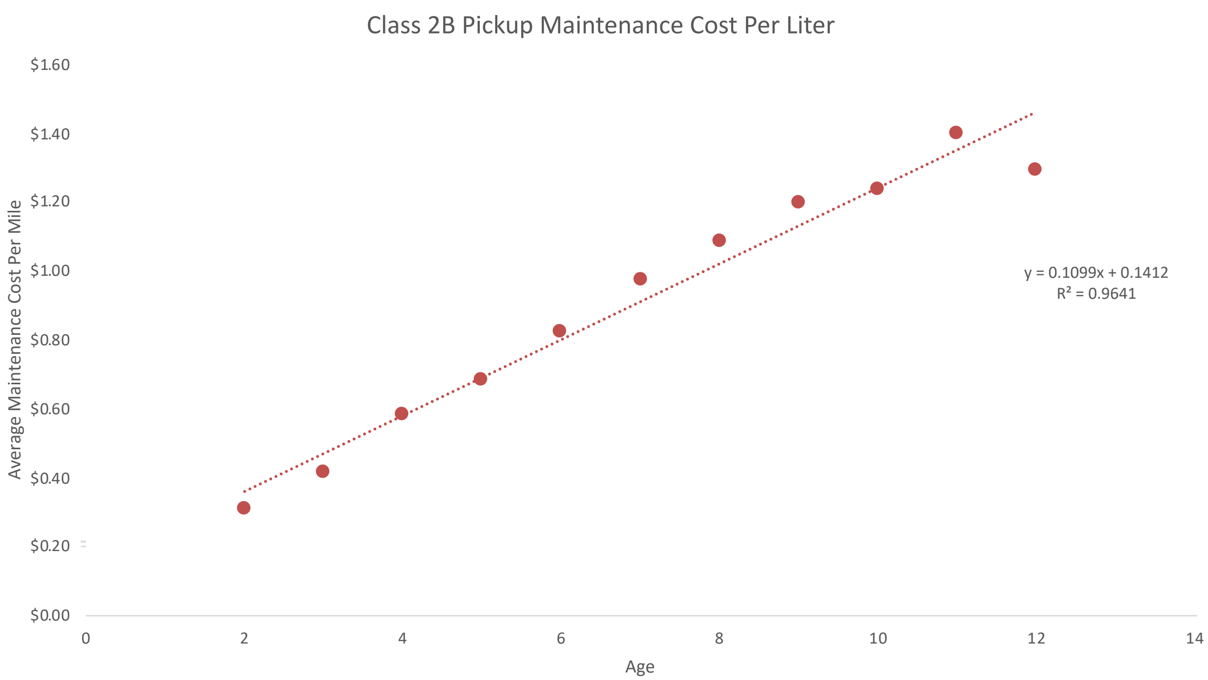
Class 2A Pickup Maintenance Cost Per Liter
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Average Maintenance Cost Per Mile
y = 0.1364x - 0.0041
R² = 0.9627
0 2 4 6 8 10 12
Age

## 4.2 - Pickup - Class 2b $

| Inputs | |
|---|---|
| Lifecyle | 8.00 |
| Purchase Price | $39,536 |
| Residual | $2,897 |
| Inflation Rate | 2% |
| Average Annual Liters | 5,263 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $8,484.40 | $1,348.40 | $9,832.80 | 23.6% |
| 2 | $7,574.03 | $1,662.89 | $9,236.92 | 16.1% |
| 3 | $6,793.89 | $1,985.59 | $8,779.48 | 10.4% |
| 4 | $6,123.04 | $2,316.68 | $8,439.72 | 6.1% |
| 5 | $5,544.11 | $2,656.35 | $8,200.46 | 3.1% |
| 6 | $5,042.69 | $3,004.78 | $8,047.47 | 1.2% |
| 7 | $4,606.80 | $3,362.18 | $7,968.97 | 0.2% |
| 8 | $4,226.46 | $3,728.74 | $7,955.20 | 0.0% |
| 9 | $3,893.34 | $4,104.67 | $7,998.01 | 0.5% |
| 10 | $3,600.49 | $4,490.17 | $8,090.66 | 1.7% |
| 11 | $3,342.06 | $4,885.46 | $8,227.52 | 3.4% |
| 12 | $3,113.15 | $5,290.75 | $8,403.90 | 5.6% |
| 13 | $2,909.63 | $5,706.27 | $8,615.90 | 8.3% |
| 14 | $2,728.02 | $6,132.24 | $8,860.26 | 11.4% |
| 15 | $2,565.38 | $6,568.89 | $9,134.27 | 14.8% |
| 16 | $2,419.19 | $7,016.46 | $9,435.66 | 18.6% |
| 17 | $2,287.35 | $7,475.19 | $9,762.54 | 22.7% |
| 18 | $2,168.04 | $7,945.32 | $10,113.36 | 27.1% |
| 19 | $2,059.70 | $8,427.11 | $10,486.81 | 31.8% |
| 20 | $1,961.03 | $8,920.81 | $10,881.84 | 36.8% |


Class 2B Pickup Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$0
Average Cost Per Year
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lifecycle (Years)

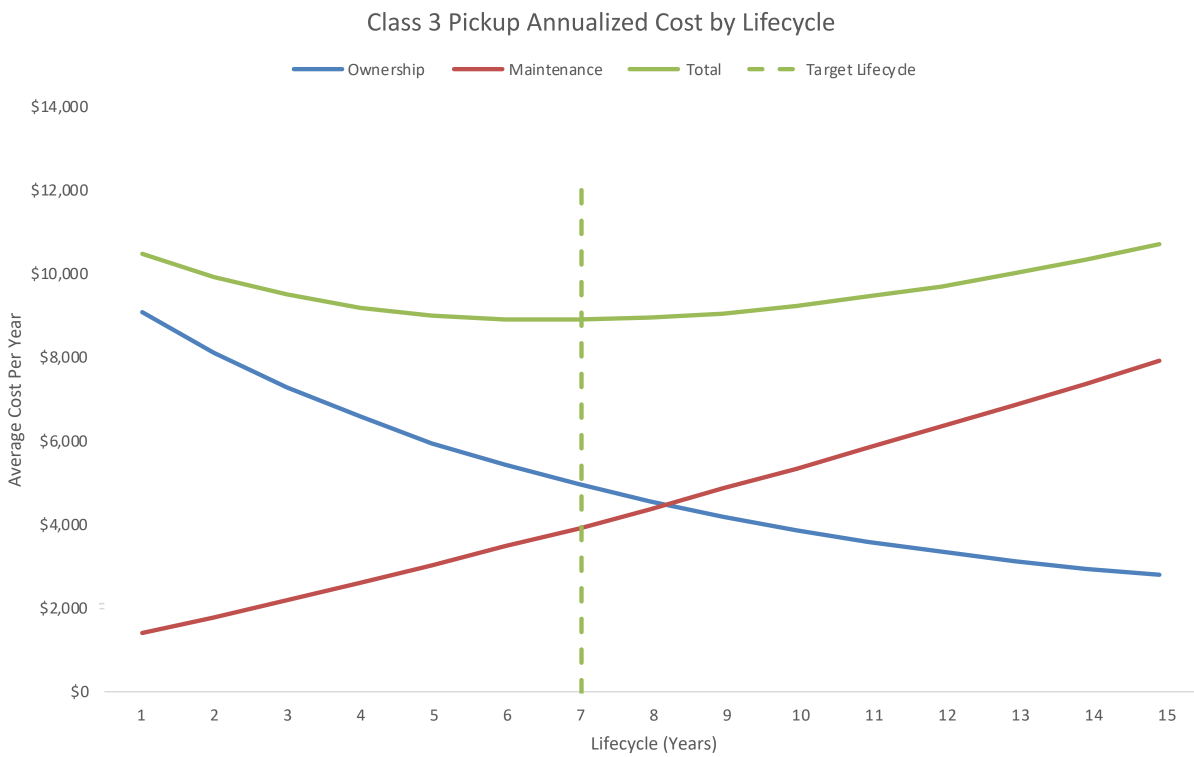

Class 2B Pickup Maintenance Cost Per Liter
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
Average Maintenance Cost Per Mile
y = 0.1099x + 0.1412
R² = 0.9641
0
2
4
6
8
10
12
14
Age

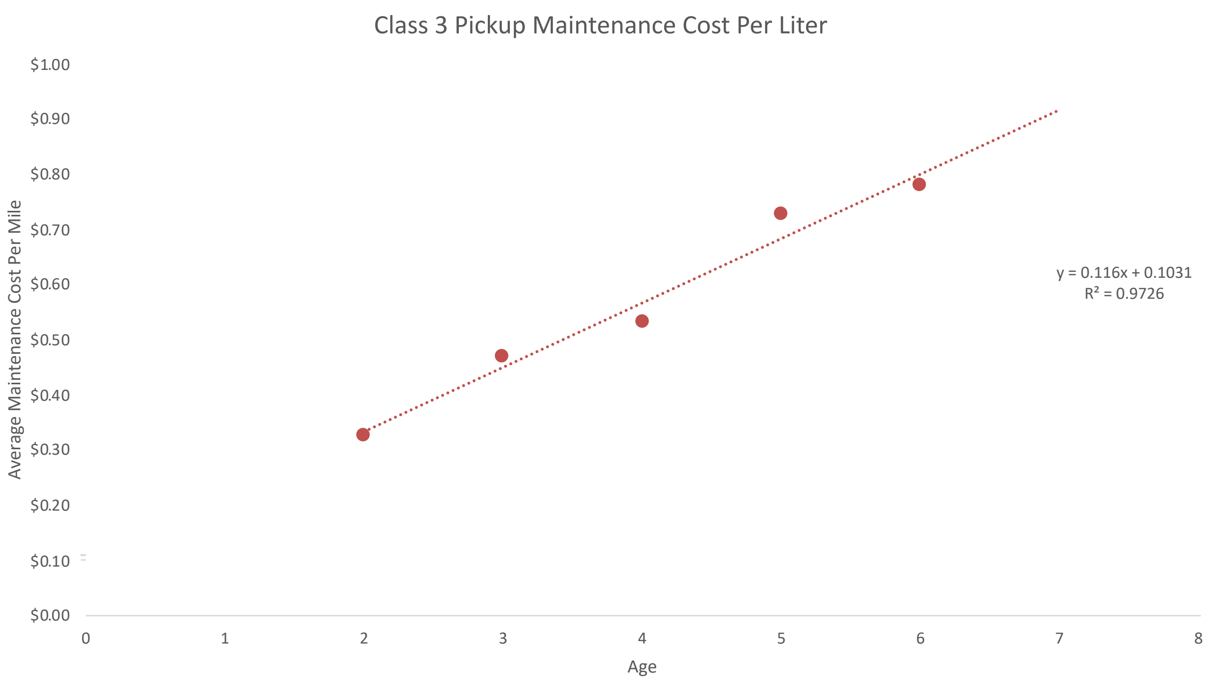
 

## 4.3 - Pickup - Class 3 $

| Inputs | |
|---|---|
| Lifecyle | 7.00 |
| Purchase Price | $42,383 |
| Residual | $3,105 |
| Inflation Rate | 2% |
| Average Annual Liters | 6,328 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $9,095.31 | $1,414.44 | $10,509.75 | 18.2% |
| 2 | $8,119.39 | $1,810.45 | $9,929.83 | 11.7% |
| 3 | $7,283.08 | $2,216.83 | $9,499.91 | 6.9% |
| 4 | $6,563.93 | $2,633.81 | $9,197.74 | 3.5% |
| 5 | $5,943.31 | $3,061.64 | $9,004.94 | 1.3% |
| 6 | $5,405.78 | $3,500.54 | $8,906.32 | 0.2% |
| 7 | $4,938.50 | $3,950.78 | $8,889.28 | 0.0% |
| 8 | $4,530.78 | $4,412.59 | $8,943.37 | 0.6% |
| 9 | $4,173.68 | $4,886.25 | $9,059.93 | 1.9% |
| 10 | $3,859.74 | $5,372.01 | $9,231.74 | 3.9% |
| 11 | $3,582.70 | $5,870.14 | $9,452.84 | 6.3% |
| 12 | $3,337.31 | $6,380.91 | $9,718.22 | 9.3% |
| 13 | $3,119.13 | $6,904.62 | $10,023.75 | 12.8% |
| 14 | $2,924.45 | $7,441.53 | $10,365.98 | 16.6% |
| 15 | $2,750.09 | $7,991.95 | $10,742.04 | 20.8% |
| 16 | $2,593.38 | $8,556.17 | $11,149.55 | 25.4% |
| 17 | $2,452.05 | $9,134.49 | $11,586.54 | 30.3% |
| 18 | $2,324.14 | $9,727.24 | $12,051.38 | 35.6% |
| 19 | $2,208.01 | $10,334.72 | $12,542.73 | 41.1% |
| 20 | $2,102.23 | $10,957.27 | $13,059.49 | 46.9% |


Class 3 Pickup Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$0
Average Cost Per Year
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Lifecycle (Years)

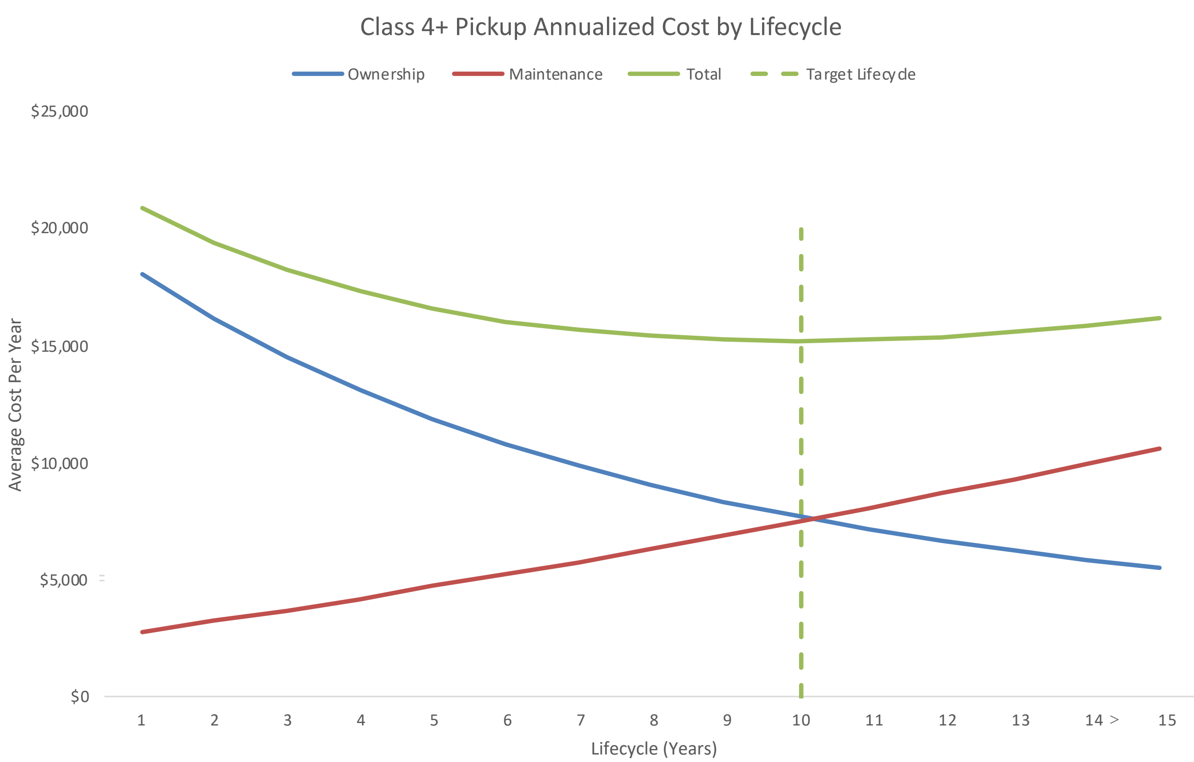

Class 3 Pickup Maintenance Cost Per Liter
$1.00
$0.90
$0.80
$0.70
$0.60
$0.50
$0.40
$0.30
$0.20
$0.10
$0.00
Average Maintenance Cost Per Mile
y = 0.116x + 0.1031
R² = 0.9726
0
1
2
3
4
5
6
7
8
Age

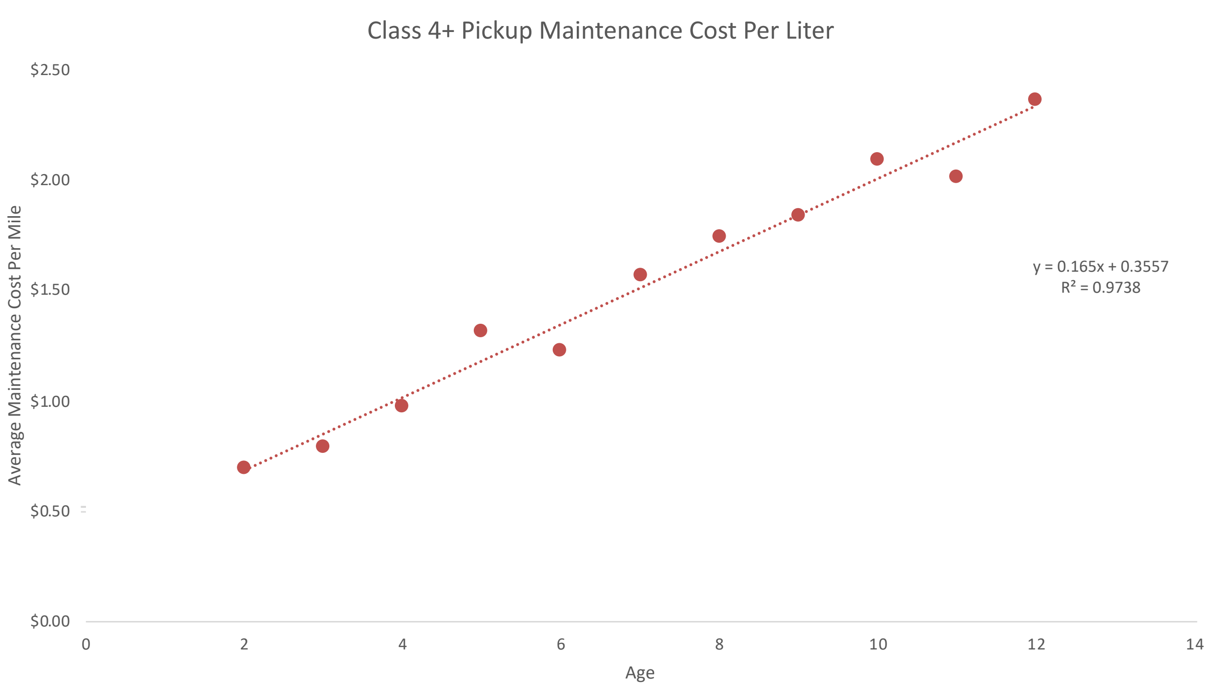
 

## 4.4 - Pickup - Class 4+ $

| Inputs | |
|---|---|
| Lifecyle | 10.00 |
| Purchase Price | $84,223 |
| Residual | $6,171 |
| Inflation Rate | 2% |
| Average Annual Liters | 5,220 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $18,074.24 | $2,772.17 | $20,846.41 | 37.2% |
| 2 | $16,134.88 | $3,247.81 | $19,382.69 | 27.6% |
| 3 | $14,472.97 | $3,735.77 | $18,208.74 | 19.9% |
| 4 | $13,043.86 | $4,236.32 | $17,280.18 | 13.8% |
| 5 | $11,810.57 | $4,749.73 | $16,560.30 | 9.0% |
| 6 | $10,742.39 | $5,276.30 | $16,018.69 | 5.5% |
| 7 | $9,813.81 | $5,816.32 | $15,630.13 | 2.9% |
| 8 | $9,003.58 | $6,370.08 | $15,373.66 | 1.2% |
| 9 | $8,293.95 | $6,937.89 | $15,231.84 | 0.3% |
| 10 | $7,670.08 | $7,520.06 | $15,190.15 | 0.0% |
| 11 | $7,119.55 | $8,116.91 | $15,236.46 | 0.3% |
| 12 | $6,631.91 | $8,728.77 | $15,360.67 | 1.1% |
| 13 | $6,198.36 | $9,355.95 | $15,554.31 | 2.4% |
| 14 | $5,811.48 | $9,998.81 | $15,810.29 | 4.1% |
| 15 | $5,465.00 | $10,657.69 | $16,122.69 | 6.1% |
| 16 | $5,153.59 | $11,332.94 | $16,486.53 | 8.5% |
| 17 | $4,872.72 | $12,024.92 | $16,897.64 | 11.2% |
| 18 | $4,618.55 | $12,734.00 | $17,352.54 | 14.2% |
| 19 | $4,387.77 | $13,460.55 | $17,848.32 | 17.5% |
| 20 | $4,177.56 | $14,204.96 | $18,382.52 | 21.0% |

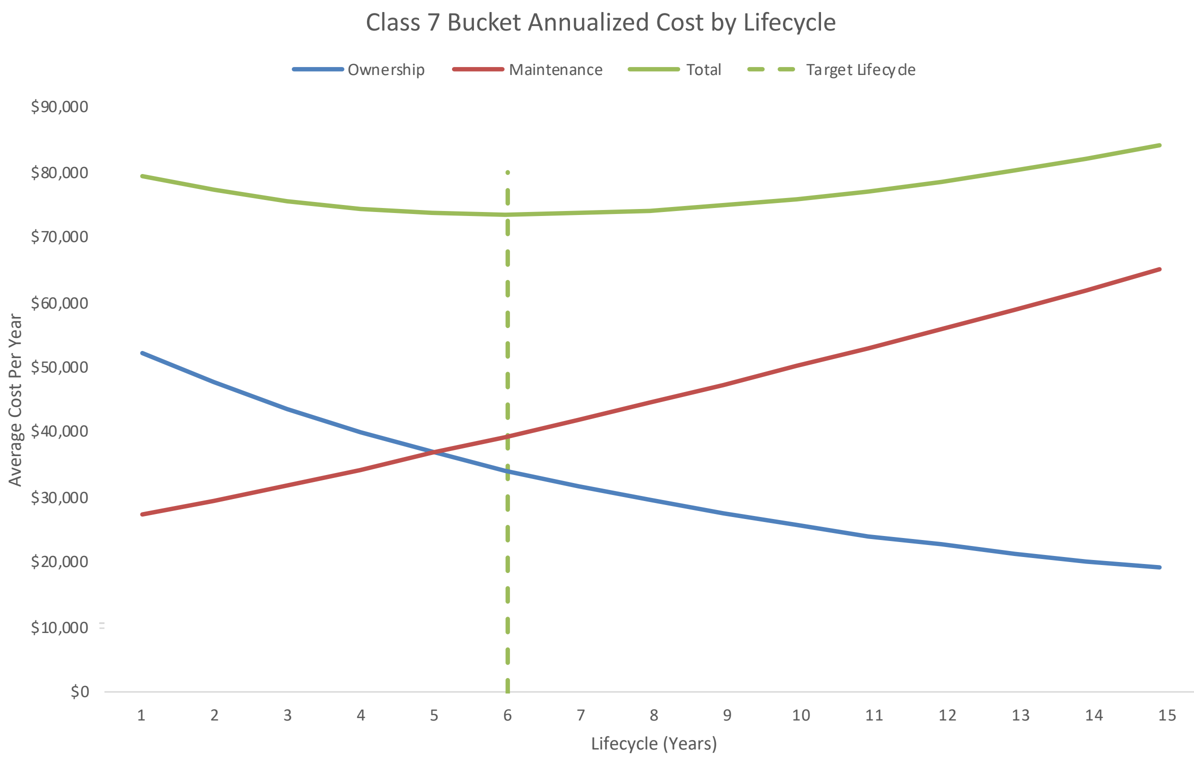

Class 4+ Pickup Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$25,000
$20,000
$15,000
$10,000
$5,000
$0
Average Cost Per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lifecycle (Years)

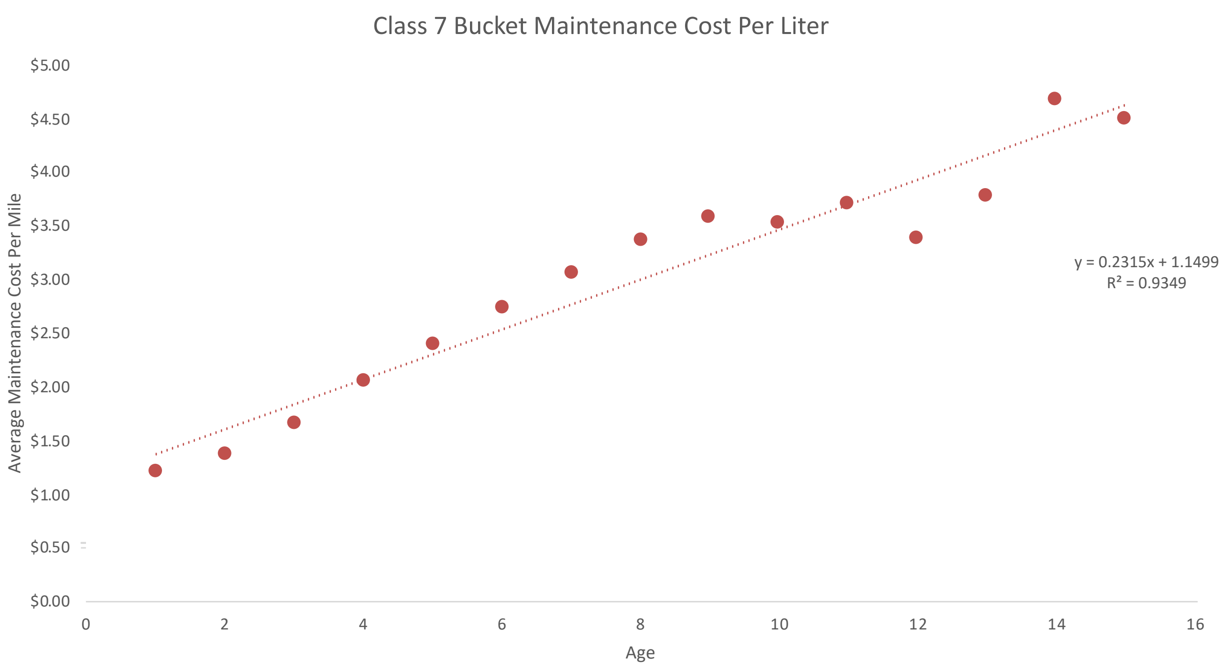

Class 4+ Pickup Maintenance Cost Per Liter
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Average Maintenance Cost Per Mile
y = 0.165x + 0.3557
$R^2$ = 0.9738
0 2 4 6 8 10 12 14
Age

## 4.5 - Bucket Truck - Class 7 $

| Inputs | |
|---|---|
| Lifecyle | 6.00 |
| Purchase Price | $300,000 |
| Residual | $36,473 |
| Inflation Rate | 2% |
| Average Annual Liters | 18,288 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $52,140.00 | $27,297.34 | $79,437.34 | 8.0% |
| 2 | $47,609.03 | $29,604.20 | $77,213.23 | 5.0% |
| 3 | $43,603.06 | $31,968.93 | $75,571.99 | 2.8% |
| 4 | $40,053.63 | $34,392.82 | $74,446.45 | 1.3% |
| 5 | $36,901.85 | $36,877.16 | $73,779.01 | 0.4% |
| 6 | $34,096.92 | $39,423.28 | $73,520.21 | 0.0% |
| 7 | $31,595.04 | $42,032.55 | $73,627.59 | 0.1% |
| 8 | $29,358.34 | $44,706.34 | $74,064.68 | 0.7% |
| 9 | $27,354.10 | $47,446.07 | $74,800.17 | 1.7% |
| 10 | $25,553.96 | $50,253.19 | $75,807.15 | 3.1% |
| 11 | $23,933.35 | $53,129.16 | $77,062.51 | 4.8% |
| 12 | $22,470.92 | $56,075.51 | $78,546.43 | 6.8% |
| 13 | $21,148.13 | $59,093.76 | $80,241.89 | 9.1% |
| 14 | $19,948.83 | $62,185.49 | $82,134.32 | 11.7% |
| 15 | $18,858.94 | $65,352.30 | $84,211.24 | 14.5% |
| 16 | $17,866.18 | $68,595.83 | $86,462.00 | 17.6% |
| 17 | $16,959.80 | $71,917.74 | $88,877.54 | 20.9% |
| 18 | $16,130.40 | $75,319.75 | $91,450.15 | 24.4% |
| 19 | $15,369.73 | $78,803.60 | $94,173.33 | 28.1% |
| 20 | $14,670.55 | $82,371.06 | $97,041.61 | 32.0% |


Class 7 Bucket Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Average Cost Per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lifecycle (Years)

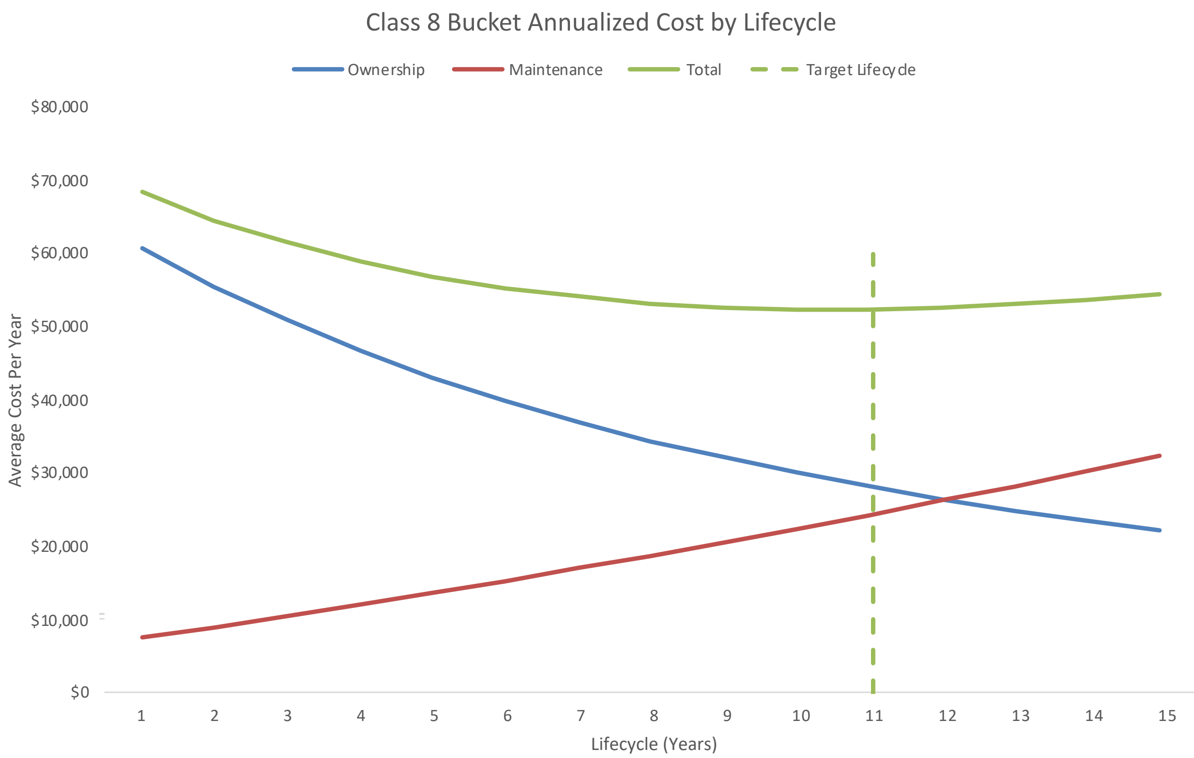

Class 7 Bucket Maintenance Cost Per Liter
$5.00
$4.50
$4.00
$3.50
$3.00
$2.50
$2.00
$1.50
$1.00
$0.50
$0.00
Average Maintenance Cost Per Mile
y = 0.2315x + 1.1499
R² = 0.9349
0 2 4 6 8 10 12 14 16
Age

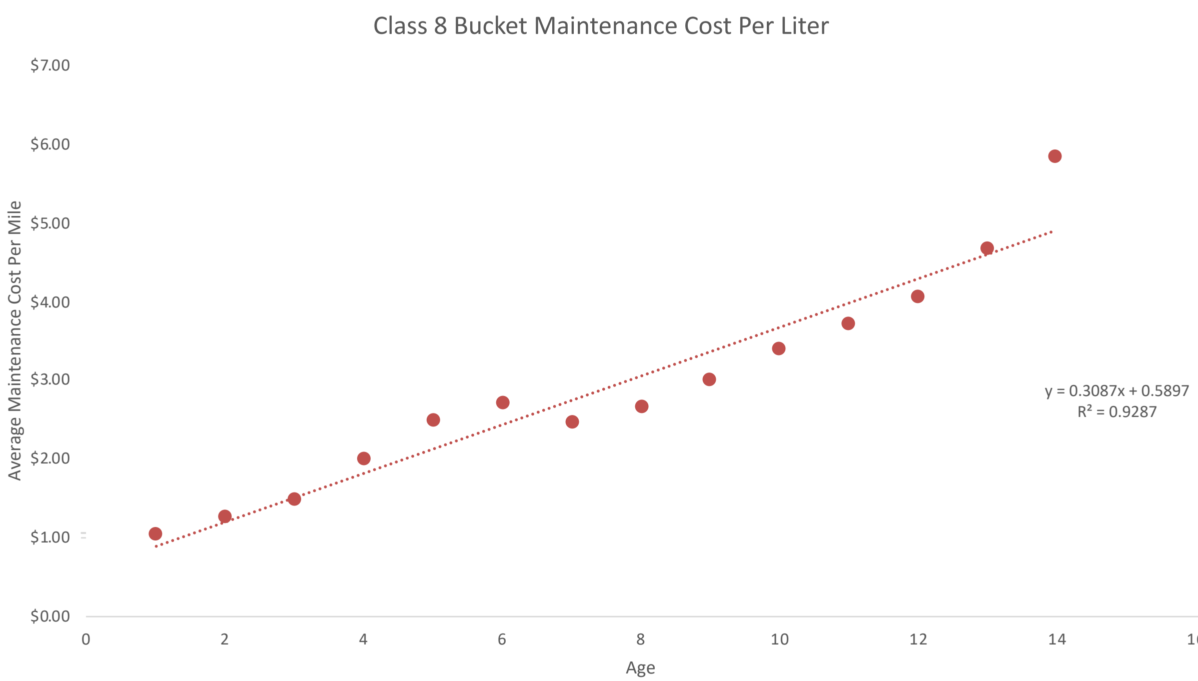
### 4.6 - Bucket Truck - Class 8 $

| Inputs | |
|---|---|
| Lifecyle | 11.00 |
| Purchase Price | $350,000 |
| Residual | $42,552 |
| Inflation Rate | 2% |
| Average Annual Liters | 8,600 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $60,830.00 | $7,483.08 | $68,313.08 | 30.6% |
| 2 | $55,543.87 | $8,987.38 | $64,531.25 | 23.3% |
| 3 | $50,870.23 | $10,530.79 | $61,401.03 | 17.4% |
| 4 | $46,729.24 | $12,114.20 | $58,843.44 | 12.5% |
| 5 | $43,052.16 | $13,738.49 | $56,790.65 | 8.6% |
| 6 | $39,779.74 | $15,404.57 | $55,184.31 | 5.5% |
| 7 | $36,860.88 | $17,113.37 | $53,974.25 | 3.2% |
| 8 | $34,251.40 | $18,865.84 | $53,117.24 | 1.5% |
| 9 | $31,913.12 | $20,662.94 | $52,576.06 | 0.5% |
| 10 | $29,812.96 | $22,505.68 | $52,318.63 | 0.0% |
| 11 | $27,922.24 | $24,395.05 | $52,317.29 | 0.0% |
| 12 | $26,216.08 | $26,332.10 | $52,548.18 | 0.4% |
| 13 | $24,672.82 | $28,317.87 | $52,990.69 | 1.3% |
| 14 | $23,273.63 | $30,353.45 | $53,627.08 | 2.5% |
| 15 | $22,002.10 | $32,439.92 | $54,442.02 | 4.1% |
| 16 | $20,843.88 | $34,578.42 | $55,422.29 | 5.9% |
| 17 | $19,786.43 | $36,770.09 | $56,556.52 | 8.1% |
| 18 | $18,818.80 | $39,016.09 | $57,834.89 | 10.5% |
| 19 | $17,931.35 | $41,317.63 | $59,248.98 | 13.2% |
| 20 | $17,115.64 | $43,675.93 | $60,791.57 | 16.2% |



Class 8 Bucket Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Average Cost Per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lifecycle (Years)

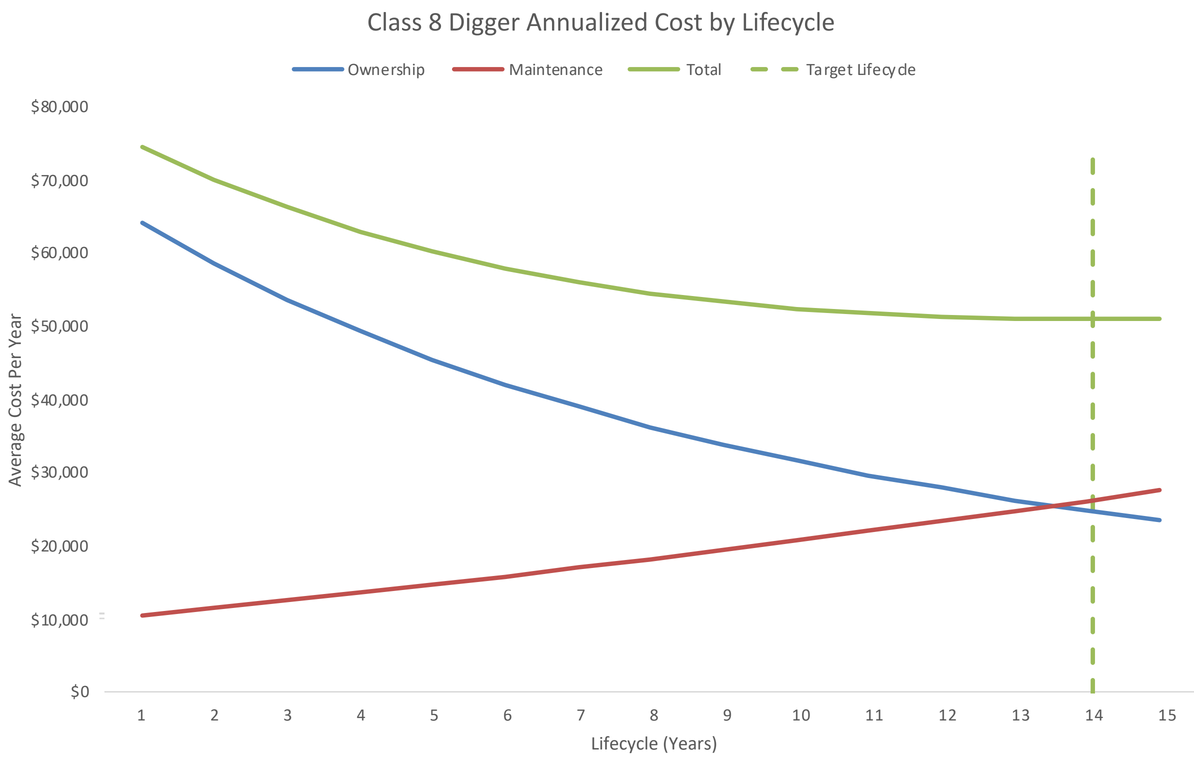



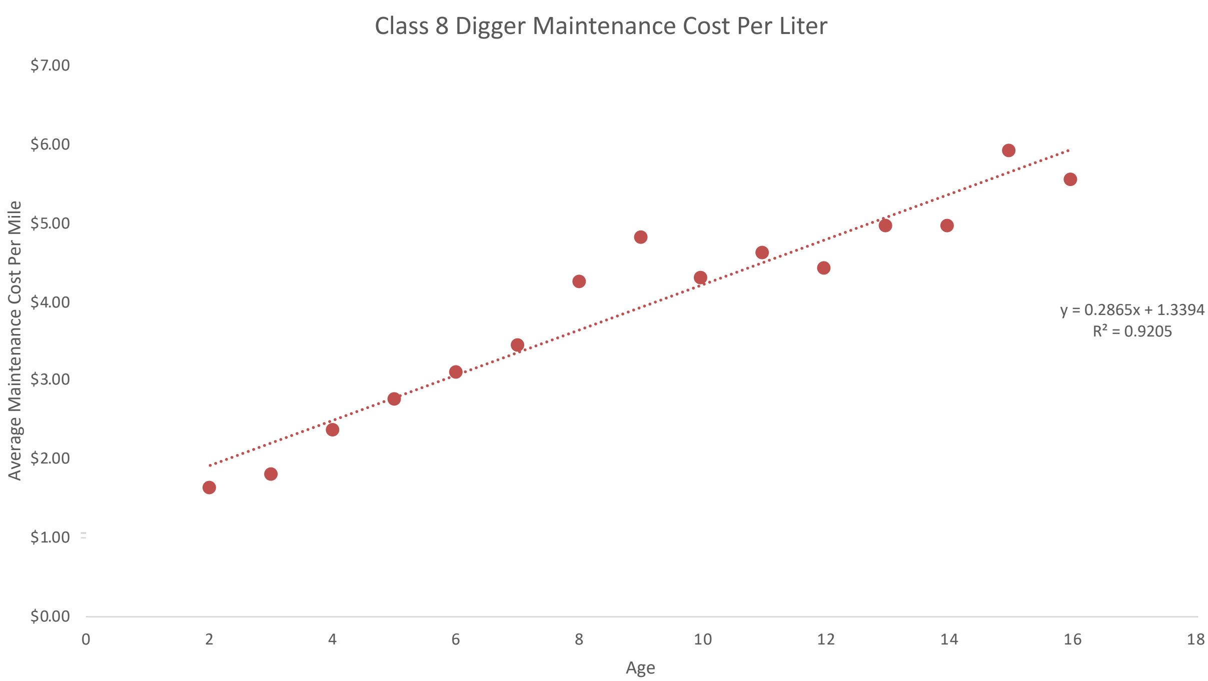
Class 8 Bucket Maintenance Cost Per Liter
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
Average Maintenance Cost Per Mile
y = 0.3087x + 0.5897
R² = 0.9287
0 2 4 6 8 10 12 14 16
Age

## 4.7 - Digger Derrick - Class 8 $

| Inputs | |
|---|---|
| Lifecyle | 14.00 |
| Purchase Price | $369,248 |
| Residual | $44,892 |
| Inflation Rate | 2% |
| Average Annual Liters | 6,294 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $64,175.25 | $10,437.24 | $74,612.49 | 46.9% |
| 2 | $58,598.42 | $11,479.59 | $70,078.02 | 38.0% |
| 3 | $53,667.76 | $12,548.35 | $66,216.11 | 30.4% |
| 4 | $49,299.04 | $13,644.10 | $62,943.14 | 24.0% |
| 5 | $45,419.75 | $14,767.43 | $60,187.17 | 18.5% |
| 6 | $41,967.37 | $15,918.95 | $57,886.32 | 14.0% |
| 7 | $38,887.99 | $17,099.28 | $55,987.27 | 10.3% |
| 8 | $36,135.00 | $18,309.07 | $54,444.07 | 7.2% |
| 9 | $33,668.13 | $19,548.95 | $53,217.08 | 4.8% |
| 10 | $31,452.47 | $20,819.59 | $52,272.06 | 2.9% |
| 11 | $29,457.78 | $22,121.66 | $51,579.44 | 1.6% |
| 12 | $27,657.79 | $23,455.86 | $51,113.65 | 0.7% |
| 13 | $26,029.66 | $24,822.89 | $50,852.55 | 0.1% |
| 14 | $24,553.53 | $26,223.46 | $50,776.99 | 0.0% |
| 15 | $23,212.07 | $27,658.31 | $50,870.38 | 0.2% |
| 16 | $21,990.15 | $29,128.20 | $51,118.35 | 0.7% |
| 17 | $20,874.56 | $30,633.88 | $51,508.44 | 1.4% |
| 18 | $19,853.71 | $32,176.15 | $52,029.86 | 2.5% |
| 19 | $18,917.46 | $33,755.79 | $52,673.24 | 3.7% |
| 20 | $18,056.88 | $35,373.62 | $53,430.50 | 5.2% |

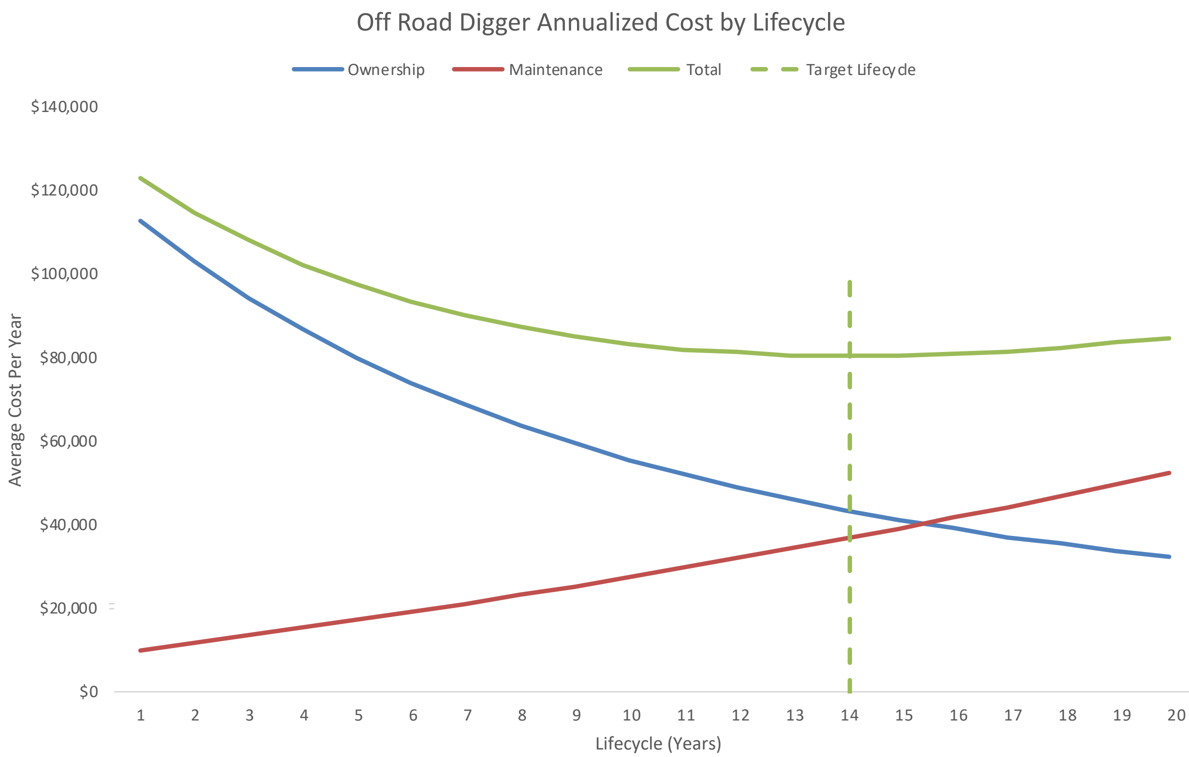

Class 8 Digger Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
Average Cost Per Year
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Lifecycle (Years)

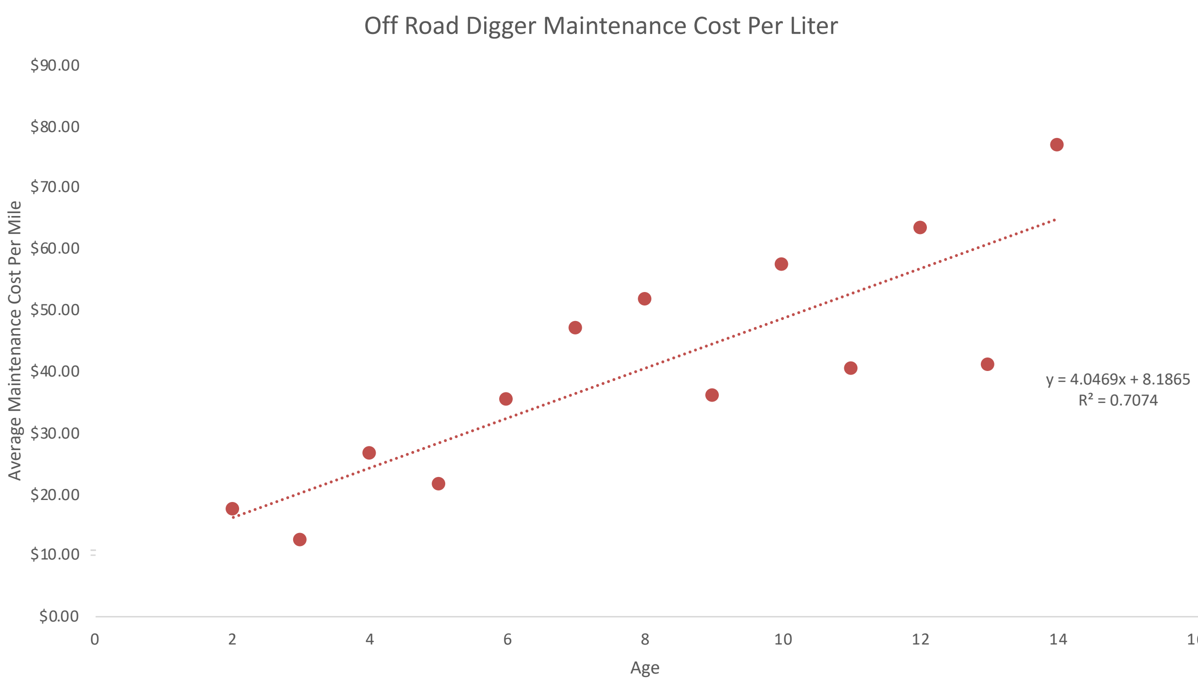

Class 8 Digger Maintenance Cost Per Liter
Average Maintenance Cost Per Mile
$7.00
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
0 2 4 6 8 10 12 14 16 18
Age
y = 0.2865x + 1.3394
R² = 0.9205

## 4.8 - Track Unit – Mounted $

| Inputs | |
|---|---|
| Lifecyle | 14.00 |
| Purchase Price | $649,497 |
| Residual | $78,964 |
| Inflation Rate | 2% |
| Average Annual Liters | 800 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $112,882.52 | $9,978.27 | $122,860.79 | 53.1% |
| 2 | $103,073.03 | $11,761.49 | $114,834.51 | 43.1% |
| 3 | $94,400.13 | $13,590.93 | $107,991.06 | 34.5% |
| 4 | $86,715.67 | $15,467.62 | $102,183.29 | 27.3% |
| 5 | $79,892.09 | $17,392.62 | $97,284.71 | 21.2% |
| 6 | $73,819.46 | $19,366.99 | $93,186.45 | 16.1% |
| 7 | $68,402.91 | $21,391.85 | $89,794.75 | 11.9% |
| 8 | $63,560.48 | $23,468.29 | $87,028.78 | 8.4% |
| 9 | $59,221.32 | $25,597.48 | $84,818.80 | 5.7% |
| 10 | $55,324.04 | $27,780.57 | $83,104.61 | 3.5% |
| 11 | $51,815.43 | $30,018.76 | $81,834.20 | 2.0% |
| 12 | $48,649.29 | $32,313.28 | $80,962.57 | 0.9% |
| 13 | $45,785.47 | $34,665.35 | $80,450.82 | 0.2% |
| 14 | $43,188.99 | $37,076.26 | $80,265.25 | 0.0% |
| 15 | $40,829.40 | $39,547.30 | $80,376.70 | 0.1% |
| 16 | $38,680.08 | $42,079.79 | $80,759.87 | 0.6% |
| 17 | $36,717.78 | $44,675.09 | $81,392.87 | 1.4% |
| 18 | $34,922.13 | $47,334.58 | $82,256.71 | 2.5% |
| 19 | $33,275.29 | $50,059.67 | $83,334.96 | 3.8% |
| 20 | $31,761.57 | $52,851.79 | $84,613.36 | 5.4% |


Off Road Digger Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$140,000
$120,000
$100,000
$80,000
$60,000
$40,000
$20,000
$0
Average Cost Per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Lifecycle (Years)

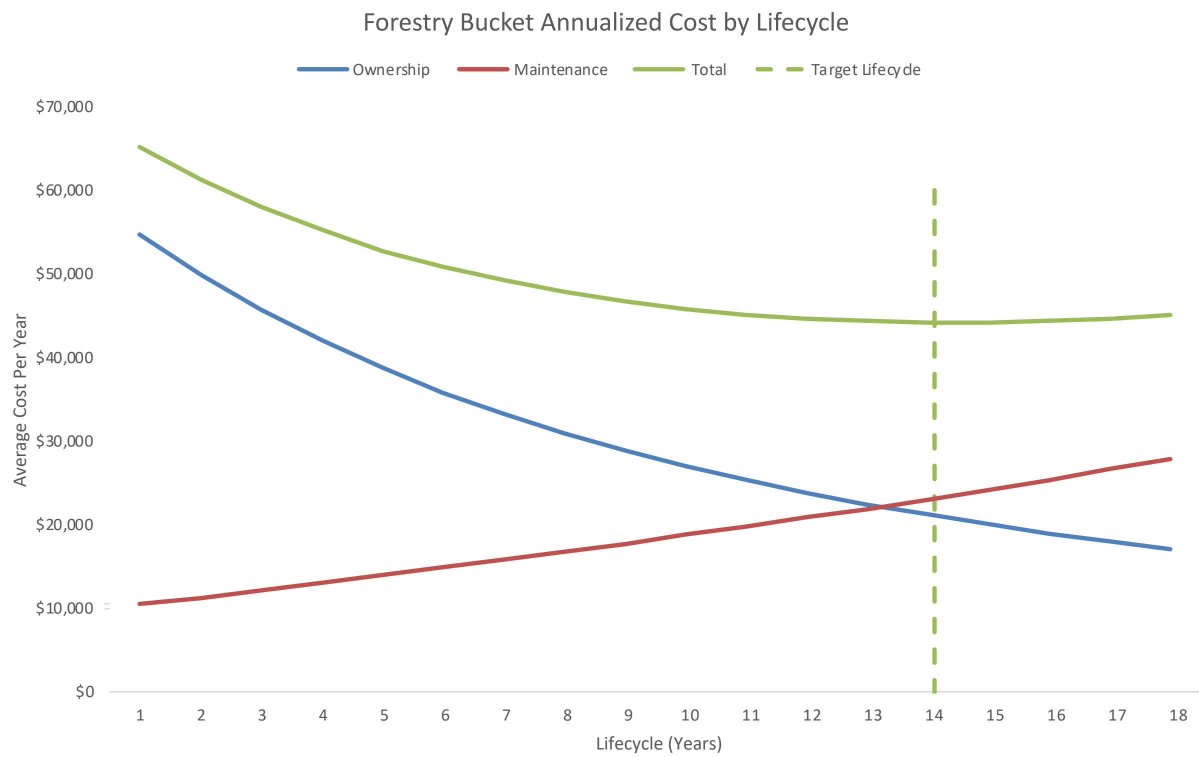

Off Road Digger Maintenance Cost Per Liter
$90.00
$80.00
$70.00
$60.00
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
Average Maintenance Cost Per Mile
y = 4.0469x + 8.1865
R² = 0.7074
0 2 4 6 8 10 12 14 16
Age

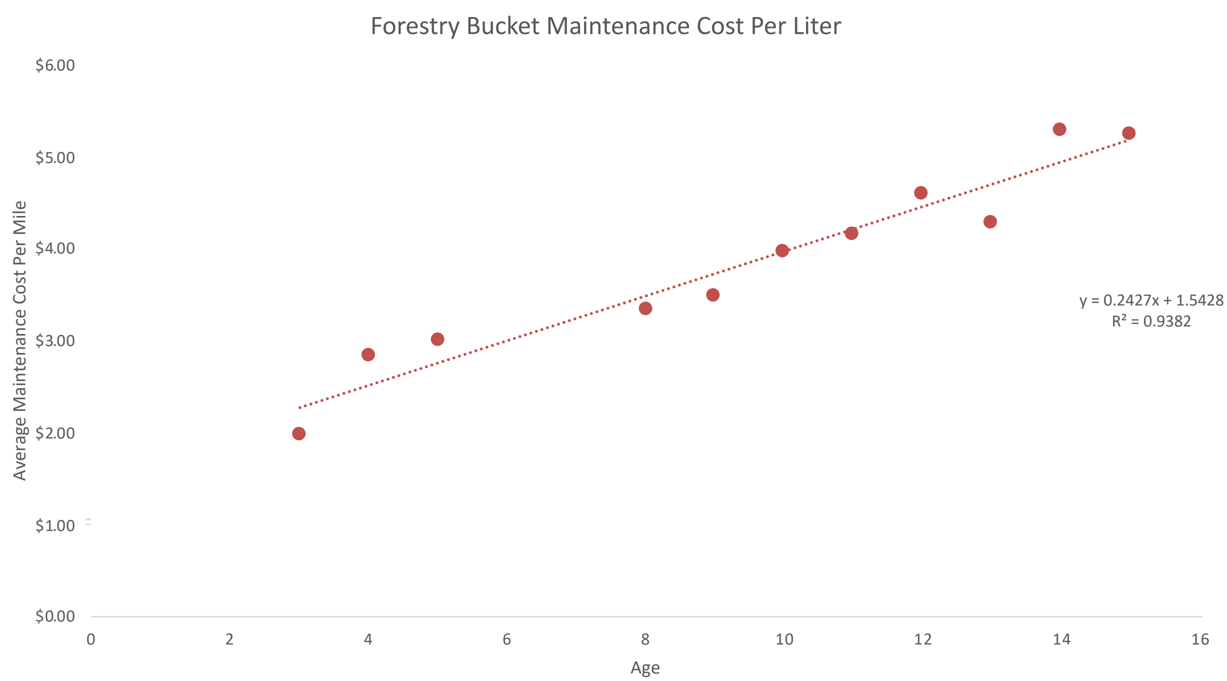
## 4.9 - Forestry Bucket $

| Inputs | |
|---|---|
| Lifecyle | 14.00 |
| Purchase Price | $315,000 |
| Residual | $38,297 |
| Inflation Rate | 2% |
| Average Annual Liters | 5,800 |

| Age | Ownership | Maintenance | Total | Deviation |
|---|---|---|---|---|
| 1 | $54,747.00 | $10,562.97 | $65,309.97 | 47.9% |
| 2 | $49,989.49 | $11,400.75 | $61,390.23 | 39.0% |
| 3 | $45,783.21 | $12,259.46 | $58,042.67 | 31.4% |
| 4 | $42,056.32 | $13,139.57 | $55,195.88 | 25.0% |
| 5 | $38,746.94 | $14,041.54 | $52,788.48 | 19.5% |
| 6 | $35,801.77 | $14,965.85 | $50,767.62 | 14.9% |
| 7 | $33,174.79 | $15,913.00 | $49,087.79 | 11.1% |
| 8 | $30,826.26 | $16,883.48 | $47,709.74 | 8.0% |
| 9 | $28,721.81 | $17,877.80 | $46,599.61 | 5.5% |
| 10 | $26,831.66 | $18,896.49 | $45,728.15 | 3.5% |
| 11 | $25,130.02 | $19,940.08 | $45,070.10 | 2.0% |
| 12 | $23,594.47 | $21,009.12 | $44,603.58 | 1.0% |
| 13 | $22,205.54 | $22,104.15 | $44,309.68 | 0.3% |
| 14 | $20,946.27 | $23,225.74 | $44,172.02 | 0.0% |
| 15 | $19,801.89 | $24,374.49 | $44,176.37 | 0.0% |
| 16 | $18,759.49 | $25,550.96 | $44,310.45 | 0.3% |
| 17 | $17,807.79 | $26,755.78 | $44,563.57 | 0.9% |
| 18 | $16,936.92 | $27,989.55 | $44,926.47 | 1.7% |
| 19 | $16,138.21 | $29,252.91 | $45,391.12 | 2.8% |
| 20 | $15,404.07 | $30,546.49 | $45,950.57 | 4.0% |



Forestry Bucket Annualized Cost by Lifecycle
Ownership
Maintenance
Total
Target Lifecycle
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$0
Average Cost Per Year
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Lifecycle (Years)

Forestry Bucket Maintenance Cost Per Liter
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
Average Maintenance Cost Per Mile
y = 0.2427x + 1.5428
R² = 0.9382
0 2 4 6 8 10 12 14 16
Age

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# Enterprise IT Spending & Staffing Benchmark

## Final Report

April 16, 2020

Engagement Number: 330063230

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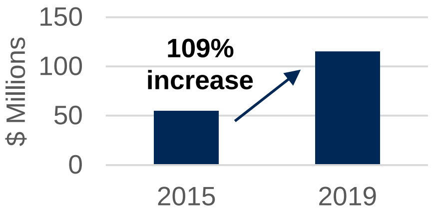
# Executive Summary

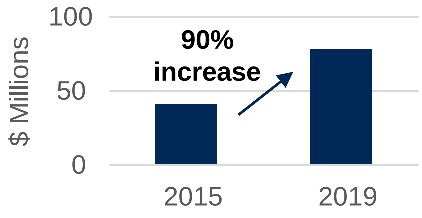
# Hydro One's 2019 IT spend as a % of Revenue and OpEx was higher than the Peer Group average, as well as 2015 levels; this was largely due to increased capital investment in digital capabilities

- Hydro One’s 2019 IT Spending as a % of Revenue was 3.9% compared to an average of 3.4% for the Peer Group, and 4.9% of OpEx compared to 4.7% for the Peer Group. The IT spending increase in 2019 over 2015 was due to significantly more capital spending. 1.8% of Revenue was spent on IT Capital in 2019, compared to only 0.8% in 2015.
- In 2019, Hydro One allocated 31% of IT Spending to “change the business” activities (17% Grow and 14% Transform), 90% more spending than four years prior. This indicates a significant level of investment in digital capabilities and aligns with the increase in capital expenditures ($55 million in 2015 versus $115 million in 2019).

**IT Capital Spending**




**Grow / Transform Spending**




| Metric | Hydro One (2019) | | Hydro One (2015*) | | Peer Group Average | Utility Industry (2019) |
|---|---|---|---|---|---|---|
| | % Spend | $ Spend (millions) | % Spend | $ Spend (millions) | % Spend | % Spend |
| IT Spend as a % of Revenue | | | | | | |
| - Operational | 2.1% | $136 | 2.2% | $140 | 1.8% | 2.0% |
| - Capital | 1.8% | $115 | 0.8% | $55 | 1.6% | 1.2% |
| - Total | 3.9% | $251 | 3.0% | $195 | 3.4% | 3.2% |
| IT Spend as a % of OpEx | | | | | | |
| - Operational | 2.6% | $136 | 2.6% | $140 | 2.5% | 2.8% |
| - Capital | 2.3% | $115 | 1.0% | $55 | 2.2% | 1.5% |
| - Total | 4.9% | $251 | 3.6% | $195 | 4.7% | 4.3% |
| Run, Grow, Transform (% of total IT Spend) | | | | | | |
| - Run % | 69% | $173 | 79% | $154 | 75% | 72% |
| - Grow % | 17% | $43 | 20% | $39 | 17% | 20% |
| - Transform % | 14% | $35 | 1% | $2 | 8% | 8% |
| - Total | 100% | $251 | 100% | $195 | 100% | 100% |

* Hydro One’s 2015 data has not been adjusted for inflation

# Outsourcing is by far the largest portion of IT spending at 59%; this $147 million spend should be further assessed to ensure Hydro One is receiving value for money in the marketplace

- IT Spending per Employee was $28,366 in 2019, 17% less than the Peer Group average. Hydro One's operational IT spending decreased from $16,821 in 2015 to $15,318 in 2019, a reduction of almost 10%.
- Hydro One relies much more heavily on Outsourcing (59% of IT spend in 2019) than the Peer Group (17%). Due to the magnitude of this spend ($147 million), Gartner recommends that Hydro One conduct market price assessments to support future outsourcing contract negotiations.
- Enterprise Computing and End User Computing consume a much larger % of IT Spend than the Peer Group and Utility Industry averages. This further emphasizes the need to evaluate the outsourcing agreements for these areas.
- The overall allocation to Applications spending is less than the Peer Group average and similar to the Utility Industry. Compared to 2015, Hydro One allocated less proportion of IT spending and staffing towards Applications, which is somewhat unusual for a period of transformation.

| Metric | Hydro One (2019) | | Hydro One (2015*) | | Peer Group Average | Utility Industry (2019) |
|---|---|---|---|---|---|---|
| IT Spend per Employee | | | | | | |
| - Operational | $15,318 | | $16,821 | | $17,871 | $19,078 |
| - Capital | $13,048 | | $6,541 | | $15,224 | $10,732 |
| - Total | $28,366 | | $23,362 | | $33,095 | $29,810 |
| | % Spend | $ Spend (millions) | % Spend | $ Spend (millions) | % Spend | % Spend |
| IT Spend per Cost Category | | | | | | |
| - Outsourcing | 59% | $147 | 66% | $129 | 17% | 26% |
| - Personnel | 9% | $23 | 14% | $27 | 45% | 32% |
| - Software | 20% | $51 | 11% | $21 | 23% | 27% |
| - Hardware | 12% | $30 | 9% | $18 | 15% | 15% |
| - Total | 100% | $251 | 100% | $195 | 100% | 100% |
| IT Spend Distribution by Area | | | | | | |
| - Enterprise Computing | 26% | $65 | 25% | $49 | 14% | 13% |
| - End User Computing | 20% | $52 | 14% | $27 | 6% | 12% |
| - IT Service Desk | 2% | $4 | 2% | $4 | 4% | 5% |
| - Voice & Data Network | 9% | $23 | 10% | $20 | 13% | 11% |
| - Applications | 38% | $94 | 44% | $85 | 55% | 39% |
| - IT Mgmt. & Admin | 5% | $13 | 5% | $10 | 8% | 20% |
| - Total | 100% | $251 | 100% | $195 | 100% | 100% |

* Hydro One's 2015 data has not been adjusted for inflation

# Energy and Utility companies are being driven to new operating and business models with enterprise digital competency as the foundation – Hydro One is making these investments


Source: Gartner – Energy and Utilities Digital Transformation and Innovation Primer for 2020 – ID G00714347

- Four powerful forces — decarbonization, democratization, decentralization and digitalization — are disrupting energy and utilities around the world.
- Utilities have to reduce their dependence on pure commodity supply-, distribution- and marketing-based business models. Digitally enabled or enhanced operating and business models offer an opportunity for companies to add value in new ways, and many are pursuing them. But deep uncertainty, entrenched practices and the asset-centric nature of the industry make the transition demanding and complex.
- Non utility, asset intensive companies face highly uncertain demand and unpredictable pricing as the world seeks to reduce its carbon footprint, yet still meet growing needs for affordable energy. For utilities, the long-established utility-to-customer commodity value chain has been upended by technology-enabled innovation and customer innovation at the grid edge.
- Successful companies will change the way they work by radically optimizing asset, network and business operations and reenvisioning the customer experience. Operating models — in the enterprise and in IT — must be modernized so firms can differentiate themselves in the era of radical optimization and the Internet of Energy.
- Digital leadership and innovation are essential priorities, as is investing in digital business technology platforms to support new business models that create value.
- Successful organizations will be those who lead through the transition, developing execution strategies that replicate digital innovation at scale across the enterprise and support operating and business model innovation.

# Engagement Context & Objectives

# Engagement Context & Objectives

| | |
|---|---|
| **Our Understanding of Hydro One's Requirement** | ▪ Hydro One sought an independent assessment of enterprise-level IT spending and staffing to:<br>• Provide insights on Hydro One's IT spending and investments levels relative to comparable peers.<br>• Identify areas where action may be needed to optimize IT budget and investment in line with Hydro One's strategic and operational priorities.<br>• Provide support for regulatory applications on IT spending and investments required to support the business. |
| **Hydro One's Objectives and How Gartner Consulting Meets Them** | ▪ Gartner conducted an Enterprise IT Budget Benchmark study, with a peer group tailored to Hydro One industry peers.<br>▪ The benchmark compares IT spending and staffing levels relative to business metrics, as well as distribution of spending across assets, technologies and investment objectives. |



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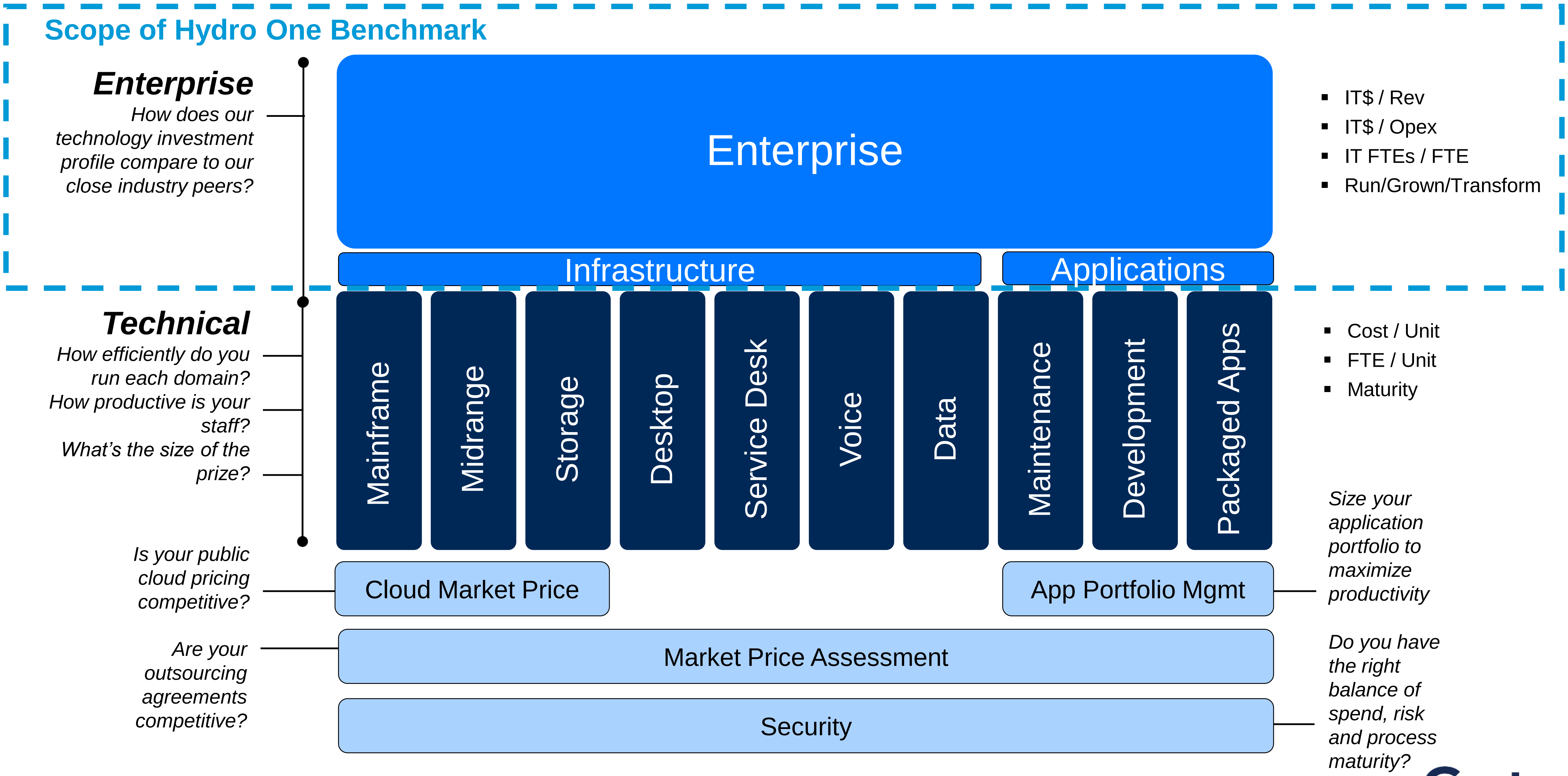
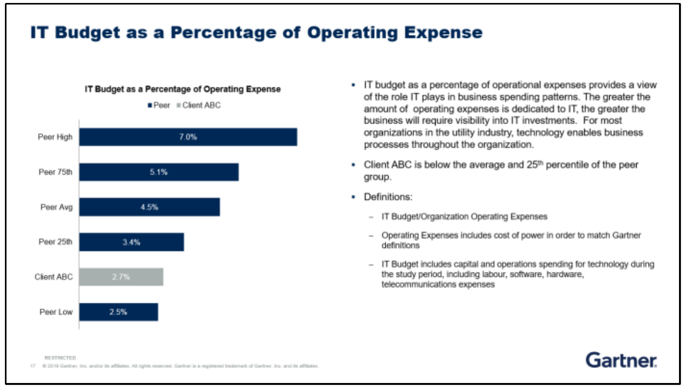
# IT Spending & Staffing Benchmark – Methodology Overview

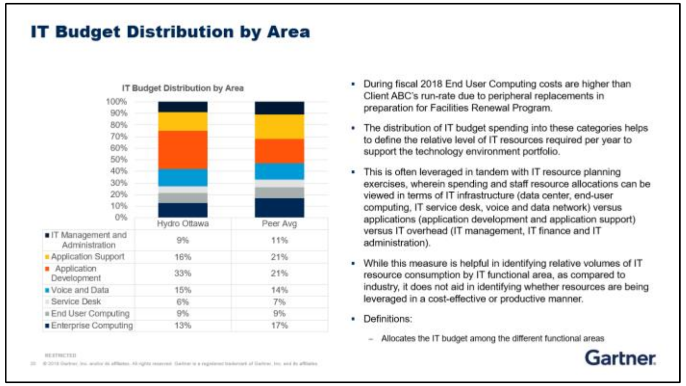
# Gartner's Benchmarking Framework

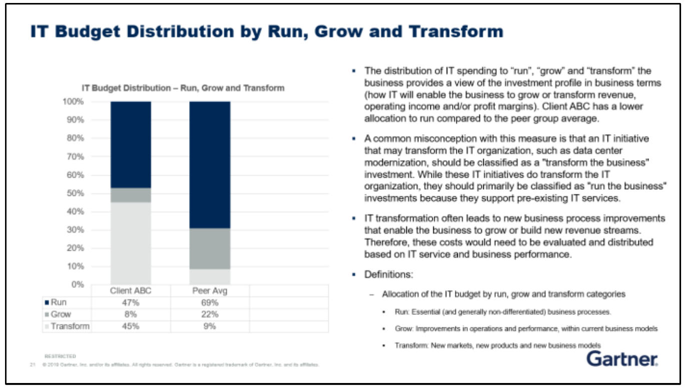


# IT Spending & Staffing Benchmark: Representative Metrics

- Gartner used its industry-leading benchmarking consensus models to compare Hydro One's total IT Spending & Staffing relative to a customized group of peer organizations derived from our benchmark database.
- The scope of benchmark included the following IT Spending and Staffing metrics:
  - **Spending Measures**
    - IT Spending as a % of Revenue and/or % of Operating Expense
    - IT Spending Per Employee
    - Capital vs. Operational Spending
    - Distribution of IT Spend—Hardware, Software, Personnel, Outsourcing, Other
    - Distribution of IT Spend—by IT Function
    - Distribution of Run, Grow, Transform Spending
  - **Staffing Measures**
    - Percent of Employees Dedicated to IT
    - IT Contractor Usage
    - Distribution of IT Support—by IT Function
- Based on the outcomes of the IT Budget Benchmark, Gartner and Hydro One can drill down into specific IT domains to further define optimization opportunities in future phases



# IT Spending & Staffing Benchmark – Detailed Results

# Peer Group Profile

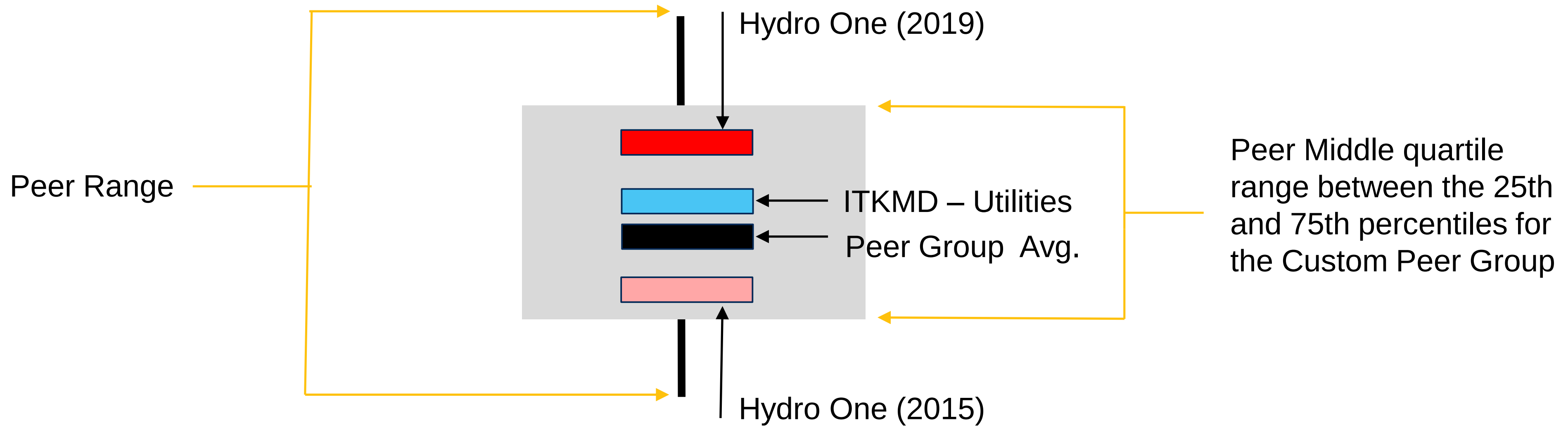
| Selection Criteria | |
|---|---|
| **Primary Criteria** | Industry & Organizational Focus |
| **Secondary Criteria** | Revenue, Business Operational Expense, # of Employees, Geography |

| Custom Peer Group Profile | | | | 2019 IT Key Metrics Data (ITKMD), Utilities Industry |
|---|---|---|---|---|
| **Number of Organizations** | 8 | | | 114 |
| **Industry Type** | Utilities industry with electricity generation, transmission and distribution | | | Utilities |
| **Geographical Location** | Canada (4) & USA (4) | | | Global |
| | **Hydro One (2019)*** | **Hydro One (2015)**** | **Peer Group Average** | **2019 ITKMD, Utilities** |
| **Annual Revenue***** | $6.48 Billion | $6.5 Billion | $5.28 Billion | $5.96 Billion |
| **Total Employees** | 8,842 | 8,344 | 5,986 | 5,500 |

* All Hydro One (2019) data is for fiscal 2019
** Hydro One’s 2015 data has not been adjusted for inflation
*** All analysis is in Canadian dollars, using the exchange rate of 1 USD = 1.3249 CAD

# Benchmark Analysis Methodology
# Peer Comparisons

Hydro One's results are displayed in comparison with the following reference points:

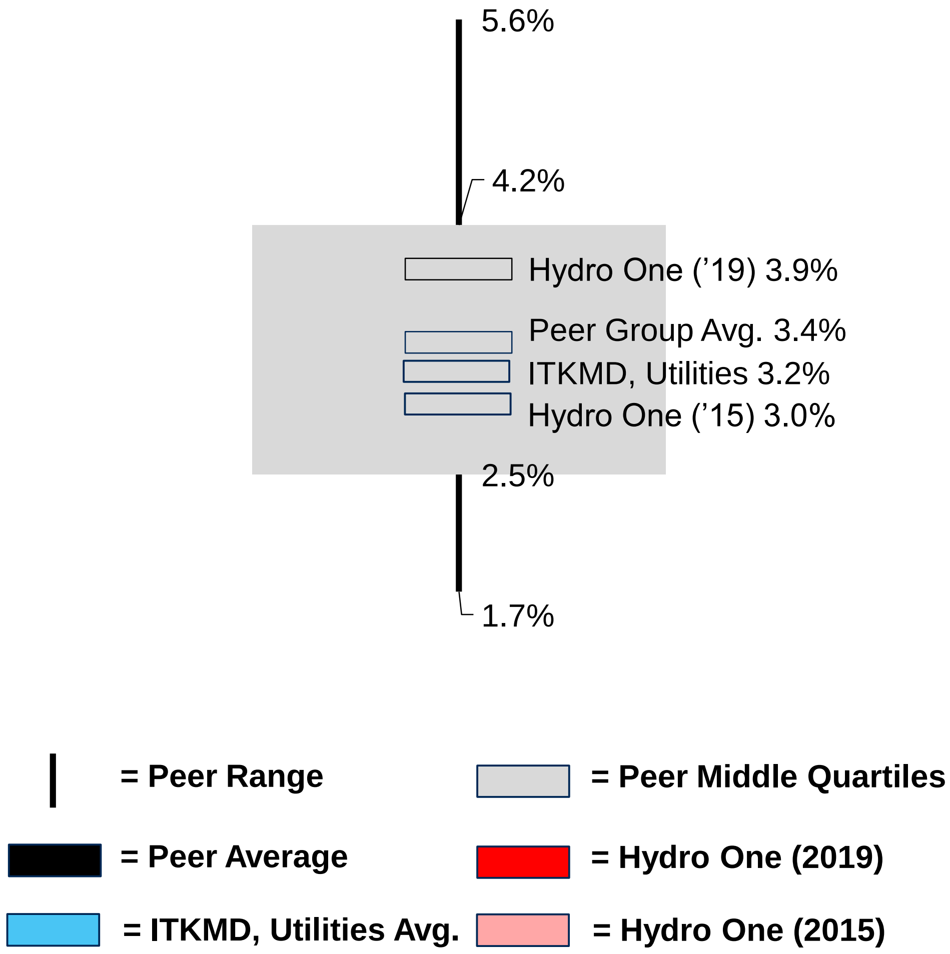



There are not necessarily "good" or "bad" results for any individual metric.

Differences in spending and staffing metrics derived from this analysis provide insight into current strategic IT investment levels relative to business performance and scale vs. your competitive landscape.

These measures should also be considered within the context of your future state business objectives.

# IT Spend as a Percentage of Revenue




| Observation | Strategic Consideration |
|---|---|
| • Hydro One's 2019 IT Spending as a % of Revenue was 3.9%, compared to 3.0% in 2015, and an average of 3.4% for the Peer Group. The increase in spending was due to significantly more capital spending aimed at business growth and transformation. | • Hydro One needs to continuously evaluate the appropriate level of IT Spending, and areas of focus, required to support the corporate-wide objectives. |

| | | |
|---|---|---|
| **Description** | • IT spending as a percentage of revenue is a common measure of IT's role in the business, and a measure to assess the comparative level of spending with industry peers.<br>• Organizations can use this data to assess the level of spending in their environment and the distribution of spending between applications and infrastructure.<br>• Being above or below average does not necessarily mean spending is "too high" or "too low", but significant variances should be analyzed to justify spending levels (e.g. investment in business transformation). Low investment could indicate underserved business needs. | |
| **Definition** | IT Spending includes capital and operations spending for technology during the study period, including labour, software, hardware, telecommunications expenses; includes project spending | |
| **Calculation** | IT Spend / Organization Revenue | **Hydro One (2019): $250,810,000 / $6,480,000,000** |

Note: Hydro One's 2015 data has not been adjusted for inflation



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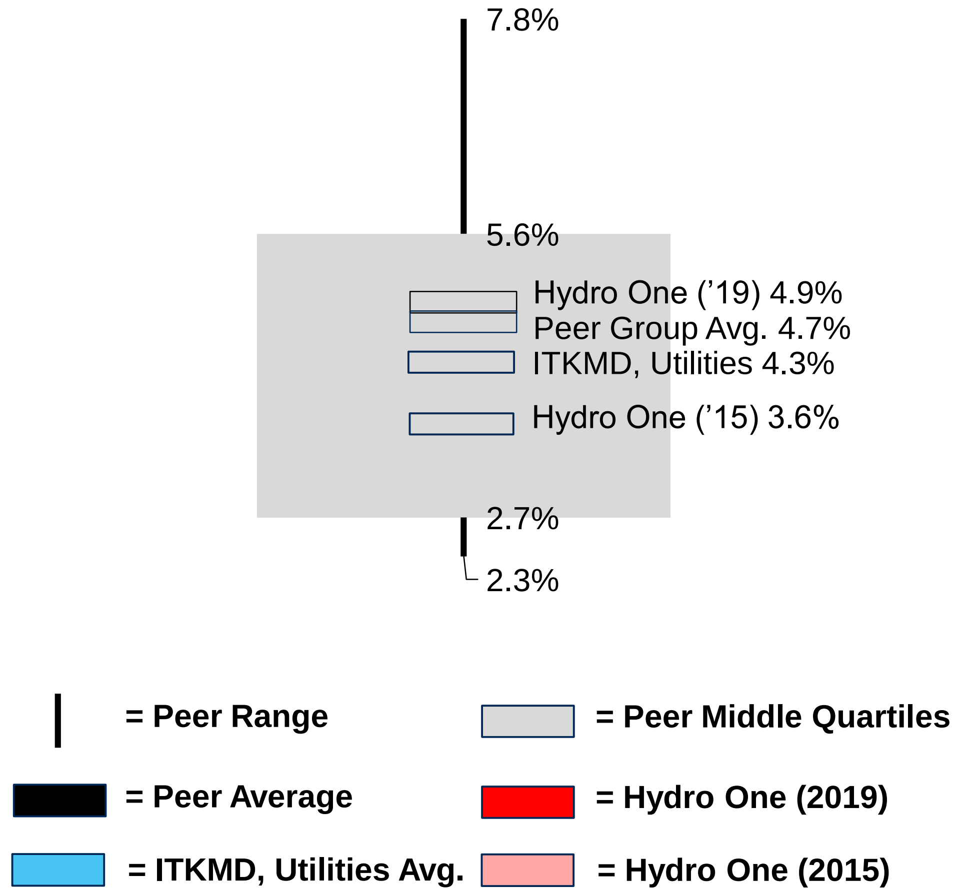
# IT Spend as a Percentage of Operational Expense




## Observation

- Hydro One's 2019 IT Spending as a % of Operational Expenses was 4.9%, compared to 3.6% in 2015, and an average of 4.7% for the Peer Group. The increase in spending was due to significantly more capital spending aimed at business growth and transformation.

| | | |
|---|---|---|
| **Description** | • IT spending as a percentage of operational expenses provides a view of the role IT plays in the spending patterns of the business. The greater the amount of the operational expenses that is dedicated to IT, typically the greater need for visibility into the IT investments the business will require.<br>• Organizations with a near-average total IT spend percentage, but with higher than average infrastructure spend should assess the nature of their IT environment. Infrastructure investments may be used strategically, or might simply reflect high maintenance costs of legacy systems. | |
| **Definition** | IT Spending includes capital and operations spending for technology during the study period, including labour, software, hardware, telecommunications expenses; includes project spending | |
| **Calculation** | IT Spend / Operational Expense | **Hydro One (2019): $250,810,000 / $5,170,000,000** |

Note: Hydro One's 2015 data has not been adjusted for inflation



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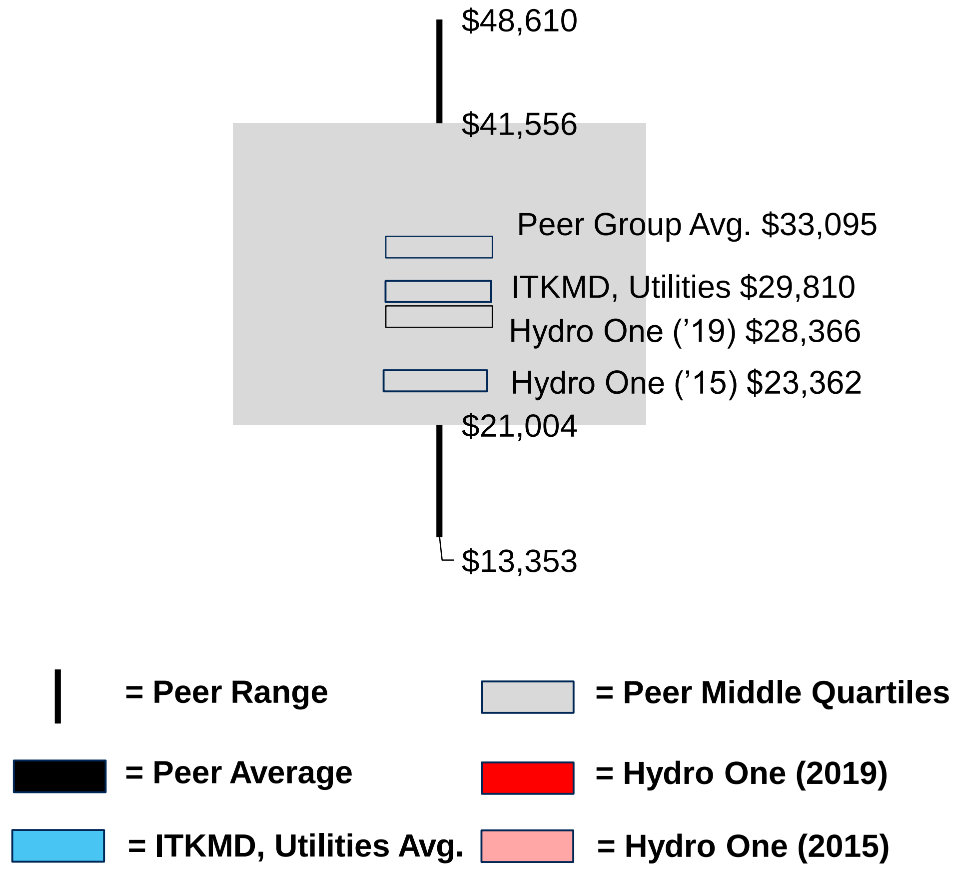
# IT Spend per Employee

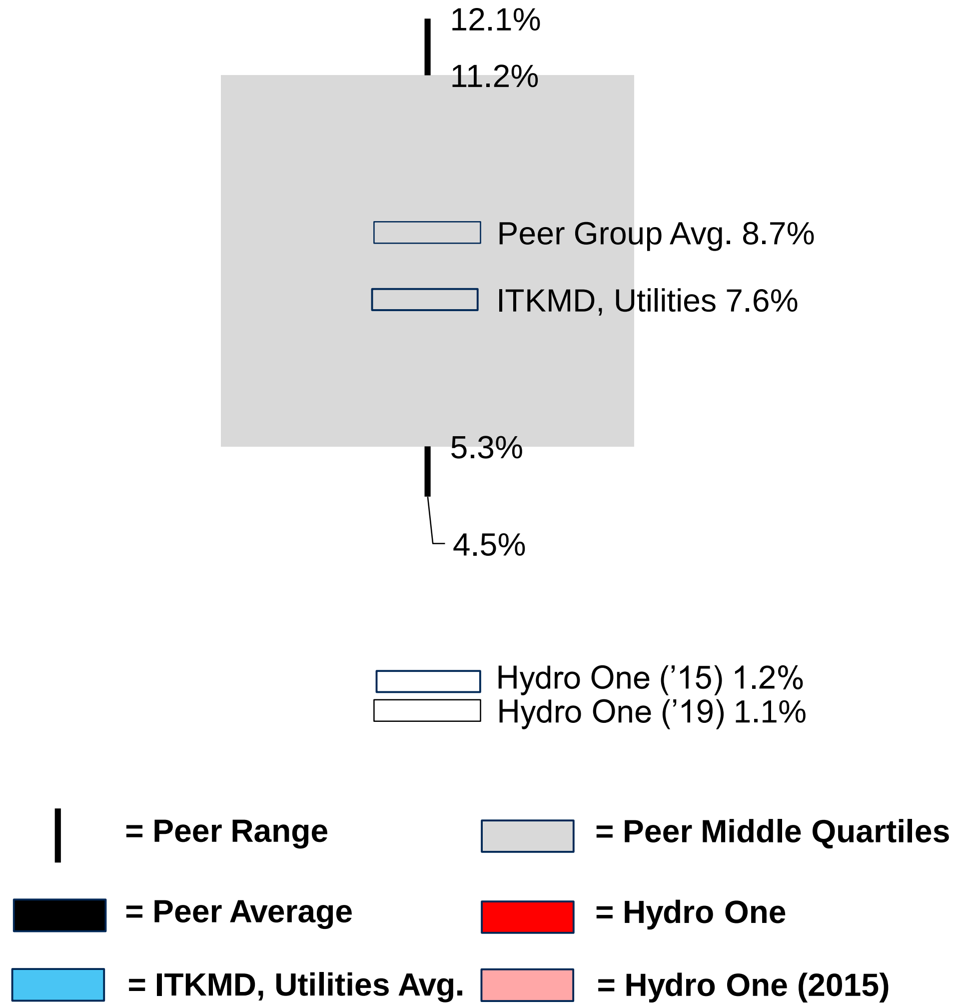



| Observations | Strategic Consideration |
|---|---|
| • IT Spending per Employee was $28,366 in 2019, 17% less than the Peer Group average.<br>• Hydro One's 2019 and 2015 organizational employees include seasonal workers that have been converted to full-time equivalents; the same is true for the Peer Group. | • Hydro One should continue to evaluate IT investments that will enable all staff to serve customers, improve productivity and reduce costs across the business. |

| | | |
|---|---|---|
| **Description** | • IT spending per employee provides insight into the amount of technology support an organization's workforce receives.<br>• High spending can imply higher levels of automation and or higher investment in IT in general. Low spending levels can be related to higher overall staffing levels and or lower IT investment than peers.<br>• Large variations within industry groups can represent different business models for service or product delivery. | |
| **Definition** | IT Spending includes capital and operations spending for technology during the study period, including labour, software, hardware, telecommunications expenses; includes project spending. Organization Employees includes Hydro One staff, exclusive of Contractors. | |
| **Calculation** | IT Spending / Organization Employees | **Hydro One (2019): $250,810,000 / 8,842** |

Note: Hydro One's 2015 data has not been adjusted for inflation

# IT FTEs as a Percentage of Total Employees



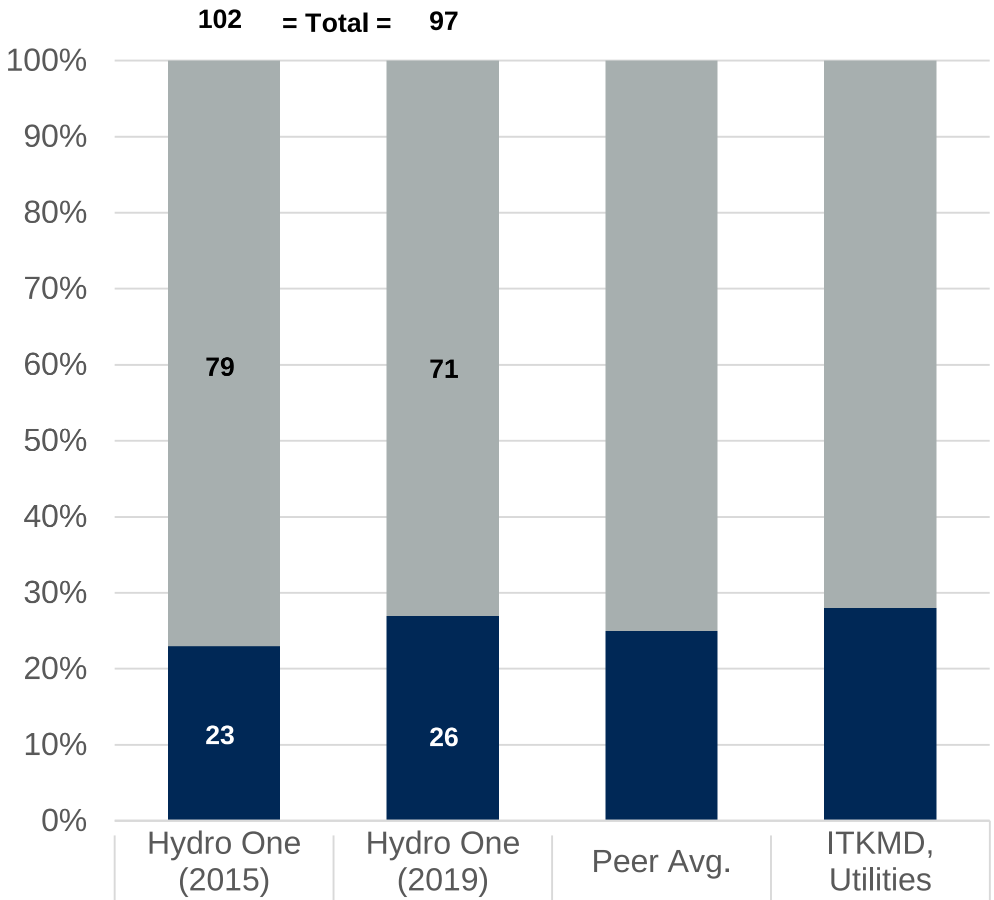

## Observations

- Hydro One has significantly fewer IT FTEs than the Peer Group, as well as the Utilities Industry overall.
- This is due to the fact that the majority of IT infrastructure functions are outsourced, thus require few employees to perform these functions.
- The higher number of Hydro One non-IT employees compared to 2015, partly due to the repatriation of the Hydro One call centre, is a factor in the reduction of IT FTEs compared to total employees between 2015 and 2019.

| | | |
|---|---|---|
| **Description** | • The percentage of IT FTEs in the organization compared to the total number of employees is a key measure of how critical IT support is to the business. This measure can be heavily influenced, however, by the level of outsourcing an organization may have.<br>• Organizations with high levels of manageability and automation should require fewer operations staff. Manual processes and lack of standards will increase the number of IT FTEs needed. | |
| **Definition** | IT FTEs includes in-house and contractor FTEs, does not include managed services adjusted FTEs. Organization Employees includes Hydro One employees, exclusive on Contractors | |
| **Calculation** | IT FTEs / Organization Employees | **Hydro One (2019): 97 / 8,842** |

Note: Hydro One's 2015 data has not been adjusted for inflation

# IT FTEs Distribution by Inhouse and Contractor



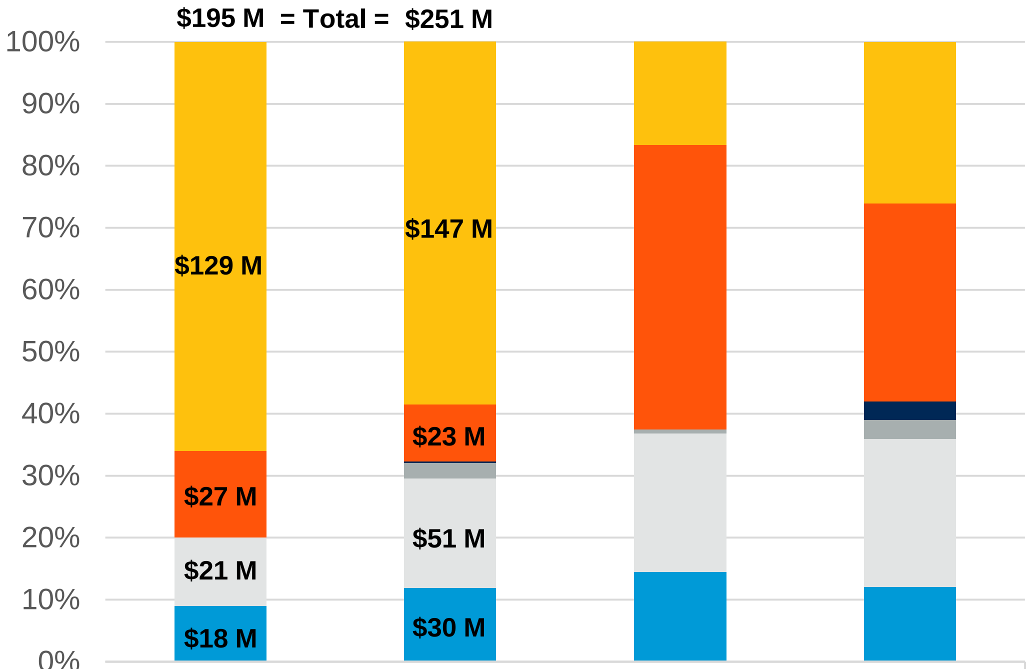

| | Hydro One (2015) | Hydro One (2019) | Peer Avg. | ITKMD, Utilities |
|---|---|---|---|---|
| Inhouse | 77% | 73% | 75% | 72% |
| Contractors | 23% | 27% | 25% | 28% |

## Observation

- Hydro One's usage of IT contractors has remained fairly steady compared to 2015 and is very much in line with the Peer Group and Industry averages.

| | |
|---|---|
| **Description** | • The distribution of IT FTEs (insourced versus contractor) provides a view of the IT staffing strategy.<br>• IT Contract labour or Contractor usage can be an effective approach to maintaining flexibility and agility when business conditions are changing. However, keeping Contractors for extended periods can be costly and limit process standardization. |
| **Definition** | Distribution of Contractor FTEs and In House FTEs |

# IT Spend Distribution by Cost Category




| | Hydro One (2015) | Hydro One (2019) | Peer Group Avg. | ITKMD, Utilities |
|---|---|---|---|---|
| Outsourcing | 66.0% | 58.5% | 16.6% | 26.0% |
| Personnel | 14.0% | 9.2% | 45.9% | 32.0% |
| IaaS | | 0.2% | 0.0% | 3.0% |
| SaaS | | 2.5% | 0.7% | 3.0% |
| Software | 11.0% | 17.7% | 22.3% | 24.0% |
| Hardware | 9.0% | 11.9% | 14.5% | 12.0% |

Notes:
a) For 2015 dollar allocations, SaaS is included in Software, IaaS is included in Hardware
b) Hydro One's 2015 data has not been adjusted for inflation

## Observations

- 58.5% of Hydro One's overall IT spend is directed to Outsourcing
- Hydro One leverages outsourcing far more than the Peer Group and the Utilities Industry overall
- Outsourcing spend has increased by $18 million over 2015 levels (14%), whereas Personnel costs have decreased by $4 million (15%).
- Hardware and Software spending have increased significantly, 143% and 67% respectively, although still remain lower than the Peer Group and Industry averages.

## Strategic Considerations

- Due to the size of this spend (including Hydro One's contract with Inergi), value for money and market price analyses should be conducted as part of the negotiations in future outsourcing contracts.
- Hydro One should also seek to improve service and innovation from providers. Refer to Gartner I-3 (Incentivize, Identity & Implement) IT Outsourcing Innovation Model - Gartner research document G00357576.

| | |
|---|---|
| **Description** | • This measure can be helpful in adding context to the IT investment strategy from a sourcing perspective, in terms of accounting-based resources that may be insourced versus services delivered by a third party.<br>• As an organization increases or decreases the level of outsourced services, it may find an inverse effect in its associated personnel, hardware and/or software expenditures, depending on the scope of services retained and on requirements. |
| **Definition** | Allocated IT Spending among the different cost categories |



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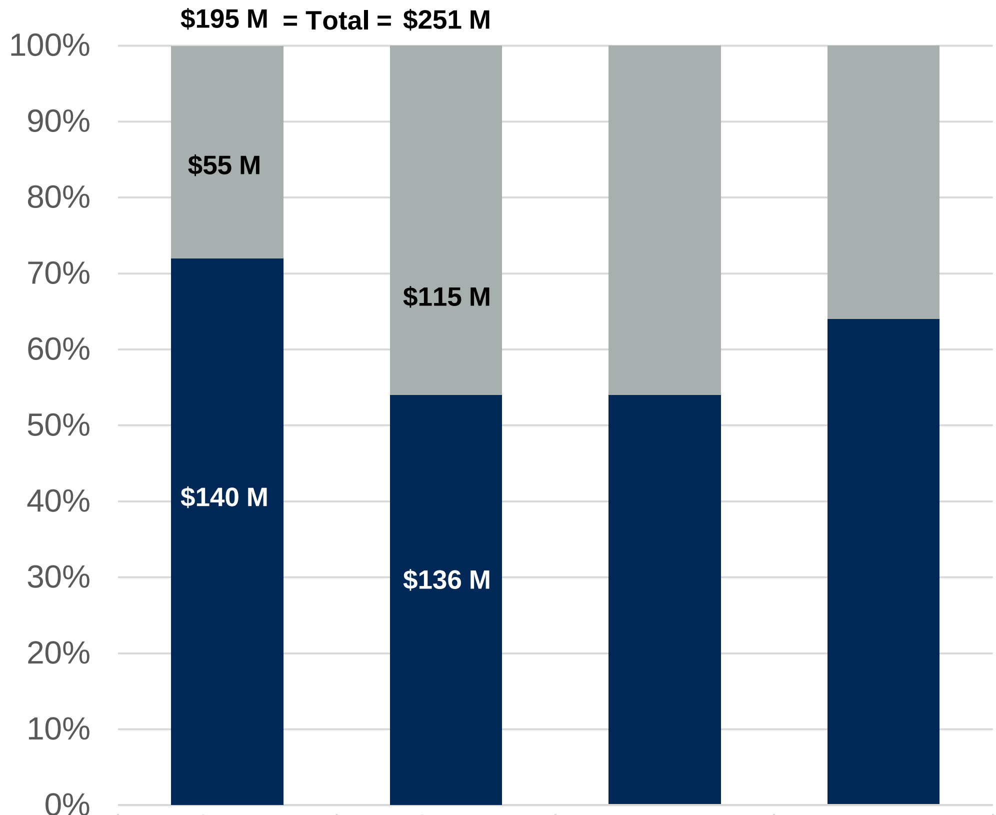
# IT Spend Distribution – Operations vs. Capital




| | Hydro One (2015) | Hydro One (2019) | Peer Group Avg. | ITKMD, Utilities |
|---|---|---|---|---|
| Capital | 28% | 46% | 46% | 36% |
| Operational | 72% | 54% | 54% | 64% |

## Observations

- Hydro One's overall operational expenses have actually decreased since 2015. The decrease would be even more significant if the 2015 spending was adjusted for inflation.
- The overall $56 million increase in IT spending is driven by increased capital expenditures to support business growth and digital transformation.
- Hydro One's 2019 CapEx / OpEx split is very similar to the Peer Group average.

## Strategic Considerations

- Applications and Infrastructure are increasingly cloud-based, creating an escalating shift away from more traditional capital-based models to operational funding.
- There can be unanticipated or overlooked operating budget increases as a result of SaaS and IaaS contracts. The resultant shift from capital expenditure (CapEx) to operating expenditure (OpEx) can cause budgetary and cost management pressures.

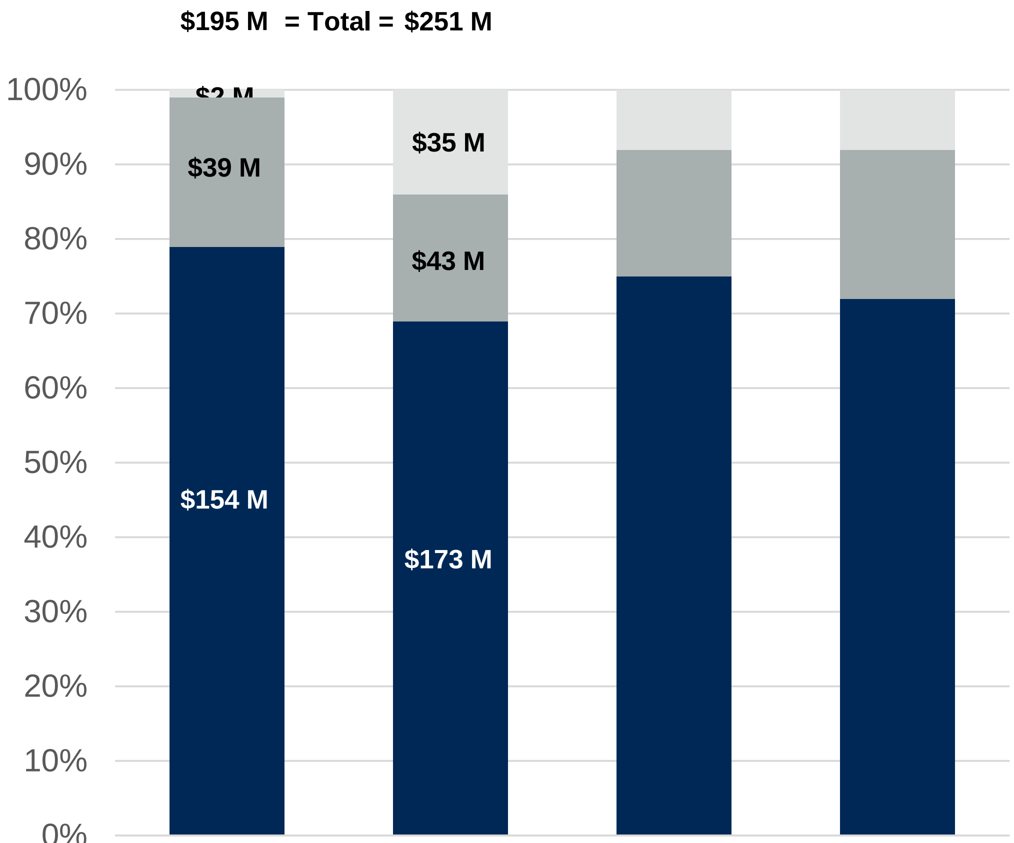
**Description**

- IT capital expenses vs. operational expenses helps to portray the investment profile for an organization in a given year.
- Organizations with a higher capital spending may:
  - Be investing heavily in strategic IT infrastructure
  - Have reached a planned point of investment in their infrastructure lifecycle
  - Not have been managing asset investments well (i.e., "catching up")
  - Simply have a more aggressive capitalization policy
- The break out of Run, Grow, Transform spending that follows may provide more insight

**Definition** Distribution of IT Operational spending versus Capital spending

Note: Hydro One's 2015 data has not been adjusted for inflation

# IT Spend Distribution by Run, Grow and Transform




| | Hydro One (2015) | Hydro One (2019) | Peer Group Avg. | ITKMD, Utilities |
|---|---|---|---|---|
| Transform | 1% | 14% | 8% | 8% |
| Grow | 20% | 17% | 17% | 20% |
| Run | 79% | 69% | 75% | 72% |

## Observations

- In 2019, Hydro One allocated 31% of IT Spending to "change the business" activities (17% Grow and 14% Transform), significantly more than four years prior, as well as the Peer Group average. This indicates a significant level of investment in digital capabilities and aligns with the increase in capital expenditures ($55 million in 2015 versus $115 million in 2019).
- After adjusting for inflation, Hydro One's "run" costs have been relatively flat since 2015, this even includes $25 million of "run" spend on the Private Cloud Data Center project.

## Strategic Considerations

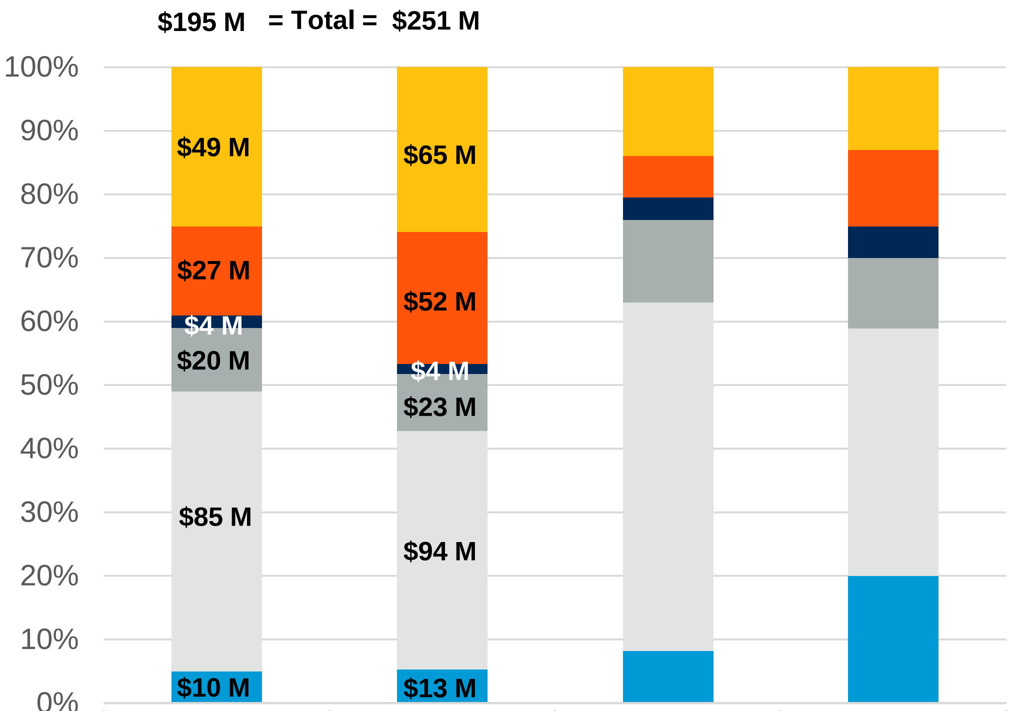
- Use the Run, Grow and Transform categorizations to help communicate the funding needed for business transformation and the cost to maintain legacy business models.
- Divide the run spending by business outcome metrics (or business capabilities) to show per-unit-cost productivity improvement, with the related volumes, to better show its value to the enterprise.

**Description**
- The distribution of IT spending provides a view of the investment profile in business terms (how IT will enable the business to grow or transform revenue, operating income and/or profit margins)

**Definition**
Allocation of IT Spending by Run, Grow and Transform, where:
- Run: Essential (and generally non-differentiated) business processes.
- Grow: Improvements in operations and performance, within current business models
- Transform: New markets, new products and new business models

Note: Hydro One's 2015 data has not been adjusted for inflation

# IT Spend Distribution by IT Functional Area




| | Hydro One (2015) | Hydro One (2019) | Peer Group Avg. | ITKMD, Utilities |
|---|---|---|---|---|
| Enterprise Computing | 25.0% | 25.9% | 14.0% | 13.0% |
| End User Computing | 14.0% | 20.7% | 6.5% | 12.0% |
| IT Service Desk | 2.0% | 1.6% | 3.5% | 5.0% |
| Voice & Data Network | 10.0% | 9.0% | 13.0% | 11.0% |
| Applications | 44.0% | 37.5% | 54.8% | 39.0% |
| IT Mgmt., Finance & Admin. | 5.0% | 5.3% | 8.2% | 20.0% |

| Observations | Strategic Consideration |
|---|---|
| • Enterprise Computing and End User Computing consume a much larger % of IT Spend than the Peer Group and Overall Utility Industry averages.<br>• Allocation to Applications spending is less than the Peer Group average and similar to the Utility Industry as a whole. Compared to 2015, Hydro One allocated a smaller % of total spend towards Applications. | • Given the gap to Peer and Industry averages and significant real dollar increases in Enterprise Computing and End User Computing spend, these areas should be examined further for cost optimization opportunities. |

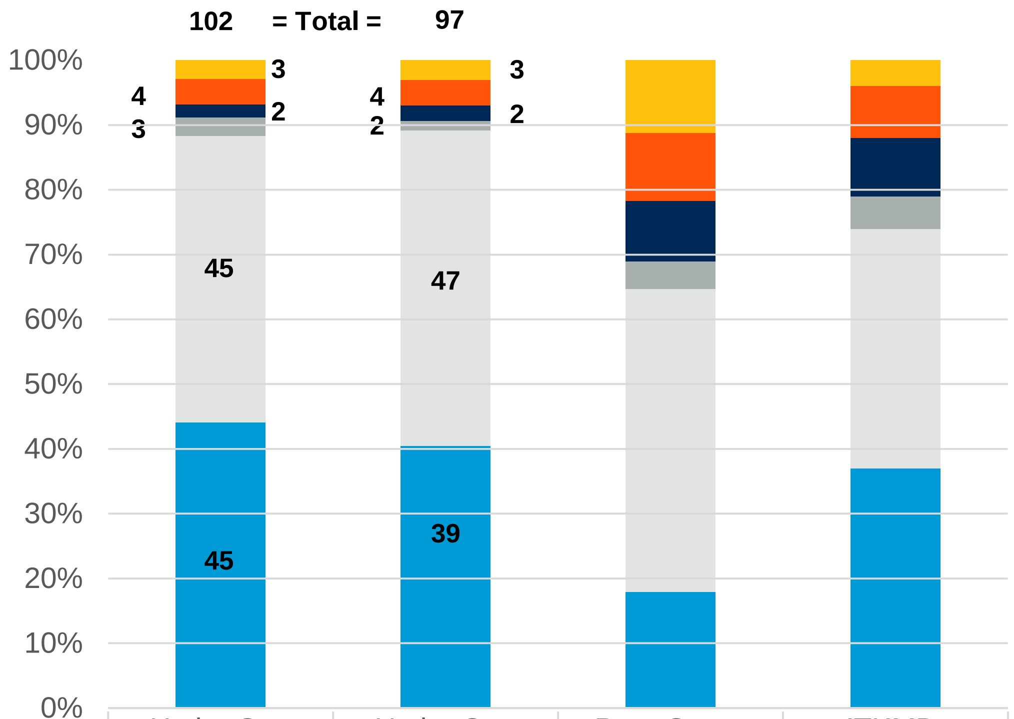
**Description**

- This information is often leveraged in tandem with IT resource planning exercises, wherein resource allocations can be viewed in terms of IT infrastructure versus applications versus IT overhead.
- While this measure is helpful in identifying relative volumes of IT resource consumption by IT functional area, as compared to Peers, it does not aid in identifying whether resources are being leveraged in a cost-effective or productive manner.

**Definition** Allocated IT Spending among the different functional areas

Note: Hydro One's 2015 data has not been adjusted for inflation

# IT FTEs Distribution by Area




| | Hydro One (2015) | Hydro One (2019) | Peer Group Avg. | ITKMD, Utilities |
|---|---|---|---|---|
| Enterprise Computing | 2.9% | 3.1% | 11.2% | 4.0% |
| End User Computing | 3.9% | 3.9% | 10.5% | 8.0% |
| IT Service Desk | 2.0% | 2.3% | 9.3% | 9.0% |
| Voice & Data Network | 2.9% | 1.5% | 4.3% | 5.0% |
| Applications | 44.1% | 48.7% | 46.8% | 37.0% |
| IT Mgmt., Finance & Admin. | 44.1% | 40.5% | 17.9% | 37.0% |

## Observations

- Hydro One has fewer IT FTEs in 2019 than it did in 2015 (97 versus 102).
- Applications is the only area of increase; this is normal during a period of transformation.
- Due to Hydro One's largely outsourced IT operating environment, it is expected that IT Management, Finance & Administrative staffing would be higher as these resources are required to manage the outsourcing

| | |
|---|---|
| **Description** | • By viewing human resources (IT FTEs) within the context of the total portfolio, organizations are able to identify which environment is the most labour- intensive as a % of the IT labour pool. Typically, application activities (development and support) demand the most resources from both cost and staffing perspectives. The degree to which an organization outsources should be considered alongside such staffing metrics. |
| **Definition** | Distributes In House and Contractor IT FTEs among the different functional areas |

# Appendix: Benchmarking Definitions

# IT Spending & Staffing Benchmark Methodology — Key Definitions

- The IT Spending & Staffing Assessment follows the Gartner Benchmarking chart of accounts. In order to match the Gartner Benchmark chart of accounts, the data presented in the benchmark will not completely align with the official Information and Technology budget or organization.  For example, the Gartner Benchmark chart of accounts has historically excluded operational technology.
- IT Spending Definition
  - The total spend at the end of the twelve month budget period for information technology to support the enterprise. IT spend can come from anywhere in the enterprise that incurs IT costs, and it is not limited to the IT organization. It is calculated on an annualized “cash out” basis and therefore contains capital budget, and operational expenses.  Depreciation is not included. Gartner definitions for IT spend include all IT services, for example:
    - Hardware, software, personnel (including travel and benefits and training), contractors and consultants, outsourcing, disaster recovery, occupancy, data and voice communications/transmission, associated with supporting information technology within the enterprise.
    - Costs for the facilities being used by the staff supporting the enterprise. Some examples include office space, furniture, electricity, maintenance, property taxes, security, and office supplies. Occupancy costs for space dedicated to IT functions such as the data center and IT service desk are also included.
    - The data center (servers, storage etc), client devices (desktops, laptops, tablets, thin clients, handhelds), voice and data networks (including but not limited to voice and data transmission, fixed and mobile telephony, Internet access services), IT service desk, application development and maintenance. IT Support functions such as the office of the CIO, supervisory management, finance and administrative costs, such as purchasing, asset management, process management, and marketing of IT services.

# IT Budget Benchmark Methodology — Key Definitions

- The IT Budget Assessment follows the Gartner Benchmarking chart of accounts. In order to match the Gartner Benchmark chart of accounts, the data presented in the benchmark will not completely align with the official Information and Technology budget or organization. For example, the Gartner Benchmark chart of accounts has historically excluded operational technology.
- IT Budget Definition
  - The total spend at the end of the twelve month budget period for information technology to support the enterprise. IT spend can come from anywhere in the enterprise that incurs IT costs, and it is not limited to the IT organization. It is calculated on an annualized “cash out” basis and therefore contains capital budget, and operational expenses. Gartner definitions for IT spend include all IT services, for example:
    - Hardware, software, personnel (including travel and benefits and training), contractors and consultants, outsourcing, disaster recovery, occupancy, data and voice communications/transmission, associated with supporting information technology within the enterprise.
    - Costs for the facilities being used by the staff supporting the enterprise. Some examples include office space, furniture, electricity, maintenance, property taxes, security, and office supplies. Occupancy costs for space dedicated to IT functions such as the data center and IT service desk are also included.
    - The data center (servers, storage etc), client devices (desktops, laptops, tablets, thin clients, handhelds), voice and data networks (including but not limited to voice and data transmission, fixed and mobile telephony, Internet access services), IT service desk, application development and maintenance. IT Support functions such as the office of the CIO, supervisory management, finance and administrative costs, such as purchasing, asset management, process management, and marketing of IT services.

# IT Domain Definitions (page 1 of 2)

**End-User Computing**

- End-User Computing includes provisioning of the full life cycle management of desktop, laptop, tablet, thin client, handheld and peripheral assets including acquisition, deployment, maintenance, change management and disposal.

**IT Service Desk**

- An IT Service Desk is defined as any single location that evenly distributes the receipt and/or placement of technical support calls or contacts to a predetermined group of support staff. The IT service desk assessment examines IT efficiency and effectiveness with respect to the provisioning of remote Tier 0/Tier 1 support provided to end users by the technical support centers (e.g., network, data center, PC and consolidated).
- Because IT service desks may be organized differently across enterprises, you may be required to capture some information that is beyond your specific budget lines to ensure consistent comparisons. Examples include telecommunications equipment used specifically by the IT service desk, transmission expenses attributable to the inbound support calls and remote user support resources that may physically reside in other support groups (e.g. network operations or applications support).

**Applications**

**Development**

- New code for a new application
- Functional enhancements to current code that take more than two person-weeks or typically add greater than eight function points (see notes below)

**Support**

- Programming maintenance of currently operational computer applications. This will include some enhancements to these applications as well.
- Bug fixes of any size or duration
- Maintenance of hard-coded data or tables (including field size changes) embedded within the programs (any size or duration)
- Functional enhancements to current code that take less than two person-weeks and typically add fewer than eight function points
- Any project that produces no new business functionality for the user

# IT Domain Definitions (page 2 of 2)

**Corporate IT Management, Finance & Administration**

- *IT Management:* If an individual is clearly a management person, but has no direct reports, that person should still be classified as management.
- *Office of the CIO/CTO:* This includes the “C-level” IT management including the CIO and CTO functions. Direct reports of the CIO that spend the majority of their time providing enterprise wide support other than those functions outlined below (i.e., special projects) are also included here.
- *IT Human Resources:* This includes resources dedicated to human resource issues surrounding the recruiting and retaining of IT staff.
- *IT Marketing:* This includes resources dedicated to marketing the capabilities of the IT organization to the business units.
- *Technology Planning and Process Management:* This includes activities related to the planning for, and management of, current and future technology needs and the establishment of policies and processes relating to technology. This includes, but is not limited to, systems research, product management, technology evaluation and purchase decision-making, establishment of processes surrounding security and virus protection, and business continuity/recovery.
- *Disaster Recovery:* This includes resources dedicated to planning, testing and implementing contingency procedures across all IT functions. This includes the staff dedicated to safeguarding the enterprise's ability to continue operation of vital business functions following physical damage or other catastrophes impacting business facilities. Responsibilities include the following items: maintaining disaster recovery documentation, negotiating contingency site arrangements and serving as liaison with the vendor, managing off-site data retention
- *IT Security:* This includes resources who oversee the development of standards and procedures for ensuring overall network and systems integrity.
- *IT Administration:* This includes direct administrative and clerical support to enterprise-level IT. Positions include secretary, receptionist and administrative assistant
- *Budget and Chargeback:* This area establishes the overall IT budget, monitors actual expenses vs. the budget, arranges financing for purchases and performs financial reporting to other enterprise areas. These individuals also handle the operation of the chargeback system. Positions include financial analyst and chargeback administrator.
- *IT Asset Management:* This area provides the administrative support for tracking systems and system components. This area accounts for labor and contract costs for managing depreciation records and lease contracts, performing asset inventories (physical or automatic management), asset identification and tracking, asset database management, change recording and reconciliation. It also includes the creation and maintenance of an up-to-date record of installs, moves, adds, changes, removals and final disposal of all assets (e.g., hardware, software and circuits). The record contains information for locating, assessing, auditing, troubleshooting, counting, and assigning assets, or performing other technical and business functions without the need to visit repeatedly the asset location or reassemble data records. It also includes the determination of an asset's useful life including planning for the installation, upgrade, and removal/disposal of the asset and executing the plan. Procurement: This area solicits bids, negotiates purchasing agreements, establishes purchase orders, validates vendors’ bills, coordinates with accounts payable for payment and handles contract administration.

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# SECTION 4.4 – GSP – PLACEHOLDER

*This section is not applicable for the GSP. It is included in the GSP structure to maintain alignment with the structures of the TSP and DSP.*

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# SECTION 4.5 – GSP – PLACEHOLDER

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# SECTION 4.6 – GSP – OTHER CAPITAL PLANNING FACTORS AND CONSIDERATIONS

GSP Sections 4.2 and 4.3 presented planning considerations from the lens of system and asset needs and benchmarking results. This section focuses on other factors and considerations that shaped, informed, and impacted the development of the GSP, in accordance with the principles and requirements of OEB's Renewed Regulatory Framework (RRF), such as:

- Customer needs and preferences as identified through customer engagement;
- Regulatory and public policy requirements
- Impacts of system modernization (as applicable)

These additional considerations are presented below for each of the main areas of the GSP.

## 4.6.1 FLEET

### 4.6.1.1 HOW THE PLAN REFLECTS CUSTOMER NEEDS AND PREFERENCES

Fleet investments are essential to support and enable Hydro One's Transmission and Distribution work programs, which directly influence the level of service delivered to customers based on the investment scenario and objectives supported by the majority of customers. In this regard, customer needs drive the resources and timing associated with transmission and distribution work program execution. In turn, they impact the level and composition of Fleet investments required, including acquisition of specific assets to support large projects and/or leveraging rental contracts for light, heavy and off-road equipment to meet short term needs. In establishing the Fleet investment plan, Hydro One Fleet Management Services focuses on the need to minimize the costs associated with TWE assets' total life cycle management and maximize asset utilization, while serving the needs of complex and dynamic work programs in a reliable, safe and agile manner. This is aligned with the Company's strategic priorities to "Be the safest and most efficient utility" (as presented in SPF Section 1.7.2, Figure 3).

Hydro One found through customer engagement that “a majority of customers support Hydro One making the necessary investments in general plant to meet the same standard as similar businesses rather than just make do and only invest to address the most urgent needs”.[1] In relation to TWE assets, a break/fix approach would not meet customer expectations since it only targets the most urgent asset issues on a reactive and piecemeal basis and does not reflect the level of planned investments needed for prudent asset stewardship in line with operational needs and industry practice. This approach is not recommended as it would have a potentially significant negative impact to safety. Reliability and customer service would potentially be impacted as a result of increased downtime.

As part of customer engagement, Hydro One customers also identified “minimizing the impact on the environment” as a “very important” outcome.[2] In this regard, Fleet Management Services has an important role to play and has begun to transition the company’s commercial fleets to low or zero emission technology – in particular, electric vehicles (EVs). In addition to customer expectations related to environmental stewardship, as well as increased awareness domestically and globally to reduce greenhouse gas emissions and combat climate change, this shift is driven by and contingent upon various factors including maturing battery technology, increased EV driving range, and improved economics based on total cost of ownership models for EVs versus internal combustion engine vehicles. As a member of the Edison Electric Institute (EEI), Hydro One has committed to transforming a portion of its fleet to plug-in electric or hybrid electric vehicles by 2030.[3] Fleet Management Services has begun a gradual adoption of EVs, devoting 5% of its capital budget for EV purchases in 2021 and 50% by 2030 (including but not limited to the purchase of pickup trucks, vans and heavy power take-off units, provided their procurement is feasible based on market availability and conditions). This gradual approach will balance the need

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[1] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 5
[2] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 15
[3] See: EEI, Transportation Electrification – Utility Fleets Leading the Charge (January 2014) – page 43 (https://www.eei.org/issuesandpolicy/electrictransportation/FleetVehicles/Documents/EEI_UtilityFleetsLeadingTheCharge.pdf), which recommended that its member utilities dedicate 5% of its annual purchase plan to plug-in vehicles as a starting point.

to transition to a green fleet while also minimizing potential business and operational risks associated with rapid changes in EV technology and infrastructure. For more information on Hydro One's initiatives towards a long-term, sustainable carbon footprint reduction, please refer to SPF Section 1.8.3.

### 4.6.2 FACILITIES AND REAL ESTATE

#### 4.6.2.1 HOW THE PLAN REFLECTS CUSTOMER NEEDS AND PREFERENCES

As noted above, most customers "support Hydro One making the necessary investments in general plant to meet the same standard as similar businesses rather than just make do and only invest to address the most urgent needs".[4] In alignment with this preference, and recognizing the importance that customers attribute to reliability and safety, Facilities and Real Estate (F&RE) prioritizes issues and risks in facilities that serve critical functions to minimize adverse impact or disruptions to business operations and services delivered by Hydro One's business units to its customers. By providing resilient and functional facilities, F&RE also supports Hydro One's strategic objective to "plan, design and build a grid for the future".

Specifically, F&RE considers the criticality of buildings relative to the utility's service imperatives, prioritizing network buildings that house power and control equipment which directly impact the ongoing safe, secure and reliable grid for the future. These buildings must be maintained appropriately to avoid facility-related equipment outages, with a focus on:

- Roof replacement to protect equipment from weather conditions and prevent leaks that could damage equipment or possibly disrupt system operations. For example, in June 2019, Algoma TS experienced an outage resulting in multiple transfer trips and outages due to flooding that occurred shortly before scheduled roof repair.
- External wall upgrades to ensure building integrity, safety and thermal insulation (while also respecting the significance of perceived external appearance to the public in the urban setting).

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[4] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 5

- HVAC (heating, ventilation, and air conditioning) unit replacement (older/obsolete units) to ensure acceptable indoor air quality and improve reliability to prevent equipment overheating.
- Investments related to drainage and septic systems to prevent flooding and water damage (including potential mould growth).

In addition, F&RE investments ensure that each Line of Business has adequate accommodations to perform their work in a safe and productive work environment, which is essential to the successful execution of Hydro One's work programs and delivery of services that meet customer expectations. In this regard, F&RE considers the needs of each LOB – including anticipated changes to work programs – that may require modifications of existing facilities or development of new facilities to serve our customers efficiently. Areas that have a large customer base (e.g., Newmarket, as outlined in Section 4.11, G-GP-03) may drive the need for facility investments to accommodate the required work load (warehouse, work space, etc.). F&RE continuously monitors the condition of F&RE assets through ongoing preventative maintenance and Building Condition Assessments (BCAs) (as discussed in GSP Section 4.2.3), to ensure they remain in good operating condition and address any risks to employees or the public at large.

As also noted above, Hydro One customers view "minimizing the impact on the environment" as a "very important" outcome.[5] With respect to F&RE, the proposed plan takes into consideration, ways to invest in energy efficiency initiatives to reduce environmental impacts and lower operating costs over the long-term. For example, the implementation of the Remote Command Centre pilot program, which will assist Hydro One to enhance our operational efficiency by monitoring real time energy consumption remotely and enabling F&RE to identify root cause of failures and expedite repairs. Moreover, F&RE collaborates with other lines of business in identifying and implementing efficiency initiatives within our capital plan. For example, F&RE has an important role in supporting Hydro One's planned transition to EV commercial fleets.

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[5] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 15

#### 4.6.2.2 HOW THE PLAN REFLECTS REGULATORY REQUIREMENTS AND POLICY

Regulatory reform can impact both the development and management of facilities. It can impose obligations to act on existing facilities; introduce new requirements for facilities under development; and present best practices and recommendations to ensure health and safety of the work environment.

An example of reform that required F&RE to upgrade elements of existing facilities is The Canadian Federal *PCB Regulations (SOR/2008-273),* which imposed requirements to protect the natural environment and health and safety of occupants. This regulation limits Hydro One's use of PCB containing equipment to 2025. Specific to F&RE assets, this has necessitated the PCB Lighting Program to remove the PCB containing light fixtures/components, a condition widely prevalent within its buildings and facilities. This program was accelerated in 2018 and is to be fully completed by December 31, 2023. Approximately 42% of replacements in scope for phase out have been completed as of December 31, 2020.

Another example is the *Accessibility for Ontarians with Disabilities Act, 2005*, where Hydro One is required to upgrade certain buildings or site components (including parking spaces, ramp access, door widening, workstation layouts, washroom, elevators, wayfinding and tactile cues, etc.) on existing buildings, which must be complete by January 1, 2025 in order to be compliant.

### 4.6.3 INFORMATION SOLUTIONS AND SYSTEM OPERATIONS

#### 4.6.3.1 HOW THE PLAN REFLECTS CUSTOMER NEEDS AND PREFERENCES

Similar to Fleet and Facilities and Real Estate, Information Solutions and System Operations investments are aligned with customers' preference that Hydro One should make "the necessary investments in general plant to meet the same standard as similar businesses rather than just make do and only invest to address the most urgent needs"[6]. In this regard, Hydro One is guided

[6] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 5

by planning principles to maximize the value of technology decisions, including to prioritize proven solutions that that are most likely to yield efficiencies and achieve business outcomes and, where possible, re-use existing assets before buying new or replacing (as discussed in GSP Section 4.7.3.3).

In addition to meeting Hydro One's technology needs from a business continuity perspective, Information Solutions prudently considers enhancements or new technologies that can help better serve customers. These investments result in an improved customer experience by providing customers with access to reliable customer service applications. Support for this kind of investment was found in the customer engagement results, specifically if they "help find efficiencies and reduce customer costs and help customers better manage their usage". [7]

Below are some examples of IT investments that help improve customer experience.

- **Online Self-Service Tool** (GSP Section 4.11, G-GP-07) - In addition to addressing the end of life rebuild of the core infrastructure of Hydro One's public facing websites and self-service portals, this investment introduces new capabilities such as auto-scaling services that ensure no slowness or downtime in critical periods of high usage (e.g., storms) and will enable Hydro One to lower its ongoing maintenance and service costs as a result of not having to manage and own its own infrastructure and hardware.
- **Customer Information Management** (GSP Section 4.11, G-GP-07) - Hydro One currently uses multiple separate customer relationship management (CRM) systems to manage the company's relationships with an individual customer. The use of multiple CRMs naturally increases the potential for customers to receive overlapping information and a higher-volume of discrete contacts from Hydro One. Consolidating these platforms will ensure that customer relationships are maintained and managed through in a central system, providing a higher quality customer experience and will help to lower transactional and support costs.

[7] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 16

- **Digitization of Services** (GSP Section 4.11, G-GP-07) – These investments focus on moving processes that serve customers from paper or human-based approaches into digital or self-service capabilities. This includes moving the contract management for generation customers from paper exchanges and manual handling to digital processes; investing in digitized billing for commercial and industrial customers to allow them to conduct billing-related transactions via self-service channels (such as a "*my*Account" style service as currently available to residential customers) or by email; and further digitizing customer communications over paper interactions.

OT investments also help improve customer experience by supporting the reliable supply of power to transmission and distribution customers. Some examples of these investments are provided below.

- **The Network Management System and the Distribution Management System** (GSP Section 4.11, G-GP-16 and G-GP-18, respectively) enable Hydro One to control and monitor the transmission and distribution power systems, respectively. The remote operation and control of the power system assets minimize the impacts of an emergency situation on customers.
- **Outage Response Management System (ORMS)** (GSP Section 4.11, G-GP-17) - This operating tool is used to analyze trouble calls made to Hydro One and to predict abnormal customer connectivity issues. ORMS is also used to identify and align work crews to respond to customer problems, by supporting the monitoring and tracking workflows as well as performance reporting. ORMS enables the timely detection and restoration of system outages through enhanced situational awareness and effective use of field resources. By enabling faster restorations, ORMS maintains reliability for customers.

In addition to the investments described above, Information Solutions contributes to a positive customer experience by enabling Hydro One's day-to-day operations in a reliable and safe manner. Hydro One's Transmission and Distribution work programs influence the composition and level of Information Solutions investments that are required to support work delivery by lines of business. By working collaboratively with lines of business, Information Solutions is able to effectively assess technology capability gaps, security concerns and performance issues and develop investments to address relevant risks, including to minimize interruptions to administrative functions that support customer services and operational functions that are critical to the reliable delivery of power.

### 4.6.3.2 HOW THE PLAN REFLECTS REGULATORY REQUIREMENTS AND POLICY

As described in the previous section, many Information Technology (IT) systems directly interact with customers or support the billing and customer service functions. Consequently, whenever any changes are made to the customer service requirements under the Transmission or Distribution System Codes, IT systems must work with the business to identify any systems impact and changes needed to meet the new requirements. These changes are then incorporated in Information Solution's plan and execution.

Similarly, as rates are updated and established by the OEB, Hydro One's IT systems must be flexible enough to promptly transition to the new rates and classes (as applicable). To effectively respond to these changes with minimal interruptions to customers, it is critical for the IT Systems to be kept up-to-date and supported by vendors. The plan appropriately reflects the importance of this need through its investments in upgrading the CIS Customer Billing and other customer service applications (GSP Section 4.11, G-GP-07 Customer Service Technology Enablement).

To ensure responsible and effective operations of the Transmission and Distribution Systems, Hydro One's Operating Technology (OT) assets must be compliant with relevant requirements, under the North American Electric Reliability Corporation (NERC) reliability standards and Hydro One's Operating Agreement with the Independent Electricity System Operator (IESO). This is accomplished through Hydro One's participation in NERC Working Groups, which provides visibility of changes or new standards that are being implemented and their respective timelines. As new requirements emerge, they are integrated into the existing fleet of tools.

As discussed in GSP Section 4.2, Information Solutions manages Hydro One's security assets to ensure compliance with NERC Critical Infrastructure Protection (CIP) standards and alignment with the *Ontario Cyber Security Framework* and National Institute of Standards and Technology's (NIST) *Cybersecurity Framework*. Hydro One's compliance to the above is reviewed internally on an annual basis. Adherence to the NIST Cybersecurity Framework is reviewed annually by an external third party. Compliance to the NERC CIP standards are monitored and enforced by the IESO through compliance updates and scheduled, detailed audits to both the existing standards and any new requirements as they emerge.

### 4.6.3.3 HOW THE PLAN REFLECTS SYSTEM MODERNIZATION

The Distribution System is in a transformational period in which it is leveraging technology to improve reliability, grid operations, and work program operations. Information Solutions and System Operations have become essential partners to the Distribution business to collaboratively address technological capability needs (see GSP Section 4.7.3.3 for further description on this process). Several examples of investments that support distribution system modernization are listed below.

- **Geographic Information System (GIS)** (GSP Section 4.11, G-GP-08) – GIS is an IT system that supports a growing number of distribution work programs such as Move to Mobile, cable locate outsourcing, field design and cost estimating tools, and the implementation of smart grid technology to modernize the distribution system. To effectively support these areas, Information Solutions continues to invest in upgrades to GIS that align with lifecycle management best practices.
- **Meter Inventory Management** (GSP Section 4.11, G-GP-06) – New technologies are planned to enable enhanced warehouse technology functionality such as: mobile receipting, a devise-agnostic inventory platform, and an upgrade to the current end of life radio-frequency gun technology used to receipt and deploy AMI equipment. These new solutions will allow for seamless receipt and deployment of AMI units. In addition, enhancements to field ordering, overall material management and field inventory control are expected to be achieved.
- **Mobile Work Management Tool** (GSP Section 4.11, G-GP-08) – Hydro One's distribution and forestry operations currently use a work execution system that is supported by SAP Work Manager, a comprehensive mobile application. These distribution systems continue

to evolve as Hydro One further integrates the system with regular work and trouble work activities, including the planned new AMI 2.0 technology, driving further efficiencies in field work and better response time, supporting Distribution's focus on customer reliability.

- **Distribution Management System (DMS)** (GSP Section 4.11, G-GP-18) – The DMS provides a platform for distribution supervisory, control and data acquisition (SCADA). DMS enables Hydro One to manage distributed energy resource and integrates a broad set of distribution modernization functions such as mobility solutions. DMS also allows for the optimization of electric loads, including energy storage, and generation sources. The upcoming DMS lifecycle refresh will introduce the ability to integrate existing data from other Hydro One databases such as AMI 2.0, protection and control management information system (PCMIS), GIS, and power systems data base (PSDB) with DMS. These are critical systems that funnel important data necessary for the modeling of the electric grid. This modeling is vital for making the DMS operational and to enable safe system control functions.

# SECTION 4.7 – GSP – INVESTMENT PLANNING PROCESS

## 4.7.1 OVERVIEW

SPF Section 1.7 describes the system planning framework that governs Hydro One's asset management and investment planning activities, representing a comprehensive and sophisticated process for managing the utility's extensive asset base and prudently identifying and prioritizing investments. The outcome of the process is a detailed, five year investment plan (consisting of the TSP, DSP and GSP) that prudently addresses system and asset needs in alignment with the Hydro One's strategic values and the customer service imperatives that are at the core of its business mandate. This process accounts for and strives to achieve outcomes that are consistent with those identified in the RRF and that reflects the specific outcomes (informed by customer engagement) as described in SPF Section 1.7.2.

This Section 4.7 supplements the evidence in SPF Section 1.7, providing further information on the considerations that apply in the context of managing Hydro One's general plant assets (i.e., Fleet, Facilities and Real Estate, Information Technology/Operating Technology, and Security) which are critical to the utility's operational continuity and the successful execution of a complex portfolio of transmission and distribution work programs. In particular, Section 4.7.3 below provides general plant-specific elements of the asset management process.

### 4.7.1.1 SYSTEM PLANNING PROCESS PHASES

Hydro One's system planning framework entails a robust and value-driven approach to assess system/asset-related risks and to address such risks through investments that align with the company's objectives and service obligations as well as customer needs and preferences. This process ensures a consistent understanding of risk by planners across the organization (in this case, in respect of a diverse array of general plant assets that are crucial to enabling the utility's core service mandate), so as to identify and optimize investment solutions that can cost-effectively address relevant risks and needs over the planning period.

The system planning framework includes three main components – Strategy and Context, Asset Management, and Investment Planning:

- Strategy and Context entails the consideration of the company's operating environment (with its asset, system and customer related priorities) and overall strategic direction.
- Asset Management consists of the current state assessment of asset condition (through ongoing monitoring and evaluation) and customer and system requirements, as well as the identification and scoping of investment candidates.
- Investment Planning allows Hydro One to identify, prioritize and optimize investments in a way that prudently balances the need to efficiently address asset and system risks with the need to reflect customer needs and preferences (including in relation to rate impact).

Each component is discussed in depth in SPF Section 1.7 and specific considerations for General Plant assets are highlighted below.

### 4.7.2 STRATEGY AND CONTEXT

As with the TSP and DSP, the formulation of the GSP is guided by Hydro One's strategic priorities, as presented in Figure 1 below.

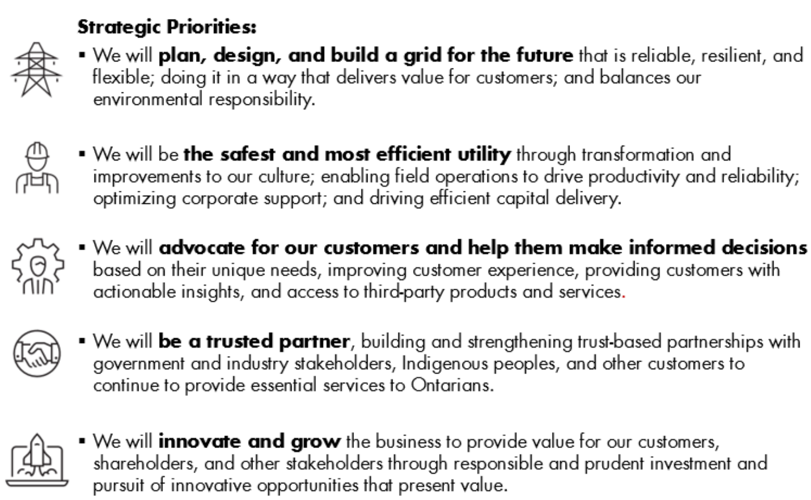


**Figure 1: Hydro One's Strategic Priorities**

Moreover, in managing assets that are critical to customers and Ontario's economy, Hydro One is committed to meet the RRF outcomes and has integrated them into its investment planning process. Figure 2 below demonstrates the close alignment of the outcomes that underpin the company's investment plan with the RRF outcomes. As demonstrated through various General Plant Investment Summary Documents (see GSP Section 4.11), each investment is developed with explicit consideration for how it will achieve outcomes in alignment with the RRF framework.

| **Renewed Regulatory Framework Performance Outcomes** | | **Plan Outcomes** |
|---|---|---|
| Customer Focus | Customer Satisfaction | • Improve current levels of customer satisfaction |
| | Customer Focus | • Engage with our customers consistently and proactively<br>• Deliver industry-leading customer service, in response to identified customer preferences |
| Operational Effectiveness | Cost Control | • Focus on continuous improvement to enhance efficiency, productivity, and reliability |
| | Safety | • Achieve top-tier safety performance and eliminate serious injuries |
| | Employee Engagement | • Achieve and maintain employee engagement |
| | System Reliability | • Maintain top tier Transmission reliability performance and improve long-term Transmission and Distribution reliability |
| Public Policy Responsiveness | Public Policy Responsiveness | • Deliver on obligations mandated by government through legislation and regulatory requirements |
| | Environment | • Lower Hydro One's environmental footprint through greenhouse gas reduction |
| Financial Performance | Financial Performance | • Responsible investment in rate base assets to ensure the safety and reliability of the grid<br>• Manageable and stable rate impacts over the course of the planning period |

**Figure 2: Alignment between RRF and Outcomes Underpinning the GSP**

Hydro One's planning context is in large part influenced by customer needs, preferences and priorities. To engage with customers consistently and proactively, Hydro One undertakes a spectrum of customer engagement activities. As described in SPF Section 1.6, these activities increase the company's understanding of customer needs and preferences so as to more effectively target outcomes that are valued by customers and plan/deliver work programs to achieve those outcomes.

While General Plant assets do not form part of the power system that convey electricity, GSP investments are nevertheless essential to the ongoing reliability, safety and resiliency of the power system and to the service experience and satisfaction of customers. As discussed in GSP Section 4.6, the GSP investments support the outcomes that customers care most about, by enabling the successful execution of the transmission and distribution work programs.

### 4.7.3 ASSET MANAGEMENT PROCESS

Through a methodical approach to asset management, Hydro One is able to effectively monitor its asset population (including General Plant assets), identify asset needs, and determine the optimal intervention (whether capital investments or maintenance) in relation to asset lifecycles. The below sections discuss the asset management approach related to each of Fleet, Facilities and Real Estate (F&RE), and Information Solutions and System Operations.

#### 4.7.3.1 FLEET

Hydro One Fleet Management Services manages its asset portfolio to ensure functional and reliable Transport and Work Equipment (TWE) is available for the company’s work programs and workforce. The objective is to enable work execution with minimal disruption due to TWE unavailability. In this regard, Fleet Management Services undertakes a multi-faceted approach to assess asset needs, including Estimated Service Life (ESL)-driven lifecycle analysis, condition verification, and operational requirements, to determine units for replacement. In addition, Fleet Management Services strives to optimize utilization and fleet size relative to work program demands (thus minimizing or deferring new acquisitions where feasible) and adopt technologies that entail operational and environmental benefits.

Fleet Management Services’ replacement strategy utilizes industry-standard guidance for lifecycle management optimization and expenditure planning, as well as ESL based on age and mileage (or engine hours, where applicable) to identify potential candidates for replacement. As third party expert input, the Utilimarc Fleet Lifecycle Study (see GSP Section 4.3, Attachment 2) determined the optimal age for asset replacement (to achieve the lowest annualised lifecycle cost based on historical data) and concluded that once an asset is past the recommended lifecycle age the maintenance costs will increase exponentially.[1] In addition, to verify that an identified candidate is indeed at end-of-life, Hydro One assesses the mechanical condition of potential replacement candidates based on findings of detailed mechanical inspections and/or a unit's inspection and maintenance history.

To ensure investments target priority needs and meet work requirements, Fleet Management Services further considers a unit's cost-per-kilometer, availability (i.e., downtime, repair time), potential safety risk to personnel, and the company's current and anticipated work requirements. The assessment of work requirements is a key input that drives the prioritization of TWE replacements. As part of this assessment, Fleet Management Services closely collaborates with other Line(s) of Business to ensure an up-to-date understanding of the types and volume of TWE assets they need, taking into account:

- Functionality of equipment – Work programs each have different needs that frequently require different equipment functionality (e.g., varying size of boom). The geographical location of work is also pertinent, including the need for specialized winterized equipment, access to boats, or access to areas that are remote or hard to reach.
- Equipment standards – As work methods evolve, it is critical for the lines of business to have access to TWE that enables them to safely conduct their work.
- Future requirements – Priority is given to fleet investments that support sustained, long-term work programs; one-off or short term initiatives can typically be addressed more economically through rentals.
- Staff and equipment complement – Investments in vehicles for full-time employees are prioritized over temporary staff. Short-term surges in equipment needs due to temporary staff can often be addressed through rentals.

[1] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3, Attachment 2

Other factors that drive investment decisions include:

- Technological improvements in the TWE industry and potential for electric vehicle (EV) adoption.
- Financial implications of replace vs. maintain – assets beyond their ESL have higher operating and maintenance costs. Those with higher incremental maintenance costs are typically prioritized over classes with smaller incremental maintenance costs.
- Procurement lead-time and availability – Specialized equipment can take much longer to procure and may not be available to lease or rent from a third party vendor.
- Equipment utilization – Through telematics technology, under-utilized equipment is identified and considered for other work or moved to another work area, as discussed immediately below.

Fleet Management Services works with other lines of business (including Distribution Lines, Forestry Operations, Transmission Lines, Stations Construction and Stations Services) to maximize equipment utilization and move under-utilized equipment or specialized equipment of limited availability around the province through scheduling and inter-line of business sharing. This is an important step that occurs prior to purchasing and, in some circumstances, may offset the need for new TWE assets. As illustrated in the 2019 Fleet Operations Benchmarking report (see GSP Section 4.3, Attachment 1), Hydro One leads comparators in terms of having the smallest proportion of low mileage vehicles as a percentage of overall fleet.[2]

To deliver value for Hydro One's business and its customers, Fleet Management Services performs further optimization by grouping investments into equipment categorization tranches and ranking each investment based on "financial opportunity", prioritizing investment candidates with higher expected operating cost offset. Additionally, Fleet Management Services conducts cost benefit analysis of rent vs. own options for repeated short term equipment needs**.**

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[2] Utilimarc, 2019 Fleet Operations Benchmarking Report (2020) – GSP Section, 4.3 Attachment 1, page 24

In addition to planned replacements, Hydro One performs preventive maintenance on all TWE assets as per manufacturer guidelines (as indicated in GSP Section 4.2.2). In the event of an unscheduled repair, decisions on whether to replace major components (e.g. engine) are made case by case based on the economic value of repair vs. replacement over the potential life of the asset.

Hydro One's EV strategy is to replace internal combustion engine vehicles where market conditions and availability allow. Hydro One's commercial fleet is beginning the gradual transition to low or zero emission technology, increasing the rate of EV spend from about 5% of the renewal forecast in 2021 to a target of 50% by 2030. Fleet Management Services will focus on replacing light class vehicles (primarily, SUVs) in the first years of the strategy. As options for EV or plug-in hybrid electric pickup trucks and work trucks mature and become available in the market, they will be incorporated into the replacement program where suitable for Hydro One work programs and geography. Fleet Management Services will continue to identify opportunities for EV use as the commercial segment of the EV market develops. Hydro One's service territory includes vast remote and rural areas. Accordingly, Fleet Management Services will focus on deploying EVs in urban areas where charging infrastructure is available and where sufficient density allows for charging infrastructure to be efficiently scaled up or supplemented by Hydro One charging stations.

#### 4.7.3.2 FACILITIES AND REAL ESTATE

Hydro One manages a complex and diverse portfolio of F&RE assets, consisting of operational facilities that house administrative and operations work centres and network buildings that house power grid assets. The asset management objective is to enable operational continuity and efficiencies through F&RE assets that meet the needs of various lines of business (each with varying requirements for facility size, configuration and functions), adequately protect high criticality electrical equipment, and ensure a safe and productive operating environment for employees and customers.

To achieve this objective, the F&RE team relies on a range of processes and inputs to establish asset needs and corresponding investments, including ongoing maintenance and inspections[3], Building Condition Assessments (BCAs)[4] to gather condition data, as well as coordinated reviews with other lines of business to identify facility-related requirements. In deciding the appropriate manner and scope of intervention, planners aim to sustain ongoing business functions being supported by F&RE assets and drive operational efficiencies. To maximize value to Hydro One customers, investments are developed through a strategic lens of the overall asset portfolio to avoid duplication, maximize utilization and minimize cost.

Hydro One's operational facilities and network buildings have been in service for about 60 years on average. While the refurbishment and renewal of these assets are never based on age alone, the fact is that many older buildings tend to contain deteriorated components and become under-sized or inadequately configured relative to current operational demands and occupancy standards. If not addressed, such issues can lead to elevated health, safety and security risks and inefficiencies (e.g., increasing maintenance/repair costs). As valuable means for accurately understanding these risks and the condition of underlying assets, regular inspections and detailed BCAs support data-driven intervention to maintain the overall health of F&RE assets (including through unplanned/urgent maintenance) while addressing poor condition assets via timely refurbishments or replacements. As part of the BCAs, the risk impact and probability relating to major building components are assessed, where the impact is based on the building's criticality to Hydro One's operations and probability is based on the likelihood of risks materializing (including health and safety risks, which are considered critical).

[3] As outlined in GSP Section 4.2.3, visual inspections are conducted at all facilities (with frequencies ranging from monthly or annual). Additional inspections maybe required after major events such as storms, fire, vandalism or other notable incidents.

[4] BCAs are detailed engineering assessments to determine replacement costs (to inform replacement decision relative to ongoing maintenance cost) and identify key projects to maintain the operations of the facility. Components covered include building structure, envelope, HVAC, plumbing, electrical, interior finishes, etc.

F&RE conducts regular operational assessments with various lines of business to confirm their facility requirements (including anticipated changes in building use). Each line of business is also assigned a prime contact to process facility-related requests/issues and ensure familiarity with current needs. This level of proactive assessment and close coordination equip the F&RE team with up-to-date information (e.g., the condition and maintenance/renewal requirements associated with major building components) to ensure appropriate allocation of capital funding. This information allows F&RE to maximize value by prioritizing work that addresses high criticality components or high impact risks in the short term and to plan future investments in a way that limits rate impact and address longer-term risks or requirements. Through BCAs, a detailed engineering review is then completed to verify facility condition and further validate the need for capital investments.

In accordance with Hydro One's strategic priority to be the safest utility (as presented in Figure 1 above), any significant health, safety and security risk identified at a facility, whether flagged by a line of business or through an inspection or BCA, is prioritized for timely investigation and resolution. In addition to physical safety, given its sizeable and multi-faceted workforce and work programs, Hydro One recognizes the value of a productive and inclusionary environment where people can work and engage with each other. F&RE assets play an essential role in enabling and fostering such an environment. An effectively integrated and high performing workforce is crucial to a modern utility like Hydro One and the successful delivery of a dynamic portfolio of work programs. In short, through prudent asset stewardship, including the proposed F&RE investments in this GSP, Hydro One will be able to minimize disruptions to work execution and service delivery and protect the safety of its employees and customers.

While not the primary basis of F&RE investment decisions, a number of external factors must be accounted for or considered in the F&RE asset management process, including:

- Regulatory Building Standards – Changes to construction and occupancy standards impact improvements of existing facilities as well as future work planning to properly serve occupancy objectives. Ongoing renovation or upgrades can increase in work or design scope as a result of such changes, impacting directly connected or complementary systems as well (e.g., air quality systems).

- Accessibility – Pursuant to the *Accessibility for Ontarians with Disability Act*, *2005*, Hydro One is required to upgrade certain buildings or site components (including parking spaces, ramp access, door widening, workstation layouts, washroom, elevators, wayfinding and tactile cues, etc.) or ensure compliance in new construction.
- Heritage Designated Buildings – Cultural heritage designations limit changes that can be made to buildings, often resulting in more stringent work standards and/or incremental work. While such designations are seldom directly applied to Hydro One buildings, the company has the added obligation as a named agency pursuant to the provincial Standards & Guidelines for Conservation of Provincial Heritage Properties. The Guidelines require assessment of buildings and structures and, where required, the development of plans for the protection for cultural heritage value.
- Environmental Regulations – Various environmental regulations affect the development or redevelopment of facilities. An example is the identification and management of designated substances (e.g. asbestos), which are common in buildings that are constructed pre-1985 and is present in approximately 35% of F&RE assets. Another example is the phase-out of PCB-containing light fixtures pursuant to federal regulations (as noted in GSP Section 4.6.2).
- Area Development Controls and/or Requirements – Development by-laws impact the siting and massing of facilities, site access, circulation and parking, connection to and provision of services, urban design/control, etc.

Based on the above-noted line of business requirements, condition assessments and external factors, F&RE develops potential projects to address known facility deficiencies and needs. Projects are grouped based on geographic area and the type of work involved (e.g., roof replacements, exterior wall upgrades, HVAC (heating, ventilation and air conditioning) replacements, site grading and paving, building upgrades, new build construction, etc.). A ranking system is used to establish an initial prioritization based on considerations related to asset condition, health and safety and operational requirements. In particular, projects that address end-of-life assets requiring prompt replacements or alleviate health and safety risks would be given a higher priority. In addition, certain facilities and supported functions are prioritized where urgent and/or critical operational impact is involved (e.g., security, grid reliability, environmental risks, and business continuity). The above-noted co-ordination between F&RE and other lines of business continues into the candidate investment development process, where the project list is reviewed with the line of business prime facility contacts and/or management team to ensure the proposed projects suit their requirements and reflect future anticipated changes. It's important to note that investment plans may need to be re-prioritized for urgent and emerging needs related to security, business continuity or health and safety. This is done by deferring lower priority planned work to future years and addressing the emerging urgent needs in year.

#### 4.7.3.3 INFORMATION SOLUTIONS AND SYSTEM OPERATIONS

As described in GSP Section 4.2.4, IT investments focus on technology to manage information, while OT investments focus on technology to allow Hydro One to monitor and control its transmission and distribution systems. Security investments aim to protect these technologies, along with Hydro One's transmission and distribution assets, from cyber, personnel and physical threats. Information Solutions is accountable for the information technology (IT) and security assets that enable Hydro One's Transmission and Distribution businesses to effectively perform day-to-day operations and meet customer service obligations. While Information Solutions looks after the implementation and execution of operating technology (OT) solutions, the planning function for OT systems is performed by Hydro One System Operations. The planning for OT systems is performed separately due to the specialized nature of OT investments, which are critical to the operation of the Bulk Electricity System.

Given Information Solutions' strategic direction to better align itself with the industry (as discussed in GSP Section 4.3.3), it is transforming to a new target operating model that will include delivering IT investments through a hybrid of waterfall and agile methodologies, with a focus on business enablement and faster and more cost-effective delivery of technology solutions.

As further discussed below, Investments made in each of the areas managed by Information Solutions and System Operations drive value for Hydro One and customers through the following:

- Enabling all lines of business to effectively perform work while driving efficiencies and desired business outcomes through the use of technology;
- Sustaining IT and OT assets by investing in and aligning technologies to support autonomous delivery of business value, ensure business continuity and optimize operations and project delivery; and
- Protecting the transmission and distribution systems and related assets/information through increased cyber, physical, and personnel security maturity with a focus on strong enterprise-level security governance.

In identifying investment solutions that enable Hydro One's lines of business to improve their operations through the effective use of technology, Information Solutions and System Operations considers the specific objectives and needs of the lines of business, assesses business capabilities gaps and opportunities, and develops business enabling initiatives to address gaps and enable business outcomes. To identify business/asset needs and candidate investments, the main considerations and activities include:

Technology Needs:

- Working with other lines of business to determine what technologies are required to achieve desired business objectives and capabilities, including in relation to operational efficiency and cost reduction, performance levels (such as delivery speed and response times), customer facing technology, safety initiatives, compliance with evolving regulatory requirements or industry standards, and improved data access and management to inform business decisions. In this regard, Information Solutions and System Operations are guided by a series of principles to drive prudent investments, including: focus on business value driven technology decisions, re-use of existing technologies before buy and/or replace, application of emerging technologies, minimizing customization, leveraging enterprise applications (e.g. SAP or GIS), maximizing ease of use, and minimizing duplicate data entry. Investments that drive higher value in the areas of cost savings and productivity are prioritized. Investments are further prioritized based on their expected business outcomes in response to relevant risk factors, including risk related to regulatory compliance, contractual commitments, potential design/delivery complexity, and the uncertainty around new and emerging technologies being considered.

- Identifying existing assets that require upgrade or maintenance based on lifecycle factors related to the ability to maintain operations and support the business. Factors considered include vendor warranty and support availability, costs of available support, hardware age, and overall system performance.

Strategic Alignment:

- Evaluating and adopting technology solutions that enable grid modernization and the development of a "grid of the future" in alignment with Hydro One's strategic objectives. For example, investments in Hydro One's Distribution Management System directly support grid modernization and allow "smart" power network devices designed for remote monitoring, operations and control to be leveraged for improved distribution reliability performance for end customers.
- Pursuing opportunities to decommission legacy systems that are no longer adequate or economical/feasible to maintain, and to rationalize and modernize IT assets where appropriate by moving towards industry standard commercial "off-the-shelf" solutions over customizations.

Candidate Investments:

- Grouping similar or overlapping needs from different lines of business to maximize the value of investments while minimizing potential duplication and costs.
- Examining candidate investments to optimize lifecycle management costs, maximize the utilization of existing systems, and leverage opportunities to provide additional value to the lines of business when upgrading applications that are near or at end of life.

In conjunction with addressing business capability gaps, Information Solutions and System Operations annually evaluates existing hardware and software assets to determine their health and capabilities. If the assets are approaching end of life (e.g., technological obsolescent or beyond vendor support) and can be linked to a specific improvement initiative, the upgrade and improvement of the asset will be incorporated into that initiative. The prioritization of these enabling investments is primarily based on the value added relative to costs. Through this approach, initiatives that improve capabilities to address multiple strategic priorities are typically prioritized.

If assets nearing their end of life cannot be linked to a business enabling initiative, a like-for-like upgrade will be planned to ensure the continuity of its supported business functions and the appropriate mitigation of cyber security vulnerabilities. Business continuity investments ensure that existing applications are able to function without posing undue risks that could disrupt day-to-day operations. Information Solutions and System Operations optimize these investments by considering the availability of vendor support, technological obsolescence, and the costs to upgrade or replace existing systems. As discussed in GSP Section 4.2.4, relying on end-of-life applications could result in deteriorated end user experience, escalation in support costs (assuming extended/custom vendor support is available), and the risk of interruptions to Hydro One's operations and customer service delivery. To reduce these risks, the balance of in-house technology and external services is also considered to optimize the cost vs. risk trade-off. In some cases, assets may also require upgrades prior to the end of their support period to address changes to regulatory requirements or emerging security risks.

Security investments are crucial to ensure the safe and effective operation of Hydro One's transmission and distribution system as well as IT and OT systems. Recognizing the value of integrated personnel, physical and cyber security programs, Hydro One has a unified security strategy to effectively and consistently manage the security risks that face its business and people. Hydro One's enterprise security program takes a pragmatic risk-based approach to identify investment needs, supported by investments that are aligned with the company's corporate strategy, enterprise risk tolerances and the prudent mitigation of relevant threats/risks. This approach ensures enterprise wide visibility and situational awareness regarding security-related risks, enabling a continuous feedback loop to improve the company's security culture and program.

Through investments in people, process and technology, the company strives to continually evolve and improve the maturity of its cyber, personnel and physical security programs, so as to maintain a robust security posture and ensure resilience to security risks across the organization. In addition, the evolving regulatory landscape – including the North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards, the Ontario Cybersecurity Framework, and industry best practices – also drive increased security-related awareness and obligations and corresponding enhancements to the security program.

### 4.7.4 INVESTMENT PLANNING PROCESS

Based on the General Plant investment candidates, Hydro One establishes a prioritized and optimized GSP through its investment planning. Investment candidates are assessed based on their benefits and contribution to desired outcomes and are calibrated to ensure a consistent view across the organization, as highlighted below and detailed in SPF Section 1.7**.**

GSP investment candidates are assessed through the lens of sustaining and enabling Hydro One Transmission and Distribution business operations. Notably, the contribution of candidates to business outcomes and efficiency (including to maximize opportunities in support of productive work delivery and realization of associated cost efficiencies) is an important consideration for many GSP investments. Further, customer and regulatory outcomes directly impact this process through "flags" that reflect priorities and investment benefits. In alignment with RRF outcomes and corporate priorities, flags are clearly defined to reflect either mandatory obligations (e.g., obligations to regulators, stakeholders or contractual counterparties) or non-mandatory priorities (e.g., customer preferences, productivity commitments). Once candidate investments have been assessed, enterprise-wide calibration sessions occur to ensure comparable and consistent evaluation (including approach, assumptions and quality of data) across investments and lines of business.

As another layer of planning rigor and validation, challenge sessions take place among a broad set of stakeholders to debate the feasibility and merits of investments on the margin and to ensure that valuable investments (from both a risk and non-risk perspective) are included in the plan. The output is an investment portfolio that is subject to enterprise engagement with portfolio owners and the executing lines of business, so as to create a realistic and up-to-date plan (i.e. reflecting the latest cost estimates, schedules and investment scope) and account for operational and execution considerations (e.g., resourcing, material availability and outage feasibility). The draft plan that results from this enterprise review then undergoes final internal review and forms the basis for Phase 2 of customer engagement.

Based on relevant planning inputs, including customer needs, independent expert studies, and latest project maturity/status information, Hydro One is able to establish the final investment plan that is presented to ELT and the Board of Directors for approval.

#### 4.7.4.1 INVESTMENT PLAN APPROVAL & DELIVERY

Following approval by the company's Board of Directors, the plan is reviewed throughout the execution phase as new information on asset condition and risks become available. Individual investments will be further reviewed and approved through the business case process before proceeding to work execution.

Hydro One closely tracks year-to-date expenditures and accomplishments as well as projected year-end expenditures. As changes to investments or other circumstances occur during the year, Hydro One deploys a rigorous redirection process, overseen by a Redirection Committee, to reprioritize work based on new information and impact on projects' expected value, timing, cost, customer benefits, etc. Plan adjustments are documented and communicated to relevant stakeholders. The ongoing comparison of actual investment costs and accomplishments to the proposed investment plan (including performance measures) is an important part of Hydro One's commitment to continuous improvement.

# SECTION 4.8 – GSP – CAPITAL EXPENDITURES – OVERVIEW

## 4.8.1 INTRODUCTION

This section introduces the GSP capital expenditure plan and provides a preliminary discussion of the material investments, which are presented under GSP Section 4.11. For the purposes of this Application, the GSP presents total expenditures for General Plant investments and the allocation of those expenditures to Hydro One Transmission and Distribution.[1] Accordingly, this section provides a comprehensive view of Hydro One's General Plant portfolio. OEB Distribution Chapter 2 Filing Requirements - Appendix 2-AB for General Plant investments is attached to this exhibit.

The GSP capital expenditure plan for the 2023-2027 forecast period is provided below in Table 1 and displayed in Figure 1.

**Table 1 - Planned net capital expenditures for General Plant by function from 2023-2027**

| General Plant Function | Forecast Period (Planned $M) | | | | |
|---|---|---|---|---|---|
| | 2023 | 2024 | 2025 | 2026 | 2027 |
| Fleet | 76.4 | 78.0 | 78.9 | 80.0 | 82.6 |
| Facilities & Real Estate | 91.4 | 92.1 | 61.7 | 58.1 | 50.5 |
| Information Solutions | 119.9 | 118.1 | 113.6 | 122.1 | 106.1 |
| System Operations | 27.4 | 18.5 | 8.2 | 8.0 | 6.5 |
| Other | 27.5 | 24.6 | 22.0 | 23.2 | 22.3 |
| **General Plant Total** | **342.7** | **331.4** | **284.3** | **291.4** | **268.0** |
| General Plant – Transmission Allocation | 146.8 | 124.0 | 114.2 | 115.9 | 105.0 |
| General Plant – Distribution Allocation | 195.9 | 207.4 | 170.1 | 175.5 | 162.9 |

[1] General Plant investments include capital expenditures that are either (i) shared between Transmission and Distribution; or (ii) are fully attributable to Transmission or Distribution and fall under the General Plant OEB investment category. For shared investments, the allocation between Transmission and Distribution is based on Black and Veatch's Shared Asset Allocation Study presented in Exhibit E-04-08 Attachment 1.

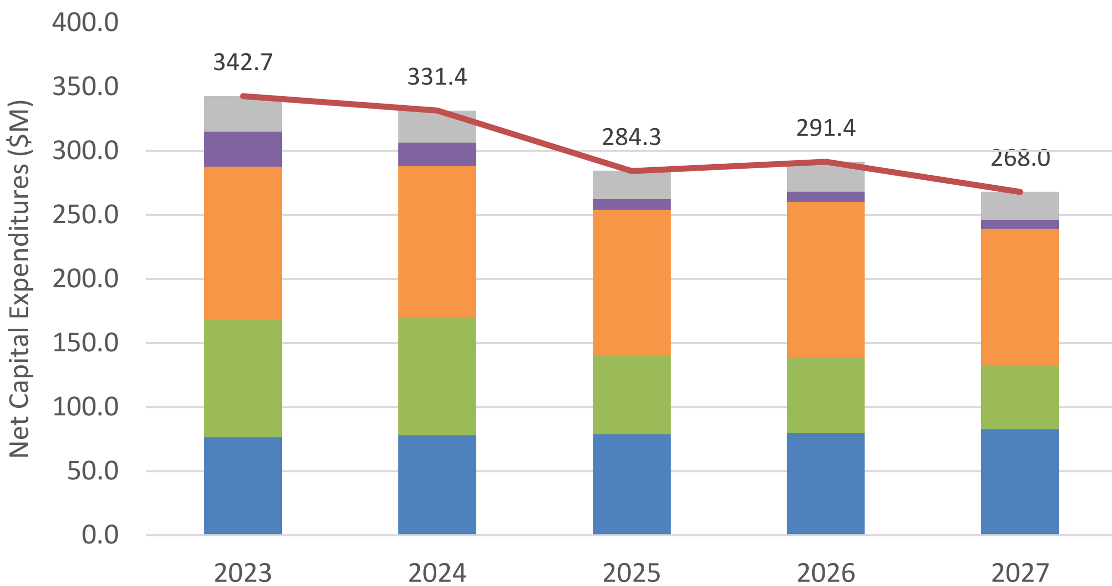


**Figure 1: Planned net capital expenditures for General Plant by function from 2023-2027**

The GSP includes $1,517.8M in General Plant investments, constituting 8% of Transmission capital expenditures and 17% of Distribution capital expenditures over the 2023-2027 period. Planned annual GSP capital expenditures range from $268.0M to $342.7M during the forecast period, with higher levels in 2023 and 2024. Year–to-year variations in total capital expenditures are mainly driven by the timing of investments of Facilities and Real Estate (F&RE) and System Operations.

The investments planned under the GSP are summarized below by function:

- **Fleet** – Planned fleet investments remain relatively steady during the forecast period, gradually increasing from $76.4M to $82.6M per year. This level of investment is required to minimize fleet lifecycle costs and equipment downtime. In turn, this allows Hydro One to optimize fleet equipment levels to meet work program demands and mitigate potential delays in response time to unplanned system interruptions, such as trouble calls and storm response. Details on the Fleet investments can be found in GSP Section 4.11, G-GP-01 and G-GP-02.

- **F&RE –** Planned investments in F&RE are just above $90M in 2023 and 2024, and then follow a decreasing trend from $61.7M in 2025 to $50.5M in 2027. The initial peak in the earlier forecast period is driven by projects to address end of life assets, consolidate facilities to manage lease expirations, and meet facility-related operational requirements of Hydro One's Transmission and Distribution businesses. The current sites are sub-optimal for operations due to overcrowding conditions, inefficient configurations, and disparate sites for field teams. The proposed investments seek to consolidate these facilities to increase efficiencies, provide room for growth, and reduce operational costs by terminating leases. Similar investments are planned in 2025 through 2027, but at a lesser volume. Throughout all test years, there are baseline investments of approximately $30M reserved for on-going sustainment program work to address end of life conditions, safety and security with facility grounds, exterior structures and elements, and building systems and accommodations. Details on the F&RE investments can be found in GSP Section 4.11, G-GP-03 and G-GP-04.
- **Information Solutions** – These investments range from $106.1M to $122.1M annually, with a focus on providing Hydro One lines of business with the technology required to complete their work and enable them to achieve the expected outcomes of their respective System Plans. These investments include:
    - upgrades to existing applications that are approaching their end of vendor support, such as foundational investments in Hydro One's SAP enterprise software that will allow for a gradual multi-year investment to migrate all of the SAP modules to the current S/4HANA platform (GSP Section 4.11, G-GP-06, G-GP-07 and G-GP-08), Geographic Information System (GIS) enterprise platform upgrades (GSP Section 4.11, G-GP-08), and refreshes to IT hardware and software to ensure lines of businesses have reliable access to technology to complete daily work (GSP Section 4.11, G-GP-05);

  - digital transformations of paper processes and automation of manual tasks to improve operational efficiencies and access and quality of data (GSP Section 4.11, G-GP-06 and G-GP-07);
  - updates to systems used by Transmission and Distribution planning, execution and field teams to improve efficiencies in work delivery and increase visibility of asset conditions and work plans across these lines of businesses (GSP Section 4.11, G-GP-08);
  - maintaining and, in some areas, improving Hydro One's security posture, such as upgrades to the cyber security equipment protecting the Operating Technology (OT) infrastructure and applications that monitor and control Hydro One's power system (GSP Section 4.11, G-GP-09); upgrades to the physical security protecting critical stations and facilities to reduce the risk of external threats (GSP Section 4.11, G-GP-10); and a refresh of Hydro One's security monitoring solution that is nearing its end of life and vendor support period (GSP Section 4.11, G-GP-11).
- **System Operations** – These investments decrease over the forecast period, starting from $27.4M in 2023 and decreasing to $6.5M in 2027. This trend reflects the upgrade of all critical systems applications that are or are nearing the end of vendor support, including the Network Management System, Outage Response Management System and Distribution Management System. Details on the System Operations investments can be found in GSP Section 4.11, G-GP-12 through G-GP-18.
- **Other General Plant** – These investments include the replacement of grid control equipment that are nearing their end of vendor support and capital contributions from Distribution to Transmission. These capital expenditures are relatively steady during the planning period, ranging from $22.0M to $27.5M annually. Investments in grid control are required to ensure compliance with IESO market rules and the capital contributions between Hydro One's Distribution and Transmission businesses are required as per the Transmission System Code. Details on the Other General Plant investments can be found in GSP Section 4.11, G-GP-19 through G-GP-22.

General Plant functions are indispensable in supporting Hydro One's business operations and delivering services to customers. The proposed investments are paced appropriately to help ensure that safe, reliable and functional General Plant assets are available to enable the Transmission and Distribution businesses to execute their work program and achieve their strategic objectives.

### 4.8.1.1 OUTCOMES

Hydro One seeks to achieve the following key Renewed Regulatory Framework (RRF) outcomes through the capital expenditure plan set out in this GSP:

- **Customer Focus -** General Plant investments play a critical, behind-the-scenes role in ensuring that Hydro One's Transmission and Distribution businesses are able to deliver safe and reliable energy and meet the needs and expectations of their customers. Fleet and F&RE ensure that the businesses have ready access to appropriate vehicles, equipment and infrastructure to run their day-to-day activities and respond promptly to outages and emergency situations. System Operations' investments provide critical control functions to manage Ontario's electricity grid and Information Solutions provides the underlying IT infrastructure and applications used to deliver and manage work programs and run Hydro One's corporate operations. These areas require investment to ensure Transmission and Distribution can effectively complete their work programs and in turn, provide customers with safe and reliable service (GSP Section 4.6 discusses how the GSP considers customer needs and preferences). This GSP also includes investments to replace and upgrade customer-facing technology that is nearing the end of vendor support, helping ensure that customers have reliable access to their accounts and other resources to help them make informed decisions. Examples include the Customer Information System (CIS), which allows Hydro One to manage the customer lifecycle (move-in, start service, meter, bill, collect payments and manage filed services) for all 1.4 million Distribution customers, and the online self-service tool (GSP Section 4.11, GP-07).
- **Operational Effectiveness** - In alignment with Hydro One's strategic priorities to enable the grid of the future and be the safest and most efficient utility, the GSP includes investments to help reliably operate, monitor and control the grid, and to continue to

provide safe and secure facilities for employees and critical grid infrastructure. For example, investments are planned to address critical OT applications such as the Network Management System (GSP Section 4.11, GP-16), Outage Response Management System (GSP Section 4.11, GP-17) and Distribution Management System (GSP Section 4.11, GP-18) that are approaching their end of vendor support and require upgrades to continue operating reliably. These applications provide real-time power system monitoring and control, and are vital not only for grid reliability but also for the safety of field staff and the protection and sustainment of Hydro One power system assets. General Plant investments also have a strong focus on continuous improvement in productivity and cost performance. This is demonstrated through its contributions to Hydro One's productivity achievements (as presented in SPF Section 1.4, Attachment 1). Through this GSP, Hydro One is maintaining its focus on continuous improvement through various initiatives, including:

  - Adjusting the fleet lifecycle replacement strategy to more closely align with third-party expert recommendations to reduce overall lifecycle costs (GSP Section 4.3.2 and GSP Section 4.11, G-GP-01);
  - Prudently consolidating facilities and real estate to provide field operations with adequate accommodations, address operational limitations/inefficiencies arising from sub-optimal facility configurations, and reduce operating costs such as leases (GSP Section 4.11, G-GP-03); and
  - Transitioning to a new target operating model for its Information Solutions Division, which provides sustained overall savings through a revised sourcing strategy (GSP Section 4.10.4).

- **Public Policy Responsiveness** - Hydro One's OT assets must be compliant with regulatory requirements relating to safe and effective system operations, including those set by the North American Electric Reliability Corporation (NERC), IESO, and the OEB's Transmission and Distribution System Codes. Likewise, Information Solutions manages Hydro One's security assets to ensure compliance with NERC Critical Infrastructure Protection (CIP) standards and alignment with the *Ontario Cyber Security Framework* and National Institute of Standards and Technology's *Cybersecurity Framework*. Hydro One's facilities are also responsive to changes in regulations and policies. For example, elements of existing facilities are being upgraded in response to the federal PCB (polychlorinated biphenyl) Regulations (SOR/2008-273), which impose requirements to protect the natural environment and health and safety of occupants and require the phase-out of certain equipment that contain PCB by 2025. In relation to F&RE assets, this necessitates the PCB Lighting Program to remove the PCB-containing light fixtures and components.

- **Financial Performance** - To maximize value to customers, General Plant investments are thoroughly assessed from a lifecycle cost perspective. Replacements are timed so as to minimize the overall cost of an asset, without jeopardizing its functionality, performance or reliability. For example, Hydro One is better aligning its fleet vehicle lifecycle replacement strategy to the assets' optimal life span to help control day-to-day operating costs while enabling field productivity through improved equipment availability. IT and OT investments are also carefully assessed to minimize overall costs, including by pursuing extended vendor support (where feasible), leveraging existing applications for additional business needs, and minimizing customization by investing in commercial-off-the-shelf applications.

#### 4.8.1.2 CUSTOMER ENGAGEMENT

To align with and achieve the RRF outcomes discussed above, Hydro One has established strategic priorities and objectives (as discussed in SPF Section 1.7.2) that set the context for and guide the implementation of the investment planning process. This process is underpinned by proactive customer engagement to understand their needs, preferences and priorities with respect to Hydro One's work to provide quality service that is focused on the safe, reliable, and cost effective delivery of electricity.

To support the preparation of its System Plans, Hydro One conducted an extensive customer engagement process, which informed the development of the System Plans in various respects as described in SPF Section 1.6. Two customer engagement findings relate specifically to General Plant:

1. "…a majority of customers support Hydro One making the necessary investments in general plant to meet the same standard as similar businesses rather than just make do and only invest to address the most urgent needs."[2]
2. Hydro One customers also identified "minimizing the impact on the environment" as a "very important" outcome.[3]

The GSP addresses the first finding by focusing on prudently managing the lifecycles of its assets and prioritizing critical facilities and applications. For example, instead of a break/fix approach, fleet asset replacements are prioritized based on asset condition and mileage. This helps ensure that reliable and functional assets are available to support work execution when and where needed. Similarly, F&RE prioritizes facilities that serve critical functions to minimize adverse impact on system reliability or disruptions to business operations and services delivered by Hydro One's business units to its customers.

IT and OT software applications are managed according to industry standard practices related to lifecycle management. A primary consideration is maintaining vendor support, so that the assets can be fixed and/or upgraded expeditiously in the event of malfunction or failure. Prudent lifecycle management helps to avoid:

- disruptions to critical systems that support or directly interact with customers;
- non-compliance with regulatory requirements;
- frequent and/or prolonged service outages that would directly impact the job performance and productivity of staff;
- increases in operating costs to support and service these applications internally; and
- cyber security risks if security patches were not available due to cessation of vendor support.

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[2] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 5
[3] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 15

On the second finding, the GSP helps reduce Hydro One's impact on the environment through long-term, sustainable greenhouse gas (GHG) reduction efforts. While GHG mitigation is not a driver of Hydro One's investments, the company looks for opportunities to prudently mitigate GHGs when identifying investments (refer to SPF Section 1.8.3 for more details on Hydro One's response to climate change). GSP investments that will contribute towards lower overall GHG emissions include:

- **Transport and Work Equipment renewal (G-GP-01)** – Hydro One's commercial fleet is beginning a gradual transition to low or zero emission technology, increasing the rate of electric vehicles from an estimate 5% of the renewal forecast in 2021 to 50% by 2030. Vehicles are replaced as needed to maintain an effective and efficient fleet, and the total cost of ownership of an electric vehicles versus conventional fuel-based has no significant incremental cost.
- **Facilities & Real Estate (G-GP-03)** – Hydro One is implementing energy savings initiatives at Operations and Service Centres, including installation of high-efficiency equipment (e.g., Heating, Ventilation, and Air Condition (HVAC) units, generators and lighting) and the Remote Command Centre program which monitors energy consumption remotely and allows Hydro One to take the appropriate actions required to minimize energy consumption. In addition to prudently addressing business needs, these investments have the added benefit of contributing to GHG emissions reductions.

Hydro One's capital expenditure plan was developed using Hydro One's ongoing process of assessing the condition of critical assets and enhanced investment planning process, which are detailed in SPF Section 1.7 and GSP Section 4.7. The proposed capital expenditure plan is detailed in the following sections for each functional segment under the GSP.

- 4.8.2 Fleet
- 4.8.3 Facilities and Real Estate
- 4.8.4 Information Solutions
- 4.8.5 System Operations
- 4.8.6 Other General Plant

## 4.8.2 FLEET

### 4.8.2.1 CAPITAL EXPENDITURE PLAN

For the 2023-2027 plan, the GSP includes $396.0M in Fleet investment, of which $133.8M is allocated to Transmission and $262.2M is allocated to Distribution. These costs are presented below in Table 2 by material investment.

**Table 2 - Fleet Material Investments for 2023-2027**

| ISD | Investment Name | Test Years (Planned $M) | | | | | Cost Allocation (Shared, Transmission, or Distribution) |
|---|---|---|---|---|---|---|---|
| | | 2023 | 2024 | 2025 | 2026 | 2027 | |
| G-GP-01 | Transport and Work Equipment | 67.2 | 68.7 | 69.3 | 70.4 | 72.8 | Shared |
| G-GP-02 | Helicopter Renewal | 9.2 | 9.4 | 9.6 | 9.6 | 9.8 | Shared |
| **Fleet Total** | | **76.4** | **78.0** | **78.9** | **80.0** | **82.6** | |
| Transmission Allocation | | 25.8 | 26.4 | 26.7 | 27.0 | 27.9 | |
| Distribution Allocation | | 50.6 | 51.7 | 52.2 | 53.0 | 54.7 | |

Fleet investments are broken out into two material investments – G-GP-01 Transport and Work Equipment (TWE) and G-GP-02 Helicopter Renewal, as described below.

G-GP-01 includes the 2023-2027 capital TWE replacement programs for light and heavy non-power take off (PTO) vehicles, heavy PTO vehicles, off-road vehicles, miscellaneous equipment for specific tasks, small off-road equipment, and service equipment. Each category of TWE is described below:

- **Light & Heavy Non-PTO** – Cars, SUVs, pickups, vans, (including electric vehicles) used by all Hydro One lines of business to transport tools and crews to work locations and to tow small trailers, highway tractors, used to tow large equipment and off-road units to and from job sites.
- **Heavy PTO** – Service trucks (including electric vehicles and EPTO), used to support and service off-road units and work locations, radial boom derricks, used to dig holes and to

set poles at road side and for heavy towing and bucket trucks, used to work at heights to complete line maintenance and tree trimming.

- **Off-Road** – Rubber tire and tracked equipment, used for building roads and right-of-ways, clearing brush, building/maintaining lines and act as personnel/material carriers.
- **Miscellaneous** – This category includes boats used to access isolated customers, chippers required for environmental cleanup as mandated by the Ministry of Environment, tensioners used for stringing projects, man-lifts used for working within a non-energized environment and by Fleet for working on elevated equipment/aerial devices, and forklifts required for loading/unloading material at various work sites.
- **Small Off-Road Equipment** – Equipment used to transport crew and materials to remote locations, including snowmobiles and utility task vehicles.
- **Service Equipment** – Minor fixed assets such as generators, compressor and other tools or equipment.

Over the 2023-2027 period, Hydro One will focus on replacing end of life equipment, while maximizing utilization of the existing fleet to ensure that lines of business have ready access to the equipment needed to complete their work programs. Hydro One plans to invest $348.5M between 2023 and 2027 to keep its 7,000 fleet vehicles and 1,000 small off-road units operating safely and reliably. Hydro One plans to increase investment in Fleet assets in order to contain overall lifecycle costs and excessive day-to-day maintenance and operational costs associated with an aging fleet. By replacing assets at their optimal lifespans, these investments will also allow Hydro One to protect public and employee safety and meet compliance obligations (e.g., under the *Highway Traffic Act*). Hydro One is not proposing to increase the size of its fleet during the JRAP period.

Hydro One has begun the transition to clean energy – in particular, fleet electrification. This shift is driven by various factors including maturing battery technology, increased driving range for electric vehicles (EVs), increased global awareness to climate change and GHG emissions, and improved economics based on total cost of ownership models for EVs versus internal combustion engine vehicles. Hydro One plans to begin a gradual EV adoption of light duty vehicles to minimize risks associated with rapid changes in EV technologies and infrastructure.

G-GP-02 sets out the 2023-2027 Helicopter Renewal program. Helicopters support many functions across Hydro One’s lines of business, including transporting workers and materials to remote locations, facilitating skywire and conductor replacement, supporting insulator change programs, pole delivery and pole-sets, and support for construction and the forestry management program. These aircraft are a vital tool during elevated operational postures such as storm response and restoration and are key to both Distribution and Transmission line patrols and are used extensively by the vegetation management program.

For 2023-2027, Hydro One plans to invest $47.5M in the Helicopter Renewal program to replace and standardized Hydro One’s helicopter fleet in order to meet the needs of the Transmission and Distribution lines of business and enhance the safety of flight operations. Six of Hydro One’s eight helicopter units are greater than twelve years old. Given that the expected service life of these helicopters is approximately fifteen years, most of the fleet will require replacement over the 2023-2027 period. The new generation of aircraft provides a range of improvements over the prior generation, including more powerful engines, flight data recorders, improved hydraulic flight control systems and crash resistant fuel tanks will offer enhanced safety margins for the pilots and other employees. Adding two new next- generation multi-engine helicopters will further enhance the safety profile during low level and low speed flight operations. Hydro One plans to replace one helicopter each year during the period.

#### 4.8.2.2 IMPACT OF CAPITAL INVESTMENTS ON OPERATIONS, MAINTENANCE AND ADMINISTRATION SPENDING

Planned capital investment in replacing end of life TWE will minimize escalations in maintenance costs (labour and parts) year over year and lead to increased equipment availability due to reduced breakdowns and maintenance requirements overall. In turn, this will mitigate potential delays in response time to unplanned customer incidents, such as trouble calls and storm response and optimal levels of availability of fleet vehicles and other specialized equipment to reduce manual labour and minimize risk of personal injury in the field.

A well-maintained fleet lowers day-to-day operating cost by reducing downtime and travel time. In addition, since new equipment is under warranty for the first three to five years, maintenance costs for a younger fleet are generally lower. The capital planned investments also allow for greater equipment efficiencies and reduce Hydro One’s environmental impact, as newer vehicles emit fewer greenhouse gas emissions due to more efficient vehicle mechanics and enhanced technology. However, these cost savings may be offset by external factors such as increasing costs in garage labour and parts in the automotive industry.

Capital investment for the helicopter fleet is a long-horizon event in that the service life of these aircraft can exceed 15 years. Increased operational capability coupled with longer engine overhaul cycles (i.e., longer time intervals between overhauls) drive cost efficiencies within helicopter services. These capabilities are married to a more capable platform with dual hydraulic controls, crash resistant fuel tanks, better tail rotor controllability and a greater lifting ability to better suit Hydro One’s operational needs for tasks such as pole setting. The first two years of each new aircraft are managed under warranty and also provide reductions by 7% in the costs of parts purchased from the manufacture, further reducing the operating costs of the helicopter fleet.

### 4.8.3 FACILITIES AND REAL ESTATE

#### 4.8.3.1 CAPITAL EXPENDITURE PLAN

Over the 2023-2027 period, the GSP includes F&RE investments of $353.7M, of which $101.3M is allocated to Transmission and $252.4M is allocated to Distribution. These costs are presented below in

Table 3 by material investment.

**Table 3 - F&RE Material Investments for 2023-2027**

| ISD | Investment Name | Test Years (Planned $M) | | | | | Cost Allocation (Shared, Transmission, or Distribution) |
|---|---|---|---|---|---|---|---|
| | | 2023 | 2024 | 2025 | 2026 | 2027 | |
| G-GP-03 | Facilities and Accommodations | 78.5 | 79.3 | 51.6 | 48.4 | 40.8 | Shared |
| G-GP-04 | Transmission Facilities | 12.9 | 12.8 | 10.1 | 9.6 | 9.7 | Transmission |
| **F&RE Total** | | **91.4** | **92.1** | **61.7** | **58.1** | **50.5** | |
| Transmission Allocation | | 26.0 | 24.9 | 17.5 | 18.2 | 14.8 | |
| Distribution Allocation | | 65.4 | 67.2 | 44.2 | 39.9 | 35.7 | |

F&RE investments are broken out into two material investments: G-GP-03 Facilities and Accommodations and G-GP-04 Transmission Facilities. Both programs include on-going sustainment investments at existing facilities and the construction of new facilities as needed. As shown in Table 3 above, investment levels in 2023 and 2024 are approximately $30M higher. This is mainly driven by new facilities, primarily for Orillia (Operation Centre and Warehouse) and Peterborough (Operation Centre and Fleet Maintenance Garage). As outlined in Section 4.2.3, Hydro One relies on a range of processes and inputs to establish asset needs and corresponding investments, including inspections (both regular and as required following major events such as storms, fire, vandalism or other notable incidents), issues identified during maintenance, Building Condition Assessments (BCAs) to gather condition data, and internal reviews with lines of business to identify facility-related operational requirements.

Ongoing sustainment investments, such as improvements and asset replacements are necessary to ensure facilities are kept in good working condition to meet line of business requirements, ensure business continuity and to minimize health and safety risks. These investments focus on prioritizing roof replacements, external wall upgrades, HVAC units and investments related to drainage and septic and other fundamental structural elements. Without necessary repairs, upgrades and replacements, facility conditions will continue to deteriorate and will not meet operational and regulatory requirements, while posing an increased risk to health and safety of our employees and security of our facilities. Through strategic and corrective investments, Hydro One expects to:

- enhance health and safety;
- lower maintenance costs;
- improve operational performance;
- maintain regulatory compliance;
- reduce risk of asset failure resulting in potential business disruptions; and
- provide facilities with the ability to adapt to accommodate operational requirements within the Line of Business known or anticipated changes to the business.

Planned F&RE investments also include new facilities that will benefit rate payers by minimizing total asset lifecycle costs. These investments are required as the current facilities are approaching end of life, where considerable investments are required to ensure their condition is suitable for operational needs. For example, the investments in Hanmer Work Centre and Rockford Operation Centre are a result of existing facility components in poor condition. In addition, the investments in Orillia, Peterborough, Timmins and Newmarket, will consolidate operations and allow Hydro One to eliminate the need for leased facilities in the above mentioned areas. Without these investments, the company’s operations will be less efficient and potential risks to health, safety and security of employees may develop. Hydro One selects the locations of new facility investments strategically to improve the distribution and performance of Hydro One’s facility portfolio (i.e., terminate leases, reduce operating costs, etc.) and optimally serve Hydro One customers and assets in the area.

Investments are determined through preventative maintenance and BCA results, in combination with the lines of business needs. Given the emerging risks that can affect the need for specific F&RE investments, Hydro One assesses and, as necessary, reprioritizes F&RE investments annually. For example, storms and other external events can cause or accelerate critical issues with facilities, requiring the company to re-prioritize work within these investments.

The proposed Facilities and Accommodation (G-GP-03) investments include expenditures to reduce environmental impacts and lower operating costs over the long-term. For example, the implementation of the Remote Command Centre pilot program will assist Hydro One to enhance our operational efficiency by monitoring real time energy consumption remotely and enabling F&RE to identify root cause of failures and expedite repairs. Hydro One also works to identify and implement efficiency initiatives within the capital plan. For example, F&RE supports Hydro One's planned transition to EV commercial fleet vehicles through the installation of EV Charger stations at Hydro One facilities determined by the rollout of EV locations, which will produce long-term benefit through reduced GHG emissions and operating costs.

The proposed investment plan for transmission facilities under G-GP-04 includes Hydro One's PCB Lighting Program, the goal of which is to remove light fixture and related components that contain PCBs. Under Federal PCB Regulations (SOR/2008-273), Hydro One must cease using light ballasts that contain PCBs by the end of 2025. In addition, both investment plans take into consideration the *Accessibility for Ontarians with Disabilities Act*, where Hydro One may be required to upgrade certain buildings or site components (i.e., including parking spaces, ramp access, door widening, workstation layouts, washroom, elevators, wayfinding and tactile cues, etc.) on existing buildings, which must be complete by January 1, 2025 in order to be compliant with the applicable regulations.

#### 4.8.3.2 IMPACT OF CAPITAL INVESTMENTS ON OPERATIONS, MAINTENANCE AND ADMINISTRATION SPENDING

The impacts of F&RE investments on OM&A costs vary depending on the specific investment. Replacements and upgrades of older assets and equipment often result in reductions in energy costs, as new installations are typically more energy efficient. Cost savings are also expected from new facilities consolidate sites. Hydro One expects that these consolidations may allow the company to forgo some lease costs and reduce maintenance, utilities and management fees as a result of the reduced number of buildings or sites. However, if an investment results in additional space or sites, OM&A costs may increase as a result of additional utilities, maintenance and building management fees.

### 4.8.4 INFORMATION SOLUTIONS

#### 4.8.4.1 CAPITAL EXPENDITURE PLAN

The 2023-2027 plan includes $579.9M of investments in Information Solutions, of which $228.6M is allocated to Transmission and $351.3M is allocated to Distribution. These costs are presented below in Table 4 by material investment.

**Table 4 - Information Solutions Material Investments for 2023-2027**

| ISD | Investment Name | Forecast Period (Planned $M) | | | | | Cost Allocation (Shared, Transmission, or Distribution) |
|---|---|---|---|---|---|---|---|
| | | 2023 | 2024 | 2025 | 2026 | 2027 | |
| G-GP-05 | Information Technology Services Enablement | 19.5 | 21.9 | 27.2 | 28.9 | 24.9 | Shared |
| G-GP-06 | Corporate Services Enablement | 24.4 | 18.1 | 18.3 | 16.9 | 16.6 | Shared |
| G-GP-07 | Customer Service Technology Enablement | 4.1 | 18.7 | 18.1 | 35.1 | 33.0 | Shared |
| G-GP-08 | Work and Asset Management Enablement | 37.3 | 42.0 | 36.1 | 22.8 | 16.7 | Shared |
| G-GP-09 | Operating Technology Cyber Security Equipment Replacement | 5.7 | 3.4 | 2.8 | 6.0 | 7.9 | Transmission |
| G-GP-10 | Physical Security Upgrades | 14.0 | 8.0 | 8.0 | 8.0 | 4.0 | Transmission |
| G-GP-11 | Security Monitoring | 6.5 | 4.0 | 1.0 | 1.0 | 1.0 | Shared |
| Other | Other Information Solutions | 8.4 | 2.0 | 2.0 | 3.5 | 2.0 | Shared |
| **Information Solutions Total** | | **119.9** | **118.1** | **113.6** | **122.1** | **106.1** | |
| Transmission Allocation | | 57.4 | 46.5 | 45.0 | 43.7 | 35.9 | |
| Distribution Allocation | | 62.5 | 71.6 | 68.5 | 78.5 | 70.2 | |

While each investment presented above has a unique scope to address specific concerns, there are several overarching themes that are seen across multiple investments. These themes are summarized below.

**Replacing and Upgrading Legacy Technology Systems**

To minimize overall lifecycle costs of assets, planners consider the trade-off between investing in new or upgraded technology versus the ongoing costs of continuing with assets near their end of vendor support. As equipment ages and reaches the end of vendor support, extended vendor warranties are required to maintain reliable performance. These extended warranties can significantly add to the overall lifecycle costs and in some cases, may not be a viable option from the vendor. This often results in replacement/upgrades being the best option in terms of cost, performance and functionality. Hydro One works to determine the best replacement alternative to address the desired business outcomes and technological capabilities, while minimizing overall costs to customers.

Hydro One considers a number of important and coincident factors that must be considered when determining whether an application should be upgraded or replaced. These include:

- maintaining vendor supportability and the availability of additional vendor supported versions (as detailed in GSP Section 4.2.4);
- age (lifecycle) of the existing application and the costs of maintaining aging systems;
- customer and lines of business technology functionality/capability requirements;
- legislative changes or market driven initiatives, including evolving security requirements;
- complexity, cost and duration of the upgrade process;
- potential impact to the business (e.g., tolerance for downtime);
- risk, dependencies and potential impacts to other upstream or downstream applications; and
- integration and interoperability with other applications.

Each of the material investments in Information Solutions includes expenditures to replace and upgrade of legacy technology.

**Enabling Lines of Business**

Information Solutions manages investments that enable Hydro One's lines of business to improve their operations through the effective use of technology. Information Solutions considers the Company's specific objectives and needs, assesses opportunities for improvement, identifies technology solutions, and develops business-enabling initiatives to address gaps and help achieve outcomes. These improvements are typically achieved through updates to legacy systems.

To develop solutions that effectively address business requirements, Hydro One considers the technology needs in terms of performance levels (such as delivery speed and response times), compliance with evolving regulatory/compliance requirements, industry standards, and improved data access and management. For example, investments in Work and Asset Management (G-GP-08) include the implementation of a Virtual Asset Inspection technology. This technology will allow Asset Management planners to effectively and efficiently identify necessary investments in the transmission and distribution systems using virtual tools. This innovative solution will help improve safety (monitoring and assessments will be performed by unmanned technologies, reducing the need for field visits), improve customer reliability by providing ready access to condition assessments, and provide cost savings by reducing the need for employee travel and inspections.

Whenever possible, similar or overlapping needs from different lines of business are grouped to maximize the value of investments and minimizing potential duplication of functionalities. In addition, Information Solutions seeks to incorporate opportunities to decommission legacy systems that are no longer adequate or economical/feasible to maintain, and foster rationalization and modernization of IT assets where appropriate by moving toward industry standard, commercial, off-the-shelf solutions instead of customizations. This helps improve the interconnectivity of Hydro One's data and applications, improving overall performance levels and data accessibility across all lines of business.

The material investments that focus on enabling lines of business, include:

- **G-GP-05 Information Technology Services Enablement** – Investments in new technologies enable Hydro One's data centre infrastructure, access to corporate data for enriched application use cases, and replace end of life technology to operate more effectively, efficiently, and to deliver improved outcomes for customers.
- **G-GP-06 Corporate Services Enablement** – These investments directly drive or enable corporate functions to complete their day-to-day activities and achieve business outcomes, including providing logistical improvements and data modernization and automation.
- **G-GP-07 Customer Service Technology Enablement** – These investments directly drive or enable essential customer services including the contact centre, online experiences for customers, as well as the back-office functions supporting billing, collections and settlements. These functions rely on being flexible to address service needs of customers,

including non-paper based transactions, as well as being supported and maintained for 24x7 availability.

- **G-GP-08 Work and Asset Management Enablement** – These investments provide Transmission and Distribution businesses with applications that directly support the planning and execution of their work programs.

**Protecting Hydro One's Assets and Systems**

Security investments are crucial to the safe and effective operation of Hydro One's Transmission and Distribution systems, as well as the Company's IT and OT systems. Hydro One employs a unified security strategy to effectively and consistently manage the security impacts of the physical and cyber risks.

Hydro One plans security investments using a pragmatic, risk-based approach (as discussed in GSP Section 4.7) to identify investment needs, supported by investment plans and work programs that are aligned with corporate priorities, enterprise risk tolerances and threats. This approach helps ensure enterprise-wide visibility and situational awareness on security-related risks, enabling a continuous feedback loop to improve the company's security culture and program.
Over the 2023-2027 period Hydro One plans to plans to invest in security technology, striving to maintain a robust security posture by continually evolve and improve the maturity of its cyber, personnel and physical security programs.[4] The planned investments will help ensure resilience to security risks across the Company and help Hydro One keep pace with evolving regulatory requirements, including the North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards and the Ontario Cybersecurity Framework.

Over the 2023-2027 period, Hydro One plans to make material investments in the systems and technologies that protect the company's personnel, physical assets and cyber assets, including:

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[4] A security posture refers to an organizations overall security strength and how well it can predict, prevent, and respond to ever-changing threats.

- **G-GP-09 OT Cyber Security Equipment** - involves the replacement of end of life cyber security equipment that protects the OT used to control and monitor Hydro One's Transmission system. This is required to ensure ongoing regulatory compliance, reliability and operational effectiveness of the systems controlling the Ontario transmission network and North American Bulk Electricity System.
- **G-GP-10 Physical Security Upgrades** – involves the replacement of existing end of life physical security technology systems (including access control, surveillance systems, security lighting, gates, intercoms, power supplies, alarms and other systems/technologies) and the installation of perimeter security monitoring systems at critical transmission stations in order to mitigate physical security incidents and risks to transmission system reliability and resiliency, and public safety.
- **G-GP-11 Security Monitoring** – replaces and updates end of life security monitoring hardware and software systems that Hydro One uses to monitor both cyber-security and physical security systems across the company. In addition, it establishes a back-up security operations centre, in order to provide redundancy and continuation of operations, and disaster recovery if the company's primary monitoring facility is unavailable or damaged.

#### 4.8.4.2 IMPACT OF CAPITAL INVESTMENTS ON OPERATIONS, MAINTENANCE AND ADMINISTRATION SPENDING

Capital investments in Information Solutions can affect OM&A costs in several ways, but overall these investments help Hydro One avoid increases to OM&A spending. For example, investments in technology upgrades and enhancements may be needed to maintain vendor supported versions of the hardware and software. At the same time, these investments help avoid OM&A increases and prevent Hydro One from costly extended support to ensure required system reliability and service levels are met. Some capital expenditures may also help lower OM&A costs, such as the implementation of new technology to replace legacy systems, where the overall run costs are reduced. One example of this relationship are the investments that Hydro One made in 2020 to improve the Company's overall voice data architecture, resulting in annual telecom charge reductions by $1.2M (see Exhibit E-04-04, Section 2.2.3 for details on Voice and Data Services).

Typically when new technology or systems are deployed, there is often an associated increase in OM&A for any required licensing and maintenance support (i.e. third party contracts), and sustainment support. However, new technologies can enable cost savings for another line of business and result in no net OM&A increase to Hydro One. Information solutions continues to seek opportunities to rationalize applications, replacing older costly systems with lower cost technologies, and continues to negotiate reduced third party contract costs for licenses and maintenance.

### 4.8.5 SYSTEM OPERATIONS

#### 4.8.5.1 CAPITAL EXPENDITURE PLAN

Over the 2023-2027 period, Hydro One plans to invest $68.6M in System Operations, of which $28.9M is allocated to Transmission and $39.7M is allocated to Distribution. These costs are presented below in Table 5 by material investment.

**Table 5 - System Operations Material Investments for 2023-2027**

| ISD | Investment Name | Forecast Period (Planned $M) | | | | | Cost Allocation (Shared, Transmission, or Distribution) |
|---|---|---|---|---|---|---|---|
| | | 2023 | 2024 | 2025 | 2026 | 2027 | |
| G-GP-12 | Common Operating Technology Infrastructure | 8.0 | 7.0 | 5.0 | 5.5 | 4.0 | Shared |
| G-GP-13 | Operating Technology Facilities Sustainment | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | Shared |
| G-GP-14 | Integrated Voice Communication Technology Refresh | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | Shared |
| G-GP-15 | BU-OGCC Office Remediation | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | Shared |
| G-GP-16 | Network Management System Investments | 7.6 | 0.0 | 1.2 | 2.5 | 2.5 | Transmission |
| G-GP-17 | Outage Response Management System Upgrade | 5.5 | 5.5 | 0.0 | 0.0 | 0.0 | Distribution |
| G-GP-18 | Distribution Management System Upgrade | 4.0 | 4.0 | 0.0 | 0.0 | 0.0 | Distribution |
| **System Operations Total** | | **27.4** | **18.5** | **8.2** | **8.0** | **6.5** | |
| Transmission Allocation | | 12.0 | 3.8 | 4.2 | 4.8 | 4.2 | |
| Distribution Allocation | | 15.4 | 14.7 | 4.0 | 3.2 | 2.3 | |

The planned System Operations investments are divided between shared investments, the costs of which are divided between the Transmission and Distribution lines of business and discrete investments that are entirely allocated to the transmission and distribution lines of business.

The shared System Operations investments are:

- **G-GP-12 Common Operating Technology Infrastructure** – This investment involves the planned replacement of the Common Operation Technology Infrastructure (COTI), which is relied on by critical network operating systems to facilitate the key applications used for monitoring and control of the Bulk Electric System (BES). These replacements are needed for lifecycle management of the COTI to ensure continued vendor support and for ensuring compliance with cyber security requirements. A secure and vendor-supported COTI is crucial to maintaining current reliability, cyber security requirements and service levels of mission critical applications (including the Network Outage Management System and Network Management System). These applications and devices are indispensable to 24/7 system operations through the control room.

- **G-GP-13 Operating Technology Facilities Sustainment** – This investment is required to manage the structures and equipment that house and support the operating technology facilities at the Integrated System Operating Centre (ISOC) and the Backup Ontario Grid Control Centre (BU-OGCC). The planned investments in operating information technology facilities include: HVAC systems, Uninterrupted Power Supplies (UPS) units, UPS batteries, standby generators, connectivity and networking.
- **G-GP-14 Integrated Voice Communication Technology Refresh** – This investment is necessary to maintain support and reliability of Hydro One's Integrated Voice Communication Technology, which is a critical operations tool that provides voice communication management between the control centre, the IESO, Hydro One field staff, connected customers, and emergency services. These investments are also needed to ensure the system is able to recover in the event that a failure occurs.
- **G-GP-15 BU-OGCC Office Remediation** – This investment remediates facility needs at the BU-OGCC. As a critical facility, the BU-OGCC is integral to efficient and safe management of the electric grid in Ontario. The primary triggers for this investment are regulatory compliance for the Hydro One control function and mitigation of health and safety risks.

Discrete Transmission and Distribution System Operations investments are also required during the 2023-2027 period to address OT applications that are approaching the end of vendor support. To ensure the continued monitoring and control abilities on the electrical power system, upgrades are planned for the following systems:

- **G-GP-16 Network Management System (NMS) Investments** (fully allocated to Transmission) – The NMS controls switching operations and alarm monitoring at Hydro One's control centres (the ISOC and BU-OGCC). The NMS links 380,000 communication points on equipment located throughout the province to control operations at ISOC and the BU-OGCC. These links are vital for the safe monitoring and controlling of the electrical power system in Ontario. The current NMS application software, server hardware and operating system are forecast to be beyond vendor support by 2023. Hydro One must upgrade NMS components before they reach the end of vendor support. This upgrade is necessary to maintain required levels of NMS performance, reliability, availability and regulatory compliance. The expenditures in 2023 represent the final phase of the upgrade that was approved in the previous Transmission rate application.
- **G-GP-17 Outage Response Management System (ORMS) Upgrade** (fully allocated to Distribution) - Hydro One uses the ORMS to respond to outages on the distribution system. The system analyzes and groups trouble calls, predicts common upstream devices in an abnormal condition, identifies crews, tracks the work flow of the crews and provides the data for performance reporting (e.g., emergency response SLA as per Distribution System Code). It is also a key tool in the interface with Hydro One's distribution customers, allowing customers to receive more precise information regarding outages, including the problem type and estimated restoration times.
- **G-GP-18 Distribution Management System (DMS) Upgrade** (fully allocated to Distribution) – The DMS monitors and controls the distribution system. It provides a platform for the supervisory, control and data acquisition system that Hydro One uses to remotely monitor and operate critical distribution assets. It also provides a set of advanced applications that enable proactive management of the distribution system (such as fault location).

#### 4.8.5.2 IMPACT OF CAPITAL INVESTMENTS ON OPERATIONS, MAINTENANCE AND ADMINISTRATION SPENDING

Hydro One does not expect that planned System Operations investments will have a material impact on OM&A expenditures due to the direct relationship between these investments and ongoing software license costs, and the mitigation of potential OM&A increases that could result from deferral of System Operations investments. A substantial component of System Operations OM&A is driven by software license fees and labour cost, which are directly related to the sustainment of applications that are critical for monitoring and controlling the grid. Cyber security patching and updates are also included in OM&A cost. Generally, capital investments in Grid Operations and Control Facilities expenditures are mutually exclusive of OM&A, except in cases where vendor support will be needed for deferred capital investment. Additionally, the deferral of capital investment can increase OM&A cost, since deteriorated systems can break down, requiring emergency repairs and delaying restoration. These OM&A impacts can be significant depending on the breakdown event. The planned investments will reduce the risk of these costly events, but are not expected to reduce OM&A costs overall.

### 4.8.6 OTHER GENERAL PLANT

Other material investments that fall under the General Plant OEB Category are provided below in Table 6.

**Table 6 - Other General Plant Investments**

| ISD | Investment Name | Forecast Period (Planned $M) | | | | | Cost Allocation (Shared, Transmission, or Distribution) |
|---|---|---|---|---|---|---|---|
| | | 2023 | 2024 | 2025 | 2026 | 2027 | |
| G-GP-19 | Grid Control Network Sustainment | 6.5 | 6.6 | 6.8 | 7.0 | 7.1 | Transmission |
| G-GP-20 | Transmission Non-Operational Data Management System | 5.5 | 1.1 | 0.0 | 0.0 | 0.0 | Transmission |
| G-GP-21 | Remote Terminal Unit Replacement Program | 7.7 | 7.9 | 8.0 | 8.2 | 8.3 | Transmission |
| G-GP-22 | Hydro One Distribution Capital Contribution to Hydro One Transmission | 2.0 | 2.2 | 1.1 | 1.0 | 0.0 | Distribution |
| Other | Investments Below Materiality | 5.8 | 6.8 | 6.1 | 7.0 | 6.8 | Transmission |
| **Other Total** | | **27.5** | **24.6** | **22.0** | **23.2** | **22.3** | |
| Transmission Allocation | | 25.5 | 22.4 | 20.9 | 22.2 | 22.3 | |
| Distribution Allocation | | 2.0 | 2.2 | 1.1 | 1.0 | 0.0 | |

These investments consist of two main groups: (1) operating infrastructure investments, and (2) capital contributions from Hydro One Distribution to Hydro One Transmission.

- **Operating Infrastructure (fully allocated to Transmission)** – These are investments in assets that oversee the Grid Control Network and other Transmission automation assets, such as Remote Terminal Units. For the 2023-2027 test years, Hydro One is planning to spend $113.3M at a relatively steady pace of approximately $23M per year. Additional information on these investments can be found under the following investment summary documents: G-GP-19, G-GP-20 and G-GP-21.
- **Capital Contributions from Hydro One Distribution to Hydro One Transmission (fully allocated to Distribution)** – These investments are non-discretionary capital contributions to Hydro One Transmission for transmission system network upgrades to accommodate forecast distribution customer load growth and to improve reliability in the affected regions. For the 2023-2027 test years, Hydro One Distribution plans to contribute $6.3M to Hydro One Transmission, as discussed in G-GP-22.

### 4.8.7 ATTACHMENTS

The following appendices are provided as part of this section:

- Attachment 1: OEB Distribution Chapter 2 Filing Requirements - Appendix 2-AB

## Appendix 2-AB
## Table 2 - Capital Expenditure Summary from Chapter 5 Consolidated Distribution System Plan Filing Requirements

**First year of Forecast Period:** *2023*

| CATEGORY | Historical Period (previous plan and actual/forecast) | | | | | | | | | | | | Bridge | | | Forecast Period (planned) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2018 | | | 2019 | | | 2020 | | | 2021 | | | 2022 | | | 2023 | 2024 | 2025 | 2026 | 2027 |
| | Plan | Actual | Var | Plan | Actual | Var | Plan | Actual | Var | Plan | Forecast[1] | Var | Plan | Forecast[2] | Var | | | | | |
| | | | % | | | % | | | % | | | % | | | % | | | | | |
| General Plant Allocated to Transmission | 119.7 | 83.6 | -30% | NA | 92.1 | NA | 111.1 | 124.7 | 12% | 94.4 | 137.8 | 46% | 94.7 | 102.8 | 9% | 146.8 | 124.0 | 114.2 | 115.9 | 105.0 |
| General Plant Allocated to Distribution | 90.7 | 90.7 | 0% | 142.8 | 114.3 | -20% | 150.3 | 178.2 | 19% | 95.3 | 173.8 | 82% | 100.4 | 105.7 | 5% | 195.9 | 207.4 | 170.1 | 175.5 | 162.9 |
| **Total General Plant** | NA | 174.3 | | NA | 206.4 | | NA | 302.9 | | NA | 311.7 | | NA | 208.5 | | 342.7 | 331.4 | 284.3 | 291.4 | 268.0 |

**Notes to the Table:**
1. 2021 data is based on a 12-month forecast
2. 2022 data is based on a 12-month forecast

| **Explanatory Notes on Variances (complete only if applicable)** |
|---|
| **Notes on shifts in forecast vs. historical budgets by category** |
| For a more detailed explanation of shifts in forecast vs historical expenditures, please see GSP Section 4.9 Capital Expenditures - Trends and Variances |
| **Notes on year over year Plan vs. Actual variances for Total Expenditures** |
| For a more detailed explanation of shifts in forecast vs historical expenditures, please see GSP Section 4.9 Capital Expenditures - Trends and Variances, and GSP Section 4.9 Attachment 2 General Plant Capital Performance Report |
| **Notes on Plan vs. Actual variance trends for individual expenditure categories** |
| For a more detailed explanation of shifts in forecast vs historical expenditures, please see GSP Section 4.9 Capital Expenditures - Trends and Variances, and GSP Section 4.9 Attachment 2 General Plant Capital Performance Report |

# SECTION 4.9 – GSP – CAPITAL EXPENDITURES – TRENDS AND VARIANCES

## 4.9.1 INTRODUCTION

This exhibit provides an overview of the trends and variances between the 2023-2027 investment levels presented in the GSP, historical actual/forecast investment levels, and the planned amounts based on the OEB approved amounts in the Rate Order from previous Transmission and Distribution Applications. It is organized into two parts: Section 4.9.2 discusses historic variances between planned and actual/forecasted investment levels for historic and bridge years, while Section 4.9.3 focuses on investment trends between historical actual/forecast expenditure levels and the 2023-2027 plan. This exhibit is also accompanied by two attachments for General Plant investments: OEB Distribution Chapter 2 Filing Requirements Appendix 2-AA and the Capital Performance Report for General Plant investments for Transmission in 2020 and Distribution in 2019 and 2020.

## 4.9.2 HISTORICAL CAPITAL EXPENDITURES VARIANCES

Given the separate Transmission and Distribution Applications in prior years, the previous OEB approval envelopes differ between the two businesses due to evolving plans and the time elapsed between the separate filings. Therefore, any historical comparisons to the plan amounts are kept separate for Hydro One Transmission and Distribution.[1]

### 4.9.2.1 TRANSMISSION ALLOCATED HISTORICAL CAPITAL EXPENDITURES

The comparison of historical and bridge actual/forecast capital expenditures to the plan at the time of the most recent Transmission Rate Order is provided in Table 1.

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[1] Historical OEB approval on general plant has occurred on overlapping rate filings. Each of these filings use different underlying business plans based on the timing of the prior applications. The following applications are the sources of the referenced OEB Approved amounts: EB-2019-0082 (Transmission, 2020-2022) and EB-2017-0049 (Distribution, 2018-2022).

**Table 1 - Comparison of Transmission General Plant Historical and Bridge Year Capital Expenditures to Plan**

| General Plant Function | Historical | | | | | | | | | | | | Bridge | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2018 | | | 2019 | | | 2020 | | | 2021 | | | 2022 | | |
| | Plan | Actual | Variance | Plan | Actual | Variance | Plan | Actual | Variance | Plan | Forecast | Variance | Plan | Forecast | Variance |
| | $M | $M | % | $M | $M | % | $M | $M | % | $M | $M | % | $M | $M | % |
| Fleet | 16.6 | 9.3 | -44% | - | 15.0 | - | 15.8 | 13.5 | -14% | 15.1 | 14.4 | -5% | 15.1 | 14.9 | -1% |
| Facilities & Real Estate | 31.3 | 23.4 | -25% | - | 16.0 | - | 17.5 | 19.7 | 12% | 14.5 | 15.4 | 6% | 17.7 | 15.5 | -13% |
| Information Solutions | 28.9 | 42.0 | 46% | - | 47.1 | - | 25.7 | 42.2 | 65% | 18.3 | 30.1 | 65% | 16.1 | 29.1 | 80% |
| System Operations | 29.1 | 3.8 | -87% | - | 6.0 | - | 40.9 | 38.8 | -5% | 34.7 | 59.0 | 70% | 33.7 | 21.8 | -35% |
| Other | 13.8 | 5.1 | -63% | - | 8.0 | - | 11.2 | 10.5 | -7% | 11.9 | 18.9 | 59% | 12.0 | 21.5 | 80% |
| **Total Allocated to Transmission** | **119.7** | **83.6** | **-30%** | - | **92.1** | - | **111.1** | **124.7** | **12%** | **94.4** | **137.8** | **46%** | **94.7** | **102.8** | **9%** |

Hydro One is forecasting to spend $365.3M on Transmission allocated General Plant between 2020 and 2022, which is 22% ($65.2M) above the OEB approved General Plant envelope of $300.2M. This variance is mainly driven by necessary incremental investments in Information Solutions, such as the HR Pay Transformation Project, which is a foundational investment modernizing Hydro One's HR capabilities, and is a prerequisite prior to Hydro One's transition to the new SAP S/4HANA platform, and "Other" investments in operating infrastructure such as Grid Control Network and RTU Replacement in 2021 and 2022.

The most significant variances for each General Plant function are listed below:

- **Fleet** – The 2020 negative 14% (-$2.3M) variance is primarily driven by redirection of funds to address incremental investments in Information Solutions. The 2021 and 2022 forecasted levels are aligned with the plan.
- **Facilities and Real Estate (F&RE)** – The 12% ($2.2M) variance in 2020 is mainly due to the reprioritization of roofing work at critical transmission stations including Brockville TS, Frontenac TS, Cataraqui TS and Lennox TS, and the requirement for a modular trailer at Oro Operation Centre to provide much needed space to address the lines of business operational needs. For 2021, the forecasted spend is relatively aligned with the plan, and in 2022, the negative variance of 13% (-$2.2M) is driven by the deferral of multi-year new build projects into future years, such as the Orillia Warehouse, to reprioritize investments within the General Plant envelope.
- **Information Solutions** – The actual/forecast capital expenditures between 2020 and 2022 exceed plan by 65% to 80% ($16.5M, $11.8M, and $13.0M above plan for 2020, 2021, and 2022, respectively). This is primarily due to reprioritization of IT investments to ensure vendor support, security and reliability of critical systems. Variances are due to a combination of project scheduling and scope changes during detailed design and execution. Project variances include:
    - The Private Cloud Data Center project delivered a simplified, automated and virtualized data centre. This project was required to replace end of life hardware that was on extended vendor support, and migrate over 160 business

applications to a new virtualized network. This new virtualized network provides enhanced security, improved disaster recovery capabilities to support continuous business operations, and a uniform technology platform which simplifies processes and procedures to operate and maintain the network. This networking approach allows increased agility in meeting customer and business needs. The costs of the investment were reflected in Hydro One’s last distribution filing (EB-2017-0049) but only partially reflected in the most recent transmission rates application. The project expenditures were scheduled to occur mostly in 2018 and 2019, with only project closure costs originally reflected in the previous transmission filing for 2020 (EB-2019-0082). Due to the scheduling of dependent projects and detailed design work for the 160 application migrations, more elements of the project were executed in 2020, resulting in greater transmission-allocated expenditures than originally forecast in that year.

- The Enterprise Technology Enhancement project resulted in spend in 2020 that was not captured in previous rate filings. This project involved refactoring (re-writing application codes so they work with new systems) a number of legacy interfaces and applications that connected with Hydro One’s critical middleware, iHUB. This investment was not originally captured, but deemed necessary as a result of the detailed design and testing of a previously completed project to upgrade iHUB. Detailed designs during the iHUB upgrade revealed a number of older interfaces requiring refactoring in order to be migrated from the legacy environment to the new iHUB solution. This investment was done in order to decommission the legacy iHUB system and avoid unnecessary sustainment costs.
- The HR Payroll Transformation project is currently in its execution phase and is forecasted to be complete in 2022. This investment will help automate time reporting processes and result in overall time savings for Hydro One, as employees will have more time to focus on core work over administrative activities. It also enables greater employee pay accuracy, and a reduction of overpayments and the costs to correct them. While the costs included in the prior

transmission application (EB-2019-0082) were based on initial planning estimations, the cost-benefit analysis performed during the design phase indicted additional effort was required for crucial retrofitting on existing systems. Accordingly, Hydro One extended the timeline for the project to align with the revised complexity and scale of the work.

- **System Operations** – The 70% ($24.4M) variance in 2021 is primarily due to the shift in construction schedule for the Integrated System Operating Centre (ISOC) from historic years to 2021. The 2022 forecast is 35% ($11.9M) below plan due to reprioritization within the General Plant envelope.
- **Other General Plant** – The 2021 and 2022 variances of 59% ($7.0M) and 80% ($9.6M) are driven by in-year increases in Grid Control Network and Remote Terminal Unit (RTU) replacements to address end of life assets.

### 4.9.2.2 DISTRIBUTION ALLOCATED HISTORICAL CAPITAL EXPENDITURES

The comparison of historical and bridge actual/forecast capital expenditures to the plan at the time of the most recent Distribution Rate Order is provided in Table 2.

**Table 2 - Comparison of Distribution General Plant historical and bridge year capital expenditures to plan**

| General Plant Function | Historical | | | | | | | | | | | | Bridge | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2018[2] | | | 2019 | | | 2020 | | | 2021 | | | 2022 | | |
| | Plan | Actual | Variance | Plan | Actual | Variance | Plan | Actual | Variance | Plan | Forecast | Variance | Plan | Forecast | Variance |
| | $M | $M | % | $M | $M | % | $M | $M | % | $M | $M | % | $M | $M | % |
| Fleet | 18.1 | 18.1 | 0% | 27.8 | 29.0 | 4% | 29.4 | 25.7 | -12% | 28.3 | 28.3 | 0% | 28.2 | 28.5 | 1% |
| Facilities & Real Estate | 13.7 | 13.7 | 0% | 17.6 | 15.6 | -11% | 39.4 | 45.0 | 14% | 22.5 | 23.7 | 5% | 45.2 | 26.5 | -41% |
| Information Solutions | 52.3 | 52.3 | 0% | 61.6 | 67.4 | 9% | 47.2 | 76.2 | 61% | 24.6 | 66.1 | 168% | 21.6 | 44.0 | 104% |
| System Operations | 5.3 | 5.3 | 0% | 35.6 | 4.7 | -87% | 34.3 | 32.8 | -4% | 19.9 | 55.7 | 181% | 5.4 | 5.7 | 5% |
| Other | 1.2 | 1.2 | 0% | 0.2 | -2.4 | -1184% | 0.0 | -1.6 | - | 0.0 | 0.0 | - | 0.0 | 1.0 | - |
| **Total Allocated to Distribution** | **90.7** | **90.7** | **0%** | **142.8** | **114.3** | **-20%** | **150.3** | **178.2** | **19%** | **95.3** | **173.8** | **82%** | **100.4** | **105.7** | **5%** |

[2] Hydro One's 2018 expenditures align exactly with forecast expenditures due to the timing of the OEB's Decision and Order in EB-2017-0049 (issued in March 2019).

For Distribution, Hydro One is forecasting to spend $662.7M on General Plant between 2018 and 2022, which is 14% ($83.2M) above the General Plant envelope of $579.5M. This variance is predominantly driven by investments in Information Solutions that support core Distribution work. For example, the Design Optimization and Transformation (DOT) project, which accounts for $32.5M of this variance, addresses the design and cost estimation tool used for Distribution Lines capital and demand work programs.

The most significant variances for each General Plant Function are listed below:

- **Fleet** – Similar to the Transmission allocated funds, the negative variance of 12% (-$3.6M) in 2020 is primarily driven by redirection of funds within the Distribution portfolio to address incremental investments in Information Solutions. The 2021 and 2022 forecasted levels are relatively aligned with the plan.
- **Facilities and Real Estate** – Actual and forecast expenditures vary from the plan year-over-year due to the reprioritization of work and scheduling changes for multi-year projects. The capital expenditures in 2019 are 11% ($2.0M) below plan due to execution delays in sustainment work at Stayner and Minden Operation Centres, which were completed in 2020. For 2020, actual expenditures are 14% ($5.6M) above plan due to this delayed work, the reprioritization of funds to increase capacity at the Markham Call Centre, which enabled Hydro One to eliminate the need for its lease at another Markham facility, and the completion of the Woodstock Field Business Centre and Customer Contact Centre, which consolidated operational sites in the area and eliminated the need for a leased facility. While 2021 values are relatively aligned with the plan, the forecast for 2022 is 41% ($18.7M) below plan. This is due to reprioritization activities within General Plant, which required the deferral of major projects, such as the Rockford Operation Centre, Orillia Operation Centre, and Orillia Distribution Centre into the JRAP forecast period (as described in G-GP-03).
- **Information Solutions** – Between 2019 and 2022, the actual/forecast capital expenditures exceed the plan by a range of 9% to 168% ($5.8M, $29.0M, $41.4M, and $22.4M above plan for 2019, 2020, 2021, and 2022, respectively). This is primarily due to

the reprioritization of IT projects that provide significant benefits to the Distribution business. These projects include:

- The DOT project, which was developed in 2019 and was not included in the previous rate filing. The project replaces Distribution Lines' legacy design and estimating tool to ensure customer cost estimates for new connections and other demand work are more accurate, thereby improving customer experience. It will also make the estimating process faster, easier, and more consistent. By investing in an integrated computer-aided-design (CAD), SAP costing and GIS solution, this investment enables Hydro One to improve customer service and increase productivity (see SPF Section 1.4 for details).
- As described above in the Transmission context, the HR Payroll Transformation project helps automate time reporting processes and results in overall time savings for Hydro One. It enables employees to have more time to focus on core work over administrative activities. It also enables greater employee pay accuracy and reduction of overpayments, and the costs to correct them. While the costs included in the prior distribution application (EB-2017-0049) were based on initial planning estimates, the cost-benefit analysis performed during the design phase indicated additional effort was required for crucial retrofitting on existing systems. Accordingly, Hydro One extended the timeline for the project to align with the revised complexity and scale of the work.
- Identity and Access Management (IAM) is a foundational security investment that consolidates dispersed, legacy IAM systems and functions into a single, unified enterprise-wide IAM program with a central authority and effective governance structure across information and operations technology environments. An initial estimate for this investment was included in the plan at the time of the Rate Order for the last distribution filing (EB-2017-0049). While preparing the detailed design for the project, the Company determined that it would be prudent to expand the scope of the investment to reflect the evolving cyber security landscape and Hydro One's maturing technology environment.

- **System Operations** – the variances between 2019 and 2021 relate to the timing of the ISOC project. At the time of the plan, execution was expected to begin in 2019, but due to delay in approvals, the bulk of the execution work, and the subsequent costs, were pushed to 2020 and 2021. This project is still on track for a completion in 2021.
- **Other General Plant** – Actual and forecast amounts are generally aligned with plan values. Minor variances in 2019 and 2020 are due to true-ups to actual costs for capital contributions to Hydro One Transmission for Enfield TS, Leamington TS and Aylmer TS. The additional $1.0M forecasted in 2022 is for a capital contribution to Hydro One Transmission for South Middle Road TS DESN1 feeder development.

### 4.9.3 FORECAST CAPITAL EXPENDITURES TRENDS AND VARIANCES

Hydro One's ten-year capital expenditure snapshot for General Plant investments is provided below in Table 3.

**Table 3 - Ten-year Capital Plan Snapshot for General Plant Investments**

| General Plant Function | Historical Actual/Forecast ($M) | | | | Bridge Forecast ($M) | Forecast Period (Planned $M) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
| Fleet | 27.4 | 44.0 | 39.2 | 42.7 | 43.4 | 76.4 | 78.0 | 78.9 | 80.0 | 82.6 |
| Facilities and Real Estate | 37.1 | 31.6 | 64.7 | 39.1 | 42.0 | 91.4 | 92.1 | 61.7 | 58.1 | 50.5 |
| Information Solutions | 94.4 | 114.6 | 118.4 | 96.2 | 73.0 | 119.9 | 118.1 | 113.6 | 122.1 | 106.1 |
| System Operations | 9.1 | 10.7 | 71.6 | 114.8 | 27.5 | 27.4 | 18.5 | 8.2 | 8.0 | 6.5 |
| Other | 6.3 | 5.5 | 8.9 | 18.9 | 22.6 | 27.5 | 24.6 | 22.0 | 23.2 | 22.3 |
| **Total General Plant** | **174.3** | **206.4** | **302.9** | **311.7** | **208.5** | **342.7** | **331.4** | **284.3** | **291.4** | **268.0** |
| Transmission Allocation | 83.6 | 92.1 | 124.7 | 137.8 | 102.8 | 146.8 | 124.0 | 114.2 | 115.9 | 105.0 |
| Distribution Allocation | 90.7 | 114.3 | 178.2 | 173.8 | 105.7 | 195.9 | 207.4 | 170.1 | 175.5 | 162.9 |

Over the planning period, Hydro One plans to spend approximately $1,517.8M in General Plant investments, which averages to $303.6M annually. To provide an understanding of how this plan compares to historical levels, Figure 1 displays the total General Plant net capital actual/forecast expenditures next to the planning period.

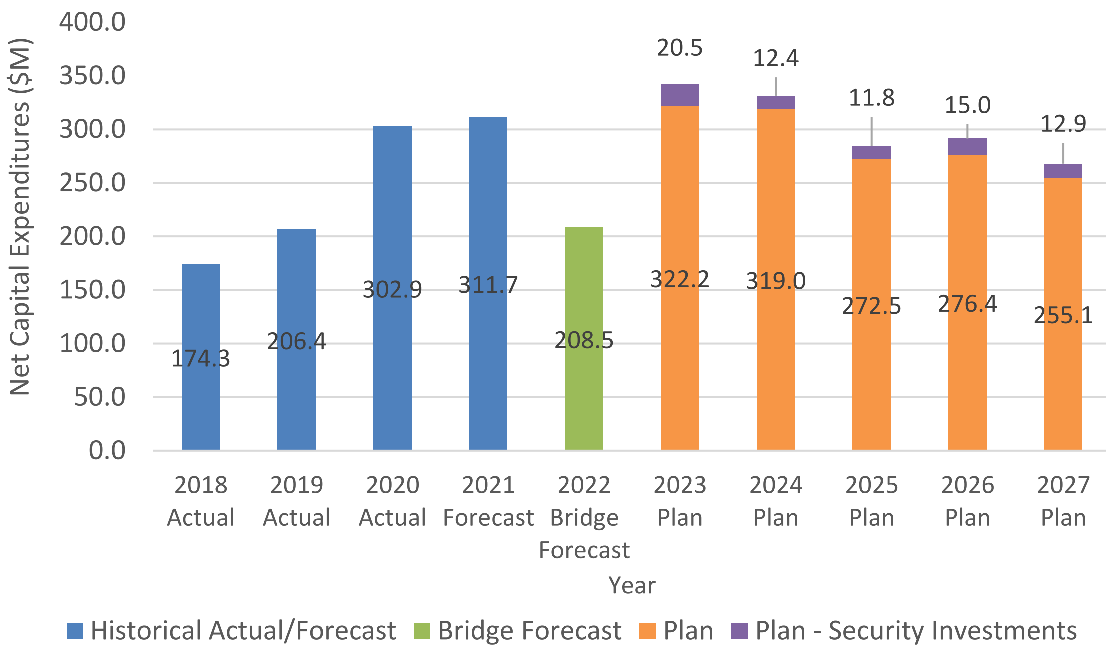


**Figure 1: General Plant Net Capital Expenditures for Historical, Bridge and Plan Years[3]**

The 2023-2027 planned investment levels reflect the increasing requirements for General Plant assets to effectively and efficiently support the needs of the Transmission and Distribution work programs, continuing the trend that is evident in the latter part of the historical period. During the current rate period, and especially in 2020 and 2021, Hydro One has increased investment in General Plant to enable and prepare for the growing power system work programs, and to make better use of new technologies that can support the Company's strategic objectives.[4]

As shown in Figure 1, the 2023 and 2024 overall capital expenditures are, on average, about 10% higher than the 2020 actual and 2021 forecast. Of this 10%, approximately 5% is related to security

[3] Beginning in 2023, security investments (included under GSP Section 4.11 G-GP-09, G-GP-10, and G-GP-11) have been reclassified from System Renewal to General Plant. These costs are highlighted in Figure 1 as "Plan – Security Investments" to illustrate their incremental impact on the General Plant portfolio.

[4] The 2022 bridge year forecast is significantly lower than the prior two historical years. This is primarily driven by the timing of major projects– the Integrated System Operating Centre (ISOC) and the Design Optimization and Transformation (DOT) project are forecasted to complete in 2021, and there are no significant in-year project costs (i.e., greater than $10M in a fiscal year) in 2022.

investments, which have been reclassified from System Renewal to General Plant beginning in 2023. These costs are highlighted in Figure 1 to illustrate their incremental impact on the General Plant portfolio. The other test years from 2025-2027 are 8% below the 2020 and 2021 levels. When security investments are excluded for historical comparisons, the 2023 and 2024 levels are only 5% higher than 2020 and 2021, a growth rate that is below inflation.

The plan presented in this GSP is appropriately sized and paced to enable the Transmission and Distribution businesses to achieve their strategic objectives. The growing Transmission and Distribution portfolios have corresponding needs for core General Plant support functions, such as Fleet and F&RE. In addition, the growing role that technology plays in Hydro One's field and corporate operations is driving investment in Information Solutions and System Operations, both of which are essential to Hydro One's plans to modernizing the Transmission and Distribution systems. These investments are critical to enabling Hydro One's plans to improve ways that it connects with customers and manages work.

### 4.9.4 ATTACHMENTS

The following appendices will be provided as part of this section:

- Attachment 1: OEB Distribution Chapter 2 Filing Requirements - Appendix 2-AA
- Attachment 2: Capital Performance Report

## Appendix 2-AA
## Capital Projects and Programs Table for General Plant ($M)

| General Plant Capital Projects and Programs | 2018 | 2019 | 2020 | 2021 Forecast | 2022 Bridge | 2023 Test | 2024 Test | 2025 Test | 2026 Test | 2027 Test |
|---|---|---|---|---|---|---|---|---|---|---|
| **Reporting Basis** | **USGAAP** | **USGAAP** | **USGAAP** | **USGAAP** | **USGAAP** | **USGAAP** | **USGAAP** | **USGAAP** | **USGAAP** | **USGAAP** |
| **General Plant Allocated to Hydro One Transmission** | | | | | | | | | | |
| Fleet | 9.3 | 15.0 | 13.5 | 14.4 | 14.9 | 25.8 | 26.4 | 26.7 | 27.0 | 27.9 |
| Facilities & Real Estate | 23.4 | 16.0 | 19.7 | 15.4 | 15.5 | 26.0 | 24.9 | 17.5 | 18.2 | 14.8 |
| Information Solutions | 42.0 | 47.1 | 42.2 | 30.1 | 29.1 | 57.4 | 46.5 | 45.0 | 43.7 | 35.9 |
| System Operations | 3.8 | 6.0 | 38.8 | 59.0 | 21.8 | 12.0 | 3.8 | 4.2 | 4.8 | 4.2 |
| Operating Infrastructure | 5.8 | 8.7 | 7.5 | 18.9 | 21.5 | 25.5 | 22.4 | 20.9 | 22.2 | 22.3 |
| System Capability Reinforcement | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Other | -0.7 | -0.7 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total GP Allocated to Transmission** | **83.6** | **92.1** | **124.7** | **137.8** | **102.8** | **146.8** | **124.0** | **114.2** | **115.9** | **105.0** |
| | | | | | | | | | | |
| **General Plant Allocated to Hydro One Distribution** | | | | | | | | | | |
| Fleet | 18.1 | 29.0 | 25.7 | 28.3 | 28.5 | 50.6 | 51.7 | 52.2 | 53.0 | 54.7 |
| Facilities & Real Estate | 13.7 | 15.6 | 45.0 | 23.7 | 26.5 | 65.4 | 67.2 | 44.2 | 39.9 | 35.7 |
| Information Solutions | 52.3 | 67.4 | 76.2 | 66.1 | 44.0 | 62.5 | 71.6 | 68.5 | 78.5 | 70.2 |
| System Operations | 5.3 | 4.7 | 32.8 | 55.7 | 5.7 | 15.4 | 14.7 | 4.0 | 3.2 | 2.3 |
| Operating Infrastructure | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| System Capability Reinforcement | 2.9 | -1.0 | -0.7 | 0.0 | 1.0 | 2.0 | 2.2 | 1.1 | 1.0 | 0.0 |
| Other | -1.7 | -1.5 | -0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total GP Allocated to Distribution** | **90.7** | **114.3** | **178.2** | **173.8** | **105.7** | **195.9** | **207.4** | **170.1** | **175.5** | **162.9** |
| | | | | | | | | | | |
| **Total General Plant** | **174.3** | **206.4** | **302.9** | **311.7** | **208.5** | **342.7** | **331.4** | **284.3** | **291.4** | **268.0** |

Notes:

1 Please provide a breakdown of the major components of each capital project undertaken in each year. Please ensure that all projects below the materiality threshold are included in the miscellaneous line. Add more projects as required.

2 The applicant should group projects appropriately and avoid presentations that result in classification of significant components of the capital budget in the miscellaneous category.

# CAPITAL PROGRAM PERFORMANCE REPORT FOR GENERAL PLANT

## 1.0 INTRODUCTION

This Capital Performance Report provides an overview of Hydro One's performance in General Plant investments in 2020 for Transmission and 2019 and 2020 for Distribution. It addresses both capital expenditures and in-service additions (ISA). This report is organized into two main parts: (i) Section 2.0 presents the performance of General Plant investments allocated to Transmission in 2020 and (ii) Section 3.0 presents the performance of General Plant investments allocated to Distribution in 2019 and 2020. For both of these sections, the capital performance is presented from the perspective of the overall General Plant OEB category level and at the project and program level.

## 2.0 CAPITAL PERFORMANCE REPORT FOR GENERAL PLANT INVESTMENTS ALLOCATED TO TRANSMISSION IN 2020

### 2.1 PERFORMANCE AT THE GENERAL PLANT LEVEL

For Transmission, the levels for General Plant capital expenditures and ISA are based on those presented in Hydro One's Draft Rate Order (DRO) in EB-2019-0082.[1] Hydro One's performance in comparison to OEB approved levels is presented below in Table 1.

**Table 1 - 2020 Capital Expenditures and In-Service Additions allocated to Transmission ($M)**

| OEB Category | Capital Expenditures | | | In-Service Additions | | |
|---|---|---|---|---|---|---|
| | OEB Approved ($M) | Actual ($M) | Variance (%) | OEB Approved ($M) | Actual ($M) | Variance (%) |
| General Plant Allocated to Transmission | 111.1 | 124.7 | 12.3% | 75.1 | 79.9 | 6.4% |

[1] Hydro One, Draft Rate Order OEB File No. EB-2019-0082 (May, 28, 2020) – Table 4, page 14 and Table 5, page 18

In 2020, General Plant investments for Transmission were 12.3% ($13.6M) higher than planned for capital expenditures and 6.4% ($4.8M) higher for in-service additions. These variances are mainly driven by the reprioritization of General Plant work among the larger Transmission envelope (see TSP Section 2.9 Attachment 2 for details on the overall Transmission envelope performance). This reprioritized work includes facility investments at critical Transmission Stations and several Information Solutions projects that ensure vendor support, security and reliability of critical systems.

Further details on the underlying variances are provided in the following section at the project and program level.

## 2.2 PERFORMANCE AT THE PROJECT AND PROGRAM LEVEL

This section presents projects and programs with greater than $3M net capital expenditures or in-service additions for planned (at the time of the Transmission DRO) or actual amounts. A variance category is assigned to any projects or programs with material variances from the DRO plan for a specific project or program. For the purposes of this report, a variance is considered material if its absolute value is greater than or equal to $0.5M and greater than or equal to 10% from planned values.

The variance categories assigned to material variances are, as follows:

- **Emergent Needs**: Emergent needs are investments that Hydro One made and in-serviced during the 2020 period in response to a change of priority due to equipment condition or failure as well as customer needs.
- **Reprioritization**: Reprioritization includes investments that are accelerated or deferred. Accelerated investments can include projects or programs that need to be completed sooner than planned and follow Hydro One’s redirection process. The process allows the company to adjust its work delivery when changes occur. In some cases, this results in the acceleration of work when resources are redirected from another delayed project.

Alternatively, deferral can occur as a result of increased demand for nondiscretionary investments and planned work is reprioritized as a result.

- **Execution Factors**: Execution factors represent delays encountered during the execution phase of work which can include timing delays that arise as a result of changing conditions, risks and priorities that need to be addressed during execution. As risks materialize, plans are adjusted to accommodate the change and mitigate the overall impact to cost, schedule and resources. This can change the year in which the project goes in-service and subsequently can impact in-service additions. However this does not typically change the in-service amount or have impacts to the volume of work completed within a capital program. Some of the main causes for delays are outage delays or cancellations, material delivery and logistics factors as well as customer needs.
- **Work Definition**: Work definition variances naturally arise as a project's scope, estimated budget and schedule are refined and the project moves from the high-level planning phase to design and estimate followed by execution. As the project is refined, there may be increases or decreases to the project cost as a result of new or changing information that becomes known during the design and estimation phase or in the execution stage of work.

The project and program variances for Transmission-allocated General Plant investments in 2020 are presented below in Table 2.

**Table 2 - 2020 Capital Expenditures and In-Service Additions Greater for General Plant allocated to Transmission**

| Functional Area | EB-2019-0082 ISD | 2020 Capital Expenditures ($M) | | | 2020 In-Service Additions ($M) | | | Variance Explanation |
|---|---|---|---|---|---|---|---|---|
| | | DRO Plan | Actual | Variance | DRO Plan | Actual | Variance | |
| Fleet | GP-12 Transport & Work Equipment | 9.2 | 8.8 | -0.4 | 9.2 | 8.8 | -0.4 | No Material Variance |
| Facilities and Real Estate | GP-10 Facility Accommodation & Improvements Service Centres & Admin | 4.9 | 6.8 | 1.9 | 4.5 | 4.8 | 0.3 | Reprioritization |
| | GP-11 Transmission Facilities & Site Improvements | 9.4 | 12.9 | 3.5 | 10.4 | 12.6 | 2.2 | Reprioritization |
| Information Solutions | GP-07 Hardware/Software Refresh and Maintenance | 4.1 | 4.0 | -0.1 | 6.0 | 5.9 | -0.1 | No Material Variance |
| | GP-08 Corporate Services Transformation - HR / Payroll | 4.2 | 4.3 | 0.1 | 0.0 | 0.0 | 0.0 | No Material Variance |
| | Private Cloud Data Center - Capital | 2.9 | 4.7 | 1.8 | 7.1 | 8.9 | 1.8 | Reprioritization |
| System Operations | GP-01 Integrated System Operating Centre | 40.3 | 28.1 | -12.2 | 0.0 | 0.0 | 0.0 | Reprioritization |
| | GP-03 Network Management System Capital Sustainment | 4.8 | 5.0 | 0.2 | 0.0 | 0.0 | 0.0 | No Material Variance |
| | Synchrophasor Central Site | 3.4 | 1.7 | -1.7 | 3.9 | 0.0 | -3.9 | Reprioritization |
| | Ontario Grid Control Centre Data Centre Remediation | 2.1 | 2.3 | 0.1 | 3.4 | 3.5 | 0.1 | No Material Variance |
| Other | GP-02 Grid Control Network Sustainment | 3.2 | 3.6 | 0.4 | 3.8 | 3.0 | -0.8 | Reprioritization |
| | Magnetometer Installation Project | 1.3 | 0.7 | -0.6 | 4.6 | 0.0 | -4.5 | Execution Factor |
| Investments Below Threshold | | 21.3 | 41.8 | 20.6 | 22.2 | 32.4 | 10.1 | |
| **Total** | | **111.1** | **124.7** | **13.6** | **75.1** | **79.9** | **4.8** | |

The impact of each variance category from a capital expenditure perspective is demonstrated below in **Figure 1: Waterfall chart highlighting the contributions to the 2020 Transmission capital expenditures variance by variance category**Figure 1.

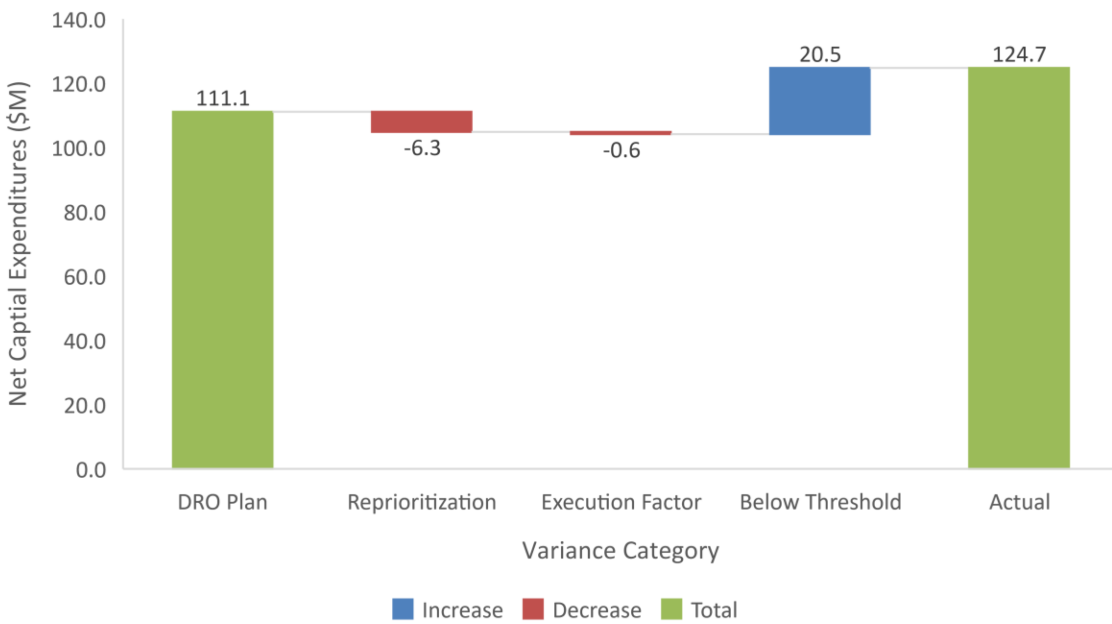


**Figure 1: Waterfall chart highlighting the contributions to the 2020 Transmission capital expenditures variance by variance category**

Table 2 and Figure 1 demonstrate that majority of the 12.3% capital expenditure variance is attributable to smaller projects (i.e. other investments below threshold). These smaller projects are mostly related to Information Solutions investments that were prioritized to ensure vendor support, security and reliability of critical systems. Other projects contributing to this positive variance include the reprioritization of roofing work at critical transmission stations including Brockville TS, Frontenac TS, Cataraqui TS and Lennox TS, and the requirement for a modular trailer at Oro Operation Centre to provide much needed space to address the lines of business operational needs. These are offset by underspending (compared to the DRO plan) in the Integrated System Operating Centre (ISOC) project, for which the construction schedule has been shifted due to timing of the approval, resulting in a subsequent shift in spend in 2020.

Notwithstanding this deferral, the ISOC is still on track to be substantially completed by September 2021.

For in-service additions, majority of the 6.4% was driven by smaller projects under Information Solutions. For the Transmission filing, no units were provided as part of the DRO plan for any of the General Plant programs.

## 3.0 CAPITAL PERFORMANCE REPORT FOR GENERAL PLANT INVESTMENTS ALLOCATED TO DISTRIBUTION IN 2019 AND 2020

### 3.1 PERFORMANCE AT THE GENERAL PLANT LEVEL

For Distribution, the levels for General Plant capital expenditures and ISA are based on those presented in Hydro One's 2020 Annual Update in EB-2019-0043.[2] Hydro One's performance in comparison to OEB approved levels for 2019 and 2020 are presented below in Table 3 and Table 4, respectively.

**Table 3 - 2019 Capital Expenditures and In-Service Additions allocated to Distribution ($M)**

| | Capital Expenditures | | | In-Service Additions | | |
|---|---|---|---|---|---|---|
| **OEB Category** | **OEB Approved ($M)** | **Actual ($M)** | **Variance (%)** | **OEB Approved ($M)** | **Actual ($M)** | **Variance (%)** |
| General Plant Allocated to Distribution | 142.8 | 114.3 | -20.0% | 103.9 | 104.1 | 0.1% |

[2] Hydro One, EB-2019-0043 2020 Annual Update (August 30, 2019) – Appendix A, page 27 and Appendix B, page 28.

**Table 4 - 2020 Capital Expenditures and In-Service Additions allocated to Distribution ($M)**

| | Capital Expenditures | | | In-Service Additions | | |
|---|---|---|---|---|---|---|
| **OEB Category** | **OEB Approved ($M)** | **Actual ($M)** | **Variance (%)** | **OEB Approved ($M)** | **Actual ($M)** | **Variance (%)** |
| General Plant Allocated to Distribution | 150.3 | 178.2 | 18.6% | 135.9 | 155.5 | 14.4% |

For capital expenditures, General Plant investments are 20.0% ($28.6M) lower than the DRO plan in 2019 and 18.6% ($28.0M) higher than the DRO plan in 2020. These variances are mostly related to shifts in schedule for ISOC and the Call Centre Technology project, and the advancement of the Design Optimization and Transformation (DOT) project to 2020.

The 2019 in-service additions are aligned with the DRO plan, while the 2020 in-service additions are 14.4% ($19.6M) higher. The variance in 2020 is mainly driven by the Private Cloud Data Centre installation and the completion of the Woodstock Office Field Business Centre and Customer Contact Centre. Further details on the underlying variances are provided in the following section at the project and program level.

## 3.2 PERFORMANCE AT THE PROJECT /PROGRAM LEVEL

This section presents projects and programs with greater than $3M net capital expenditures or in-service additions for planned (at the time of the 2020 Annual Update) or actual amounts. A variance category is assigned to any projects or programs with material variances from the plan for a specific project or program. For the purposes of this report, a variance is considered material if its absolute value is greater than or equal to $0.5M and greater than or equal to 10% from planned values. The variance categories assigned to material variances are the same as those presented above in Section 2.2.

The applicable 2019 projects and programs for Distribution are presented in Table 5 and the applicable 2020 projects and programs are presented in Table 6.

**Table 5 - 2019 Capital Expenditures and In-Service Additions for General Plant allocated to Distribution**

| Functional Area | EB-2017-0149 ISD | 2019 Capital Expenditures ($M) | | | 2019 In-Service Additions ($M) | | | |
|---|---|---|---|---|---|---|---|---|
| | | Plan | Actual | Variance | Plan | Actual | Variance | Variance Explanation |
| Fleet | GP-01 Transport & Work Equipment | 27.8 | 29.0 | 1.2 | 27.8 | 29.0 | 1.2 | No Material Variance |
| Facilities and Real Estate | GP-02 Real Estate Facilities Capital | 17.7 | 15.6 | -2.1 | 11.4 | 12.0 | 0.6 | Execution Factors |
| Information Solutions | GP-03 MFA Servers and Storage | 2.2 | 3.9 | 1.7 | 2.2 | 3.9 | 1.7 | Reprioritization |
| | GP-04 MFA PC and Printer Hardware | 0.5 | 4.2 | 3.7 | 0.5 | 4.2 | 3.7 | Reprioritization |
| | GP-05 Hardware/Software Refresh and Maintenance | 4.2 | 4.8 | 0.6 | 6.0 | 5.2 | -0.8 | Reprioritization |
| | GP-28 Call Centre Technology | 17.7 | 10.6 | -7.1 | 1.8 | 0.0 | -1.8 | Reprioritization |
| | GP-30 Customer Service Regulatory Changes and Pricing Options | 6.7 | 6.0 | -0.7 | 0.0 | 0.4 | 0.4 | No Material Variance |
| | GP-32 Customer Data and Analytics | 2.3 | 3.2 | 0.9 | 1.8 | 4.6 | 2.7 | Reprioritization |
| | Middleware System Upgrade | 0.5 | 1.5 | 1.1 | 2.8 | 3.4 | 0.6 | Reprioritization |
| | Private Cloud Data Center | 8.4 | 9.3 | 0.8 | 14.4 | 11.0 | -3.4 | Reprioritization |
| | SAP ECC Minor Update | 1.6 | 2.4 | 0.8 | 3.3 | 4.0 | 0.7 | Reprioritization |
| | Enterprise Drawing Management | 2.1 | 3.8 | 1.7 | 3.7 | 5.3 | 1.7 | Work Definition |
| System Operations | GP-18 Integrated System Operating Centre - New Facility Development | 28.9 | 1.4 | -27.5 | 0.0 | 0.0 | 0.0 | Reprioritization |
| Investments Below Threshold | | 22.3 | 18.5 | -3.8 | 28.4 | 21.1 | -7.3 | |
| **Total** | | **142.8** | **114.3** | **-28.6** | **103.9** | **104.1** | **0.1** | |

**Table 6 - 2020 Capital Expenditures and In-Service Additions for General Plant allocated to Distribution**

| Functional Area | EB-2017-0149 ISD | 2020 Capital Expenditures ($M) | | | 2020 In-Service Additions ($M) | | | Variance Explanation |
|---|---|---|---|---|---|---|---|---|
| | | Plan | Actual | Variance | Plan | Actual | Variance | |
| Fleet | GP-01 Transport & Work Equipment | 29.4 | 25.7 | -3.6 | 29.4 | 25.7 | -3.6 | Reprioritization |
| Facilities and Real Estate | GP-02 Real Estate Facilities Capital | 39.4 | 45.0 | 5.6 | 34.5 | 41.4 | 6.9 | Reprioritization |
| Information Solutions | GP-05 Hardware/Software Refresh and Maintenance | 1.7 | 4.0 | 2.3 | 2.0 | 5.9 | 4.0 | Reprioritization |
| | GP-13 HR and Pay Related Technology Investments | 5.0 | 4.3 | -0.7 | 5.0 | 0.0 | -5.0 | Work Definition |
| | GP-28 Call Centre Technology | 8.1 | 17.4 | 9.3 | 26.2 | 29.4 | 3.2 | Reprioritization |
| | GP-30 Customer Service Regulatory Changes and Pricing Options | 2.9 | 3.7 | 0.8 | 12.8 | 11.9 | -1.0 | Reprioritization |
| | Private Cloud Data Center | 0.0 | 4.7 | 4.7 | 0.0 | 9.0 | 9.0 | Reprioritization |
| | Enterprise Robotics Process Automation | 3.0 | 0.8 | -2.2 | 3.0 | 0.6 | -2.4 | Execution Factors |
| | Web - Redesign Front End | 2.0 | 2.3 | 0.3 | 3.0 | 1.6 | -1.4 | Reprioritization |
| | Customer Insights - Perform Analytics | 3.0 | 0.0 | -3.0 | 0.0 | 0.0 | 0.0 | Reprioritization |
| | Design Optimization and Transformation (DOT) | 0.0 | 8.8 | 8.8 | 0.0 | 0.0 | 0.0 | Reprioritization |
| System Operations | GP-18 Integrated System Operating Centre - New Facility Development | 32.6 | 28.2 | -4.4 | 0.0 | 0.0 | 0.0 | Reprioritization |
| | GP-21 Ontario Grid Control Centre Data Centre Remediation | 0.0 | 2.3 | 2.3 | 2.5 | 3.5 | 1.0 | Emergent Needs |
| Investments Below Threshold | | 23.2 | 31.0 | 7.8 | 17.5 | 26.4 | 8.9 | |
| **Total** | | **150.3** | **178.2** | **28.0** | **135.9** | **155.5** | **19.6** | |

The impact of each variance category from a capital expenditure perspective is demonstrated below in Figure 2 for 2019 and Figure 3 for 2020.


**Figure 2: Waterfall Chart Highlighting the Contributions to the 2019 Distribution Capital Expenditures Negative Variance of 20.0% (-$28.6M) by Variance Category**

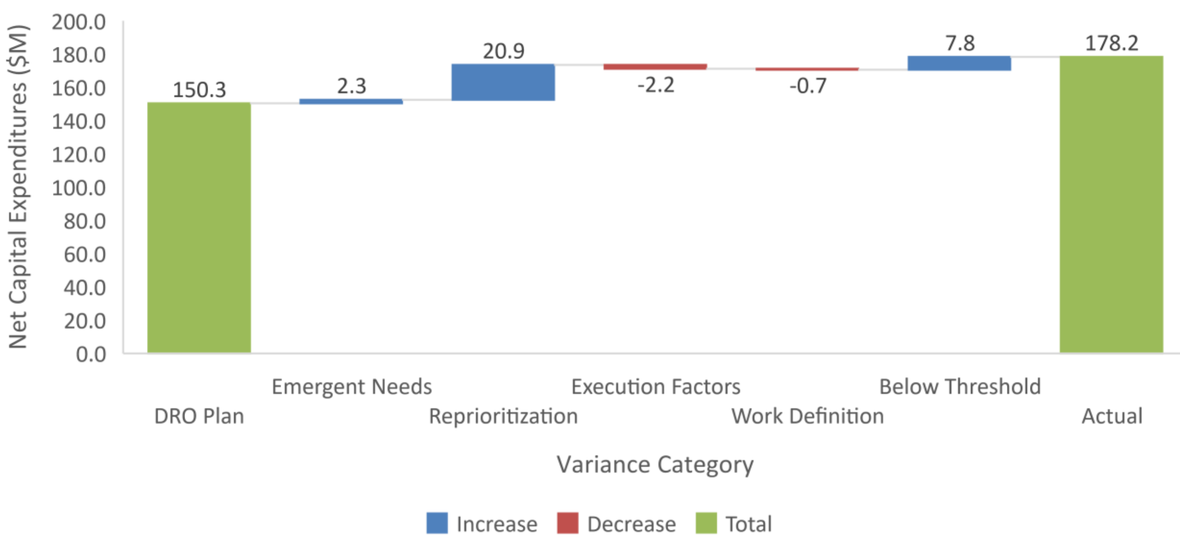


**Figure 3: Waterfall Chart Highlighting the Contributions to the 2020 Distribution Capital Expenditures Positive Variance of 18.6% ($28.0M) by Variance Category**

From the information presented in Table 5 and The impact of each variance category from a capital expenditure perspective is demonstrated below in Figure 2 for 2019 and Figure 3 for 2020.

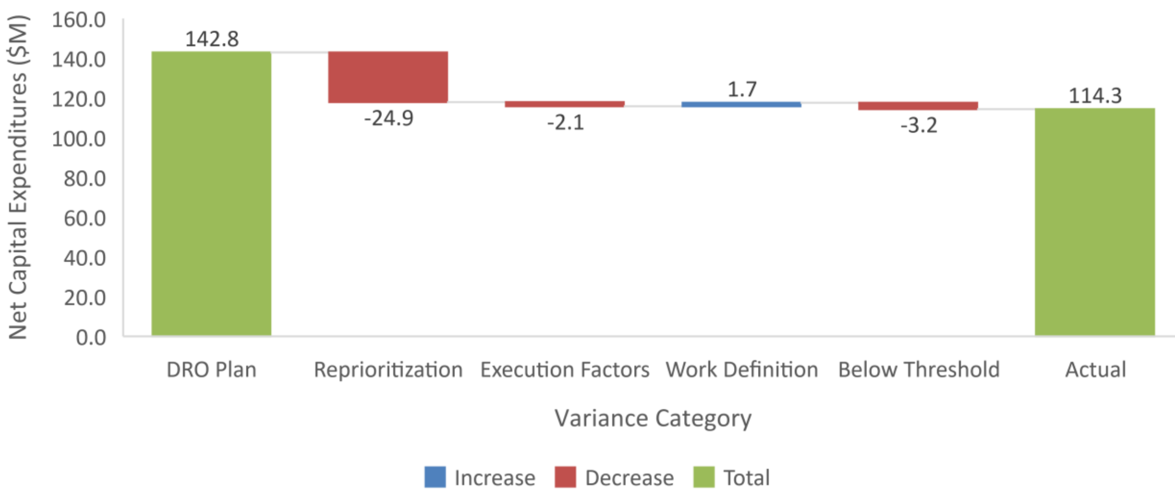


**Figure 2**, the majority of the capital expenditure negative variance of $28.6M in 2019 is related to the reprioritization of ISOC (GP-18) and Call Centre Technology (GP-28). For both of these projects some work was shifted out to future years in comparison to plan. For ISOC, this was due to a delay in the approval timelines and was subsequently reprioritized for construction to occur mostly in 2020 and 2021. For the Call Centre technology, costs shifted from 2019 to 2020 due to its dependency on other, smaller upgrades that were slightly delayed.

From the information presented in of Table 6 and Figure 3, the majority of the 2020 capital expenditure variance is driven by reprioritized Information Solutions and Facilities and Real Estate investments. Notable variances include the deferral of work from 2019 to 2020 for the Call Centre Technology project (as discussed above); the advancement of the Design Optimization and Transformation (DOT) project, which replaces Distribution Lines' legacy design and estimating tool to ensure customer cost estimates for new connections and other demand work are more accurate; and the reprioritization of funds to address lines of business facility requirements including increased capacity at the Markham Call Centre, and the completion of the Woodstock Field Business Centre and Customer Contact Centre, which consolidated operational sites in the area and eliminated the need for a leased facility.

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# SECTION 4.10 – GSP – CAPITAL WORK EXECUTION STRATEGY

## 4.10.1 INTRODUCTION

The General Plant Capital Work Execution Strategy outlines how Hydro One delivers a large and complex work program within approved expenditure levels, while maintaining the flexibility necessary to accommodate new circumstances such as site conditions, evolving customer needs, changing priorities, and emergent investments.

Hydro One's processes for planning and executing General Plant work programs vary depending on the work program in question, reflecting the distinct work execution challenges and strategies of each line of business. Accordingly, the General Plant Capital Work Execution Strategy is divided into three lines of business: Fleet, Facilities and Real Estate (F&RE), and Information Solutions. Notwithstanding these variations, Hydro One's work planning and execution activities all centre on fulfilling the company's core business objectives, including safety, quality, efficiency, and meeting customer commitments.

Hydro One is committed to executing its proposed General Plant work programs using the processes and frameworks set out herein.

## 4.10.2 FLEET

Hydro One Fleet Management Services (Fleet) manages transportation and work equipment (TWE) assets to support Distribution and Transmission work programs and staffing requirements. This exhibit presents (i) the short-term (i.e., in-year and future year) planning considerations for TWE replacements, (ii) the delivery and execution of the TWE program, (iii) the execution strategy for the helicopter fleet, and (iv) the workforce resourcing strategy for the execution of Fleet capital work.

#### 4.10.2.1 FLEET REPLACEMENT PLANNING

Fleet takes a systematic approach to fleet replacement focused on ensuring that staff have the equipment they need to execute their work programs. This process begins by identifying the end-of-life equipment that needs to be replaced each year and then prioritizing available funding based on organizational needs, as well as mechanical and financial criteria. As illustrated in GSP Section 4.2.2, every vehicle in Hydro One's fleet undergoes an annual condition inspection where its condition is assessed based the following indicators: vehicle age, mileage, maintenance costs per kilometre, engine hours, and the deficiencies noted during the annual condition inspection. Fleet then applies a series of qualifiers to determine which vehicles are provisionally eligible for replacement. For vehicles that marginally meet this eligibility threshold (e.g., they meet the age threshold but not the mileage threshold), Hydro One performs a case-by-case assessment to determine whether the vehicle will still be deemed eligible for replacement.

In the next phase of assessment, Fleet ranks and prioritizes the eligible vehicles based on the indicators discussed in Section 4.2.2 and the extent to which they need to be replaced to drive value for work programs in the coming year. The purpose of this ranking exercise is to maximize financial benefit (i.e., savings on operating costs) and to minimize vehicle downtime.

Fleet standardizes TWE based on safety, reliability and work program execution needs. Fleet engineers review each individual request to ensure that it meets the technical needs required to fulfil the work program. Fleet holds regular meetings with the original equipment manufacturer to confirm that Hydro One's purchases and configurations are in line with those of other similarly situated utilities. Fleet also holds membership in various utility forums to ensure alignment with industry standards.

#### 4.10.2.2 FLEET DELIVERY AND EXECUTION

Fleet has a number of processes in place to ensure that equipment is ordered efficiently and is delivered on time and in proper working condition, providing value to the ratepayer. The timeline for procuring light-duty vehicles, from the date of purchase to the date of in-service operation, is roughly six months, including the time required for upfitting (i.e. adding compartments and safety equipment) to meet work needs. The equivalent timeline for heavy-duty vehicles is roughly six months for “off-the-lot” vehicles and 10 to 14 months for customized vehicles, which would apply to the majority of Hydro One’s heavy-duty fleet.

The in-year strategy for Fleet is to complete equipment orders in the first quarter of the year. Fleet generally purchases fleet equipment directly from manufacturers to leverage volume discounts. In order to provide sufficient lead time for the manufacturing process and to ensure that Hydro One is able to secure the required equipment on time, Hydro One reserves build slots with original equipment manufacturers. This is an informal process that takes place between December and January each year, at no cost to Hydro One. Fleet’s list of replacement vehicles, discussed above, is typically ready by the end of November, and in general the quantities and specifications of the required vehicles do not substantially change by the time the orders are built. This provides Fleet with the opportunity to partner with original equipment manufacturers, well in advance of the order and delivery dates, to ensure a predictable and efficient supply of equipment.

Hydro One has contracts in place with the majority of original equipment manufacturers. The contract pricing covers upfitting as well as the acquisition costs of the chassis, and the contracts include penalties for late delivery, failure of delivery, and deficiencies on arrival.

The delivery of the equipment does not mark the end of Fleet’s oversight on the delivery process. Before Hydro One accepts any piece of delivered equipment, fleet inspectors confirm that each vehicle or piece of equipment meets Hydro One’s specifications. Anything that does not meet these specifications is addressed with the supplier prior to acceptance of delivery. This inspection is done at the outset, prior to commencement of work, to avoid future downtime and to ensure that the integration of new equipment into work programs is as seamless as possible.

In the event of premature retirement of a vehicle before the arrival of its replacement, Fleet works with the internal client to develop a solution that meets their needs. This could involve, for example, vehicle retention, leveraging equipment from another Hydro One location, or renting equipment from an external source. This solution is developed collaboratively with the internal client and could take a variety of forms.

Fleet continuously monitors the performance of the equipment to ensure that it represents best value for customers, meets the need of the work programs, and justifies the initial investment. Fleet tracks the total cost of ownership of the equipment as well as uptime and equipment utilization. With the use of telematics, Fleet is able to collect and leverage valuable operational data and obtain a continuous review of the fleet to ensure the optimal number of vehicles for work programs and staffing requirements. The data is analyzed on a monthly basis to continuously identify instances of low utilization and to redistribute existing units to work programs in need. This performance data allows Fleet to assess the efficacy of equipment to support work planning and execution activities.

As the Transmission and Distribution work programs have been increasing, the demand for transportation and work equipment has also increased. The options to meet this growing demand include increased utilization of existing equipment, redistribution of low-utilized equipment, and/or arranging for rentals. In 2020, 32% of requests for additional, short-term equipment were satisfied by redeploying low-utilized equipment instead of renting equipment externally. External rentals are used for short-term projects and work programs where required, but their costs are approximately 40% higher than owned-equipment rates according to an internal assessment.

As illustrated in the 2019 Fleet Operation Benchmarking Report (presented in Section 4.3), only 17% of Hydro One’s on-road vehicles are considered to be operating at low mileage levels, whereas the industry average is 30%. This is the case even though Hydro One’s vehicles travel an average of 5,000 kilometers more than the benchmarking comparators. This is the lowest percentage of vehicles having low mileage among the comparator group, which demonstrates Hydro One’s ability to effectively manage utilization levels.

As indicated in Section 4.2.2, Fleet continuously monitors the real-time availability of heavy-duty and off-road work equipment. Equipment availability is maximized to enable essential work programs to deliver reliable and safe service to customers. In 2020, the average monthly uptime of the heavy-duty and off-road category was 92%, an increase from the 2019 uptime of 90%. Hydro One will continue to monitor the garages output and strive for continuous improvement year over year.

#### 4.10.2.3 HELICOPTER FLEET MANAGEMENT

Hydro One’s capital acquisition strategy with respect to helicopters is distinct from its capital acquisition strategy with respect to other types of fleet. Helicopters do not have a predetermined end-of-life based on age or flight hours, and they experience very little depreciation in the first five years of operation and tend to retain a core value even after 20 years or more. On the other hand, helicopters have very stringent maintenance requirements, some of which are capitalized. Indeed, Hydro One performs a full rebuild of its helicopters every 12 years. In addition, Hydro One is in the process of implementing a strategy to invest in new helicopters of the same model as the existing fleet (Eurocopter AS350 B3). The current fleet consists of three 25 to 30-year-old helicopters, three 15-year-old helicopters, one relatively new helicopter (18 months old), and a seven-year-old, twin-engine Eurocopter AS355 NP.

A key focus Hydro One’s capital acquisition strategy with respect to helicopters is to preserve and develop Hydro One’s capability to respond to customer demand and asset failure. Helicopters are an efficient way for crews to access work sites, to deliver materials to power line technicians as part of Hydro One’s insulator change program, and to deliver distribution poles after a destructive storm. This contributes to faster outage response, as well as worker safety. The helicopter fleet is also important for patrolling large areas at once, which drives efficiencies for Hydro One’s inspection programs.

Hydro One’s execution strategy is flexible and scalable. A staged replacement of the existing aircraft, starting with the oldest AS350 B2s, will maintain operational readiness while incrementally improving the ability to service both the planned and unplanned activities of Hydro

One, as previously discussed in this section. Hydro One will continue to use third-party vendors for specialized work for which there is no internal capability (e.g., the setting of heavier poles) or short-term work for which additional capacity may be required (e.g., peak summertime work).

#### 4.10.2.4 WORKFORCE RESOURCING STRATEGY

As described in the workforce planning Exhibit E-06-01, Section 2.0, Hydro One has a range of options at its disposal to execute work, including leveraging the casual workforce and outsourcing work when appropriate. The most appropriate resourcing strategy is determined by several factors, centred on achieving customer-focused, efficient, and cost-effective outcomes.

In 2020, Fleet conducted a benchmarking study for Fleet capital and operating costs, to assess the resourcing level required to address the increased capital and OM&A costs in the 2023-2027 work program. The benchmarking report confirmed that the regular staff complement was sufficient to address the work program growth, but the casual staff complement would be required to be maintained at the 2021 level.

The FTE level for Helicopter Services is to remain constant throughout the rate period. Replacement hires for retiring pilots may be possible as either temporary or regular seasonal hires, thereby reducing costs in the slower months, which are typically from November to January. Any such change in the level of FTE pilots will be based on data of historical flying rates. Once the helicopter replacement plan is approved, it is anticipated that there may be a need in 2024 for one additional FTE, an Avionics Aircraft Maintenance Engineer, to address the complexities of the newer generation of aircraft.

### 4.10.3 FACILITIES AND REAL ESTATE

Hydro One's Facilities and Real Estate (F&RE) group is responsible for managing a dynamic portfolio of major capital projects and sustainment programs across the province. The F&RE capital work execution strategy is mainly focused on ensuring that facility-related work (i.e., renovations, upgrades, and new builds/greenfield development) is completed on time, on budget, and in accordance with Hydro One's required standards and procedures. This section is divided into the following sub-sections that describe the process by which these investments are identified, scoped, and executed: (i) facilities assessment and preliminary scoping; (ii) capital projects and programs execution; and (iii) the workforce resourcing strategy for the execution of F&RE capital work.

### 4.10.3.1 FACILITIES ASSESSMENTS AND PRELIMINARY SCOPING

F&RE investments are identified through inspections and Building Condition Assessments (BCAs). BGIS Global Integrated Solution Canada LP (BGIS) – a Canadian firm specializing in facilities management and project delivery services – manages inspections and maintenance of all Hydro One sites and facilities except for infrastructure systems directly dealing with electrical transmission and distribution, which are performed in-house by Hydro One. Through preventative maintenance and on-site BCAs, BGIS identifies assets for repair or replacement prior to failure and submits the necessary capital cost estimates to Hydro One. All facility needs are centrally tracked by BGIS and are regularly reviewed and assessed by Hydro One. These inspections and BCAs provide the foundation to identify candidate facilities for capital investments. They are ultimately used to inform the scope of work when the list of investments are confirmed through the Investment Planning Process (see GSP Section 4.7.3.2, for more information on the facilities assessment and investment identification process).

Once an investment is selected to proceed, the preliminary stage of the work execution process mainly consists of defining the project scope. This is an important step as it ensures that appropriate funding is allocated to the project and that the desired outcome will meet the needs of the respective line of business. During this stage, F&RE conducts a detailed review of the project requirements, BCAs, and operational constraints/considerations (e.g., the number of employees who will need to use the facility space, the type of function); identifies potential risks; and determines the required completion dates if applicable. Consideration is also given to which method of project delivery to use and whether to use BGIS or execute the project internally – all with a view to achieving best value and meeting the required schedule. Whether a project is executed through BIGS or internally, both processes follow Hydro One's Supply Chain policies, and a competitive Request for Proposals (RFP) is conducted in order to drive innovative solutions, efficiencies, and value for our customers. Before the construction tender package is issued, consideration is given to opportunities for cost savings, value engineering, and economies of scale that could be achieved by grouping programs and projects of similar scope together.

Successful bidders are selected and approved by Hydro One prior to project execution. Hydro One has partnered with BGIS under a 10-year agreement for facilities maintenance (refer to Exhibit E-05-01, Section 7.0 for contract details). We have established agreements with BGIS that cover new-build and capital sustainment projects. These services are further outlined below.

#### 4.10.3.2 CAPITAL PROJECTS AND PROGRAMS EXECUTION

Once the successful bidder is selected, BGIS leads the execution process with support from Hydro One in accordance with project charters that address project scope, schedule, risks, milestones, and other project deliverables. BGIS's project management is subject to four main tiers of controls:

1. The project schedule and progress is tracked by Hydro One in real-time through a cloud-based, BGIS-provided project management solution called PMWeb that monitors the project's progress, changes, and completion of work. The software also includes risk analysis and budget management tools.
2. In addition to providing real-time visibility of project costs and schedule, BGIS officially reports monthly to Hydro One on the progress of the capital plan and to resolve any instances of escalations.
3. Biweekly operational meetings are held between BGIS and Hydro One to address more detailed matters such as project approvals, funding requirements, and associated decision-making.
4. Finally, Hydro One has day-to-day touchpoints with BGIS through which Hydro One monitors the progress of projects, follows up on particular issues, and reviews invoices and the work that is taking place.

For the construction of new capital projects that involve unique, one-off work and require detailed scope and specifications, Hydro One may engage with specialized consultants or larger construction firms to develop a design technical package, which will then be included in an RFP to solicit qualified vendors. In such cases, Hydro One internally tracks project progression to ensure the successful completion of the project.

Any cost overruns or project delays are addressed in accordance with Hydro One's processes outlined in SPF Section 1.7.4.6, which includes the governance of variance approvals to modify the scope, schedule, or cost of either projects or programs. As a precondition to the release of funds, major projects, even if approved in Hydro One's investment plan, require a business case that sets out total cost, need for the investment, scope, expected result, other alternatives, regulatory impact, and potential material risks. The Program and Project Approval Procedure sets out the limits within which the scope of work, schedule, or cost may vary from a business plan before requiring approval. The thresholds, forms, and levels of approval are set out in the Procedure, and are based on the total value of the program or project, the size of the variance, and the forecasted expenditures.

In the final stage of execution – project closeout – Hydro One confirms that all necessary records, approvals, and permits are uploaded and archived before placing the project in service (i.e., ready for occupancy and financial closing).

For capital sustainment programs and projects such as roofing, wall refurbishment, building upgrades, and electric vehicle (EV) charger installation, BGIS arranges for consulting and construction work through a competitive bidding process to achieve cost efficiencies. BGIS manages the RFP process and shares documentation, bids, and prices with Hydro One. BGIS provides a recommendation to Hydro One regarding which bid to select based on price, project history, and references. Hydro One takes this recommendation into account in selecting the successful bidder. With respect to Hydro One's roofing programs, instead of awarding the work to multiple contractors, BGIS single-sourced the work to one general contractor as a package for multiple sites. This improves project delivery and the quality of work execution by ensuring an integrated, consistent, and streamlined approach and by allowing the general contractor to gain expertise in the unique aspects of Hydro One's facilities. With respect to EV chargers installed at

Hydro One facilities to support its electrical vehicle strategy (as provided in Section 4.11, G-GP-01), BGIS solicited bidders to complete all 11 sites in order to take advantage of economics of scale. This strategy provided cost savings in the form of lower consultant costs (as a result of tendering one program as opposed to 11 separately), consistency of work across sites, efficiencies from increased familiarity with Hydro One sites by contractors, and cost savings in materials.

#### 4.10.3.3 WORKFORCE RESOURCING STRATEGY

With respect to planned increases within its regular-status workforce segment, F&RE will be minimally impacted over the course of the rate period. This line of business will add one regular-status management FTE in 2023 to manage the Indigenous Relations portfolio and to manage land-use agents, as additional managerial support is required. In 2026, as a result of work being moved to BGIS, two FTEs will be internally transitioned from roles represented by the Power Workers' Union (PWU) to roles represented by the Society of United Professionals (the Society), due to a PWU agreement related to the BGIS contract. There will also be an addition of one Society-represented FTE to support the high volume of transmission capital and sustainment work and property management proposals (submissions from third parties to use the transmission corridor or other Hydro One lands for a compatible use defined by Hydro One, such as parking, parks, trails, pipeline/water mains, agriculture, etc.)

### 4.10.4 INFORMATION SOLUTIONS

Hydro One's Information Solutions Division (Information Solutions) is accountable for executing Information Technology (IT), Operating Technology (OT), and Security investments. Its capital work execution strategy is underpinned by a five-stage governance process as well as organizational changes designed to streamline the execution of programs and projects. These are discussed further below in Sections 4.10.4.1 and 4.10.4.2, respectively. This section also addresses the workforce resourcing strategy for the execution of Information Solutions capital work under Section 4.10.4.3.

#### 4.10.4.1 CAPITAL DELIVERY GOVERNANCE

Hydro One's capital work execution strategy for Information Solutions investments is governed by a five-stage process: (i) initiation, (ii) execution planning, (iii) business case, (iv) execution, and (v) closeout. This process is followed for all capital projects, regardless of the delivery methodology, to ensure that investments are prudently developed and monitored. Each of the stages is addressed in turn below.

**INITIATION**

The first step in the capital project delivery process for Information Solutions investments is the "initiation" of the solution, which focuses on defining the technology solution or combination of technologies that will meet business need and close gaps in capabilities required to achieve desired business outcomes.

In the initiation phase, lessons learned from previous projects are reviewed, initial technology requirements are gathered, and other potential stakeholders are identified who may be impacted by the technological changes. Project delivery methodology (i.e. waterfall vs agile) is also discussed and confirmed at this stage, prescribing the set of pre-determined activities and deliverables expected through the remaining stages. These discussions align the identified business needs with the corresponding IT investments and desired business outcomes. These discussions are then used to inform the overall scope and financial cost of the project.

The approach taken during the initiation phase depends on the type of the investment at issue, such as whether it involves an upgrade to an existing application or the implementation of an entirely new one. For example, the assessment conducted by Information Solutions may reveal that the business's needs can be met by expanding or transplanting solutions from elsewhere in the organization (e.g., extending a project management application from Engineering to Human Resources and Supply Chain, as discussed in GSP Section 4.11, G-GP-06). Other times, there may be a need to undertake a more intensive process of determining the best solution for the business need based on recent and/or anticipated technological changes. This generally involves putting out a request for information (RFI) to determine the solutions offered by various vendors, tendering an RFP, defining the technological approach to take, and selecting the successful bidder. In contrast, a "like-for-like" software upgrade – such as upgrading to a new version, without introducing changes to the application, database, or infrastructure – does not require this definitional exercise and can proceed straight to scoping. This is because the technology and vendor that will be used is already known, as is the business justification.

**EXECUTION PLANNING**

The execution planning phase consists of three stages that allow for refinement of a project before committing to budgets and forecasts:

1. **Defining the project.** This involves the creation of a project charter which, apart from defining the project, sets out change management issues that need to be addressed and describes what is intended to be accomplished with the solution.
2. **Scoping the solution to meet the precise requirements of the line of business**. This involves improving the enterprise architecture artifacts (the documents that facilitate the planning and execution of IT investments) and determining all the work needs to be done to implement the solution, what technological components are required, and what the security requirements are.
3. **Preparing a cost estimate**. This involves preparing a cost estimate to determine the resources required to do the work.

**BUSINESS CASE**

Information Solutions follows the same general business case process described in Section 4.10.3.2 above. A business case is required for each phase of work: initiation, execution planning, and implementation.

However, there are also governance processes specific to Information Solutions. In particular, once the initiation phase is complete, there is a set of mandatory enterprise architecture artifacts that must be prepared and presented to the IT Project Control Office. A project or program cannot go ahead unless it passes an audit and all mandatory artifacts are completed and approved by the respective lines of business. In addition, within larger IT projects, Hydro One uses internal Design Authority Governance Bodies to provide quality assurance and oversight. These bodies review project execution from a technical perspective to ensure that customization of solutions is minimized and that Hydro One adopts solutions that are efficient to maintain.

**EXECUTION**

At the execution stage, Information Solutions performs the required steps to deliver the IT solution to the business. This begins with a checkpoint with Hydro One’s Sustainment organization to determine the service levels of IT support that are required for the solution. Internal stakeholders then review the project status and determine whether all project conditions have been met. If the solution passes user acceptance testing (i.e., if it receives approval from the target user community), it can go live. The delivery methodology agreed to at the onset of the project may affect the number of “go lives”. For example, in an agile delivery framework, there may be iterative releases of bundled work that are developed, tested, agreed, and go live throughout the entire Execution stage.

Once the solution is live, it enters technical in-servicing, which begins with “hypercare support” – a defined period of heightened support by the project team to ensure that solution is functioning as planned. The length of this period varies depending on the size of the initiative: it is typically two weeks but could be as long as multiple months for a multi-year project.

**CLOSEOUT**

Hypercare support is followed by project closeout, which involves finalizing the financial information, closing off project accounts, and preparing a project closeout report as described above in Section 4.10.3.2. Once closeout is complete, the project is considered financially in-service.

### 4.10.4.2 TARGET OPERATING MODEL

Prior to 2021, Information Solutions Division (ISD) followed a “design, build and run” business model that followed a traditional waterfall delivery methodology for IT investments. The waterfall methodology is designed to execute work in logical sequences to ensure that the end product built for the business not only meets their needs, but had a clear timeline and cost. Many projects, particularly large new system implementations, have been successfully delivered utilizing this methodology, ensuring end to end solution components are fully tested before being released to production for business use. Through a review of entire IT portfolio delivered, there were a number of risks or challenges identified, noted as areas for potential improvement. These areas include:

1. **Delivery Time:** Projects that have multiple components to be delivered to the business were often bundled together as project. Waterfall delivery is prescriptive in its sequencing, resulting in longer delivery time to the business before realization of benefits.
2. **Costs:** Some projects may result in business requirement changes that are identified only after user testing. User testing is often sequenced after a number of design, build, and documentation project activities, which can then result in re-work across all of these earlier stages to accommodate the changes. This can lead to overall higher costs for the projects to achieve desired outcomes.
3. **Execution planning and estimation:** Project scope is often consolidated together as one project, which can increase the overall risk of estimation quality, and can lead to cost or time under/overruns to achieve the identified scope.
4. **Technology adoption:** Limited business involvement in the development of technology functionality has sometimes led to misalignments with business needs, resulting in lower rates of adoption of a technology solution.

5. **Ratepayer value:** The factors outlined above can erode the realized business value of an investment.

To overcome these challenges ISD developed a strategy to re-invent how to increase the value delivered to the business. This strategy included three core pillars:

1. Develop a new delivery model (Target Operating Model or TOM) to increase the *velocity* of solutions to the business with increased *quality* that promotes better adoption resulting in increased business *value*;
2. Invest in modern IT technologies that reduce development and sustainment costs while pushing IT as close to the business as possible; and
3. Negotiate a new third party sourcing agreement to increase the transparency of costs and allow Hydro One to diversify its supply chain to ensure optimal value.

**VELOCITY, QUALITY AND VALUE (VQV)**

Core to the new delivery model is achieving *velocity*, *quality* and *value* objectives. To achieve this, the delivery model decomposes the traditional design, build and run monolithic organization into highly focused delivery teams called "pods". A pod is aligned to specific business capabilities that support a specific line of business such as human resources, finance or asset management. Not only does the pod deliver solutions, they support the solution from cradle to grave. The pod, owned by the business, staffed with the necessary personnel to design, build and run the solutions.

The pod is responsible for all aspects of a solution; it requires the ability to prioritize work between sustainment break fix, enhancements and new functionality. To manage this effectively the pod will leverage an agile delivery framework. The design of the framework is to manage a backlog of work based on the business priority decomposed into delivery sprints. A sprint encompasses a specific feature, function or fix that typically delivered in a two to three week timeframe. When a sprint is completed, it either builds on previous sprints or is automatically deployed as an incremental release to the business. The business defines what functions are required, at a minimum, to deploy and realize value. This, known as Minimal Viable Product or MVP, allows the business to realize value sooner.

To manage the work effectively Hydro One is investing in development technologies to track work and the efficiency of the pod in its delivery. This technology combined with other technologies creates a “tool chain” that automatically manages the entire development life cycle from requirements, build, security, test, deployment and operations (this is known in the industry as “DevSecOps” or Continuous Integration, Testing, Deployment, Security and operations). Overtime the tool chain will become highly automated; testing, security, deployment and operations is continuous with minimal user involvement. In summary, the tool chain is integral to the velocity of delivery for the pod, the quality due to the continuous security, testing and deployment, and the delivery of value to the business sooner.

Key to driving increased efficiency of a pod is reflecting on the experience after each sprint completed. The retrospective allows the pod to understand what worked well and where there are opportunities for improvements. Industry best practices demonstrate that over time a pod will become efficient and predictable in their ability to deliver functionality. This reduces the estimation risk; better staffing levels based on backlogs; and reliable delivery timelines for business value.

Lastly, the agile methodology focuses on value rather than documentation. The proper amount of documentation is still required; however, the creation aligns with the development. The important difference is that the documentation now reflects what is built rather than what will be built. This reduces rework to align with the to-be solution and does not require formal approval governance. The agile delivery methodology is developed to fit within Hydro One’s overall project delivery governance, utilized as an alternative to the existing waterfall methodology, executed through the 5-stage process to ensure adequate oversight is maintained. Project methodology that best aligns with the project scope and delivery requirements to deliver the highest velocity, quality, and value, will be determined during project kick-off as part of the Initiation stage.

## ENTERPRISE ARCHITECTURE, OPERATIONS AND SECURITY

Three groups augment the pods: Enterprise Architecture, Security and Operations.

### Enterprise Architecture

Enterprise Architecture provides two central functions to support pods: Governance and Digital Centers of Excellence (COE). These services are provided to pods to ensure alignment across the enterprise in order to maximize business value and support the Hydro One drive to digitize the business and help identify incremental productivity savings in the future.

Architecture Governance has two major roles: enterprise alignment for technologies and investments. Technology alignment ensures that pods follow the standards and reference architectures as agreed upon when developing solutions for the business. This ensures that the enterprise achieves optimal benefit from the investments. Investment alignment focuses on aligning pod investments to the overall enterprise value realization. This includes end of life modernization, upgrades, over-all enterprise delivery capacity, pod collisions and new technology introduction.

The digital centers of excellence provide pods the services to support the digitization of the business: automation, analytics (AI, Machine Learning, Visualization, etc.) and software engineering technologies (micro services for integration, agile tool chains, and low code/no code platforms. This support includes principles, standards and guidance to the pods. The digital canters of excellence also perform joint innovation trials with the pods on upcoming technologies applied to existing business challenges at Hydro One. This collaboration allows innovation to breed from start and fail fast methodologies to determine the efficacy of new technologies.

### Operations

Provides managed reliable data center services and network connectivity to the broader enterprise. The governance follows the IT Infrastructure Library (ITIL) processes and provides insights and analytics into service operations. Operations also provides client technology, tools and self-service capability to improve digital maturity and end user satisfaction. Furthermore, through their Centers of Excellence they will support delivery environments, test and quality management along with the coordination of functionality release.

**Security**

Provides the policies, procedures, standards and reference architectures for the enterprise. Supports the PODS with expertise in adopting security within their delivery processes. This allows Hydro One to deliver secure and resilient products faster to the business. Finally, the protection of our network and data facilitated through event detection and incident response capabilities.

**Summary Benefits of the Target Operating Model**

The ISD strategy to build a new delivery organization built upon the negotiation of the new third party agreement with Capgemini (refer to section E-05-01, Sections 5.0 and 6.0) and new technologies will:

1. **Reduce Delivery Time:** Increase the velocity in which deliver new functionality to the business to realize their desired outcomes.
2. **Reduced Costs:** By organizing teams focused on solutions, adopting proven agile delivery methodology supported by an automated development, deployment and operational tool chain will reduce the delivery costs to the business.
3. **Execution planning and estimation:** Requirements decomposed into smaller, more manageable sprints, based on historical delivery efficiency, will allow for higher level of estimation and delivery accuracy.
4. **Technology adoption:** By working with the business throughout the entire build and delivery, will increase the likelihood that the business adopts the changes and realizes the expected outcomes.
5. **Ratepayer value:** Better estimates, reduced delivery costs and timelines will deliver more value to Hydro One rate payers.

#### 4.10.4.3 WORKFORCE RESOURCING STRATEGY

The key drivers of Information Solutions' resourcing plans are as follows:

1. Cost savings: reduced sustainment costs through ISD's new sourcing strategy.
2. Service delivery: support business enablement by ensuring that the right skills and methods are focused on business outcomes.
3. Enhanced trust and transparency: increased collaboration with embedded cross-functional teams.
4. Efficiency: improved digital capabilities enabling faster outputs, better data, and more value delivered to all lines-of-business.

These drivers support Information Solutions' resourcing decisions, such as its decision to self-perform certain work through the 2021-2027 period and to implement the new target operating model described above. Accordingly, the work program of Information Solutions is based on collaboration with the business to provide capabilities and enhanced services that will enable their business outcomes. Information Solutions' new operating model will aim to increase the speed of delivering high-impact solutions to the businesses, thus driving efficiencies.

Information Solutions is planning to deliver more work using internal resources through the 2021-2027 period compared to previous periods, largely due to the insourcing of Inergi resources and new services agreement reached with Capgemini, outlined in Exhibit E-05-01, Sections 5.0 and 6.0. As part of the negotiations for the new contract, Capgemini will maintain support of Hydro One's Help Desk, infrastructure support, as well as support related to SAP and Microsoft SharePoint. The remaining application support has been insourced to Hydro One, resulting in approximately 160 FTEs being added to Information Solutions effective March 1st, 2021.

This decision to insource aligns with the goals of Information Solution's target operating model, as it is expected to result in substantial efficiency and cost-saving opportunities for Hydro One, including:

- Regaining internal IT know-how and intellectual capital;
- Allowing for increased flexibility by enabling the agile target operating model;
- Reducing sustainment costs through the new agreement with Capgemini, achieving market-competitive prices while providing Hydro One with increased transparency on services delivered and increased control on outcomes through service-level agreements;
- The ability to internally pursue minor business enablement projects for Hydro One; and
- Increasing Hydro One's flexibility to go to market for competitive rates by reducing the scope of contracts for project service delivery on major projects.

Although Hydro One anticipates reduced reliance on external vendors and contractors as part of the increase in regular FTEs, which includes the insourcing of Inergi staff, third party delivery partners will continue to be a key pillar of Information Solutions' capital work execution strategy. Information Solutions will continue to leverage third-party vendors and contractors to successfully deliver the investment plan. Going to market allows for a competitive procurement process and the engagement of contractors with specialized skillsets to support and supplement short-term and project-based work that exceeds the available normal workforce levels (additional information on the role of contractors can be found in Exhibit E-06-01, Section 2.0). Working with Supply Chain, Information Solutions will maintain vendors of record to support major projects and transformations, base sustainment, business enablement, and specialized projects. A diverse partner landscape is intended to provide comprehensive support for Hydro One's technology organization, to provide the flexibility to scale up when needed, and to manage greater amounts of capital throughput using industry best practice.

# SECTION 4.11 – GSP – MATERIAL INVESTMENT SUMMARY DOCUMENTS

## 4.11.1 INTRODUCTION

For the purpose of the GSP, investments are defined as material based on either of the following conditions:

- The Transmission-allocated portion exceeds $3M during any year within the planning period, as defined in Section 2.1.1 of Chapter 2 of the OEB's Filing Requirements for Electricity Transmission Applications; or
- The Distribution-allocated portion exceeds $1M during any year within the planning period, as defined in Section 2.0.8 of Chapter 2 of the OEB's Filing Requirements for Electricity Distribution Applications.

The list of material investments are provided in Table 1 and their associated Investment Summary Documents (ISD) are provided in the following sections.

**Table 1 - Material General Plant Investments**

| ISD | Investment Name | Test Years (Planned $M) | | | | |
|---|---|---|---|---|---|---|
| | | 2023 | 2024 | 2025 | 2026 | 2027 |
| **Fleet** | | | | | | |
| G-GP-01 | Transport and Work Equipment | 67.2 | 68.7 | 69.3 | 70.4 | 72.8 |
| G-GP-02 | Helicopter Renewal | 9.2 | 9.4 | 9.6 | 9.6 | 9.8 |
| **Total Fleet** | | **76.4** | **78.0** | **78.9** | **80.0** | **82.6** |
| **Facilities and Real Estate** | | | | | | |
| G-GP-03 | Facilities and Accommodations | 78.5 | 79.3 | 51.6 | 48.4 | 40.8 |
| G-GP-04 | Transmission Facilities | 12.9 | 12.8 | 10.1 | 9.6 | 9.7 |
| **Total Facilities and Real Estate** | | **91.4** | **92.1** | **61.7** | **58.1** | **50.5** |
| **Information Solutions** | | | | | | |
| G-GP-05 | Information Technology Services Enablement | 19.5 | 21.9 | 27.2 | 28.9 | 24.9 |
| G-GP-06 | Corporate Services Enablement | 24.4 | 18.1 | 18.3 | 16.9 | 16.6 |
| G-GP-07 | Customer Service Technology Enablement | 4.1 | 18.7 | 18.1 | 35.1 | 33.0 |

| ISD | Investment Name | Test Years (Planned $M) | | | | |
|---|---|---|---|---|---|---|
| | | 2023 | 2024 | 2025 | 2026 | 2027 |
| G-GP-08 | Work and Asset Management Enablement | 37.3 | 42.0 | 36.1 | 22.8 | 16.7 |
| G-GP-09 | Operating Technology Cyber Security Equipment Replacement | 5.7 | 3.4 | 2.8 | 6.0 | 7.9 |
| G-GP-10 | Physical Security Upgrades | 14.0 | 8.0 | 8.0 | 8.0 | 4.0 |
| G-GP-11 | Security Monitoring | 6.5 | 4.0 | 1.0 | 1.0 | 1.0 |
| Information Solutions Projects and Programs Less Than Materiality Threshold | | 8.4 | 2.0 | 2.0 | 3.5 | 2.0 |
| **Total Information Solutions** | | **119.9** | **118.1** | **113.6** | **122.1** | **106.1** |
| **System Operations** | | | | | | |
| G-GP-12 | Common Operating Technology Infrastructure | 8.0 | 7.0 | 5.0 | 5.5 | 4.0 |
| G-GP-13 | Operating Technology Facilities Sustainment | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 |
| G-GP-14 | Integrated Voice Communication Technology Refresh | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| G-GP-15 | BU-OGCC Office Remediation | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 |
| G-GP-16 | Network Management System Investments | 7.6 | 0.0 | 1.2 | 2.5 | 2.5 |
| G-GP-17 | Outage Response Management System Upgrade | 5.5 | 5.5 | 0.0 | 0.0 | 0.0 |
| G-GP-18 | Distribution Management System Upgrade | 4.0 | 4.0 | 0.0 | 0.0 | 0.0 |
| **Total System Operations** | | **27.4** | **18.5** | **8.2** | **8.0** | **6.5** |
| **Other General Plant** | | | | | | |
| G-GP-19 | Grid Control Network Sustainment | 6.5 | 6.6 | 6.8 | 7.0 | 7.1 |
| G-GP-20 | Transmission Non-Operational Data Management System | 5.5 | 1.1 | 0.0 | 0.0 | 0.0 |
| G-GP-21 | Remote Terminal Unit Replacement Program | 7.7 | 7.9 | 8.0 | 8.2 | 8.3 |
| G-GP-22 | Hydro One Distribution Capital Contribution to Hydro One Transmission | 2.0 | 2.2 | 1.1 | 1.0 | 0.0 |
| Other Projects and Programs Less Than Materiality Threshold | | 5.8 | 6.8 | 6.1 | 7.0 | 6.8 |
| **Total Other General Plant** | | **27.5** | **24.6** | **22.0** | **23.2** | **22.3** |
| **Total Net General Plant Capital ($M)** | | **342.7** | **331.4** | **284.3** | **291.4** | **268.0** |
| Allocated to Transmission | | 146.8 | 124.0 | 114.2 | 115.9 | 105.0 |
| Allocated to Distribution | | 195.9 | 207.4 | 170.1 | 175.5 | 162.9 |

| G-GP-01 | TRANSPORT AND WORK EQUIPMENT |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness, Financial Performance |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 67.2 | 68.7 | 69.3 | 70.4 | 72.8 | 348.5 |

**Summary:**

This investment involves the replacement of the Hydro One's transport and work equipment, which is driven by the condition of Hydro One's fleet and the operational demands of the Transmission and Distribution businesses. The primary trigger of the investment is Business Support Sustainment. Through this investment, the necessary planned replacements of end of life vehicles will be carried out to ensure the ongoing availability of a functional fleet, which is crucial to maintaining the company's operational continuity and avoiding adverse impacts on work program delivery and customer reliability.

## A. OVERVIEW

The Transport & Work Equipment (TWE) program involves the replacement of end of life fleet vehicles. The program is driven by the need to replace these vehicles based on overall condition, which is assessed relative to a range of factors including: expected service life (ESL) based on age, mileage and/or engine hours, mechanical condition and maintenance history, and the requirement to support Hydro One work programs and staffing (including transmission and distribution capital and OM&A sustainment, development and operations work programs). TWE asset information and lifecycle strategy are detailed in GSP Section 4.2.2, and asset management and investment planning process in GSP Section 4.7.3.1.

This program is required to minimize fleet lifecycle costs and equipment downtime, in turn allowing Hydro One to optimize fleet equipment levels to meet work program demands and mitigate potential delays in response time to unplanned system and customer incidents, such as trouble calls and storm response. Hydro One is not proposing to increase the size of its fleet during the JRAP period.

In addition, this program will ensure that employees have the right equipment to do their job, minimize risk of injury and ensure work satisfaction. It also allows Hydro One to comply with applicable codes, standards and regulations while sustainably managing its TWE-related environmental footprint.

The projected costs of the program are estimated to be $348.5M over the 2023-2027 planning period.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

TWE investments are driven by the condition of Hydro One’s fleet and the operational demands of the Transmission and Distribution business.

A range of criteria inform the assessment of TWE assets. As a key input for the company's fleet lifecycle management approach, the ESLs of different categories of TWE help identify the assets that are considered "out of life". These assets are then further examined by technicians to verify condition prior to replacements. In 2020, Hydro One commissioned Utilimarc to conduct a Fleet Lifecycle Study[1] which showed, among other things, that in order to keep the overall fleet at an optimal life span, Hydro One will need to invest more capital to replace existing out of life equipment than historical funding levels provided. Replacing fleet equipment at the recommended ESL helps to control day-to-day operating costs and maximizes line-of-business productivity by improving uptime through equipment availability. As an illustrative example, Figure 1 depicts the annualized total cost for a light duty pickup truck over its lifespan, and shows that the optimal timing for replacement occurs before the truck's maintenance costs (which increase with age) lead to higher total lifecycle costs.

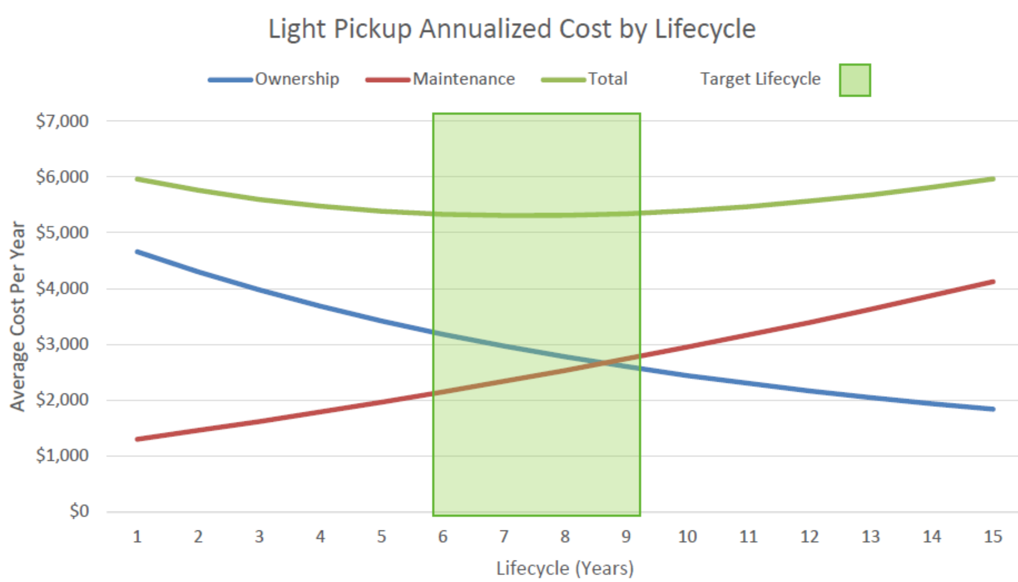


**Figure 1: Light Pickup Annualized Cost by Lifecycle [2]**

[1] Utilimarc Hydro One Fleet Lifecycle Study is provided as an attachment under GSP Section 4.3.
[2] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 9.

If Hydro One's historical TWE investment levels were to continue through the planning period, maintenance costs will increase by 17% from 2023 to 2027[3] due to the compounded effect of out of life[4] equipment increasing in population year over year (projected out of life equipment is provided in Figure 2 below). Under this funding scenario, by 2027, 47% of the fleet will be out of life and required maintenance labour hours are expected to increase by about 70,000 hours or 24% from 2023 to 2027.[5] These spikes in maintenance costs and corresponding downtime will adversely affect the utility's work programs that are crucial to ensuring customer service and reliability. Furthermore, these maintenance events could lead to equipment being unavailable due to overall mechanical condition. In order to counteract the expected increase in downtime and maintain equipment availability, Fleet Management Services is planning to replace TWE assets more consistently with the applicable optimal lifecycles (though not fully aligned with such lifecycles, due to the much higher overall capital envelope that will otherwise be required).

[3] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 13, *Historic Funding - Annual Maintenance.*

[4] Utilimarc uses the term "out of life" for equipment that has exceeded its recommended lifecycle, which aligns with Hydro One's internal definition of Expected Service Life (ESL) for planning purposes. The recommended lifecycles for various Hydro One vehicles classes are provided on page 11 of Utilimarc's Fleet Lifecycle Study.

[5] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 13, *Total Labour Hour Increase (Assuming Historic Funding)*.

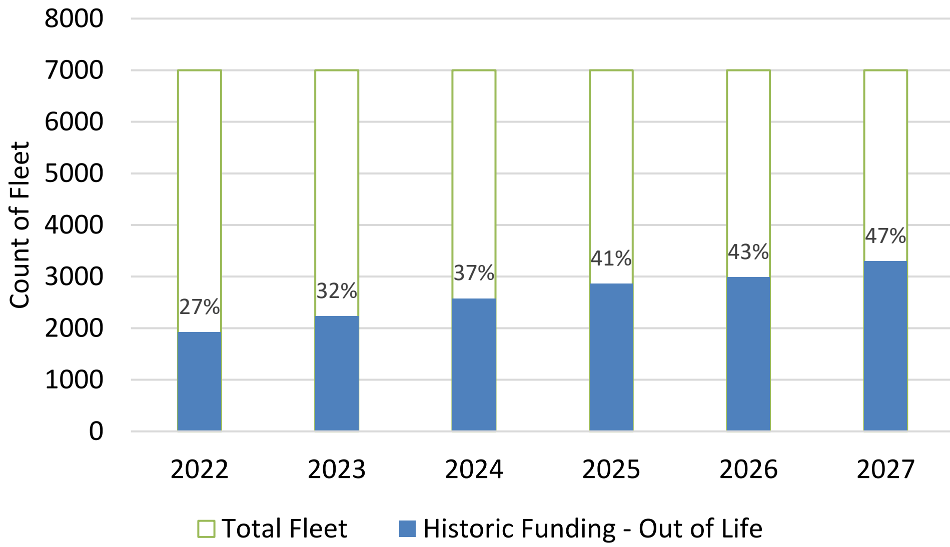


**Figure 2: Out of Life Equipment Count vs. Total Fleet Count**
**(Assuming Continuation of Historical Investment Levels)[6]**

In addition to meeting operational demands while avoiding increased fleet size and limiting costs for ratepayers, the proposed program is consistent with customer preferences. Hydro One found through customer engagement that "a majority of customers support Hydro One making the necessary investments in general plant to meet the same standard as similar businesses rather than just make do and only invest to address the most urgent needs".[7]

Fleet Management Services will continue to monitor utilization metrics in order to redeploy low mileage vehicles to meet work program demands. In 2020, 32% of the line of business requests for additional, short-term equipment were satisfied by redeploying relatively low-utilized equipment instead of the more costly external rental option.[8]

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[6] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 13, *Historic Funding - Out of Life.*
[7] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6 Attachment 1, page 5.
[8] Where required, external rentals are utilized for short term projects and work programs but have costs approximately 40% higher than owned equipment rates based on internal assessment.

In addition to like-for-like replacements, Fleet Management Services has begun the transition to low or zero emission technologies – in particular, fleet electrification. This shift is driven by various factors including maturing battery technology, increased driving range for electric vehicles (EVs), increased global awareness to climate change and greenhouse gas (GHG) emissions, and improved economics based on total cost of ownership models for EVs versus internal combustion engine (ICE) vehicles. As a member of the Edison Electric Institute, Hydro One has committed to transforming a portion of its fleet to plug-in electric or hybrid electric vehicles by 2030. Currently, Hydro One owns and operates approximately 2,800 light duty vehicles. Hydro One will begin a gradual EV adoption of light duty vehicles. In 2023, Hydro One will devote 16% of fleet's capital investment towards EVs and increasing to 50% by 2030 with the purchase of pickup trucks, vans and Heavy Power Take-Off (PTO) units as they become available in the market. This gradual approach will minimize risks associated with rapid changes in EV technologies and infrastructure.

Through this investment, the necessary planned replacements of end of life vehicles will be carried out to ensure the ongoing availability of a functional fleet, which is crucial to maintaining the company's operational continuity and avoiding adverse impacts on work program delivery and customer reliability.

## C. INVESTMENT DESCRIPTION

The TWE Replacement Program involves capital investment to replace end of life TWE assets of approximately 500 units a year, which, compared with historical investments, will more effectively control the current increasing trend in fleet average age (which means escalating maintenance requirements and total lifecycle costs) and replace TWE assets in closer alignment with optimal lifecycles. Under the proposed investment levels, maintenance costs (labour and parts) will remain relatively flat year over year, as shown in Figure 3. Over the planning period, the proposed replacements will result in increased equipment availability due to reduced breakdowns and will reduce overall exposure to maintenance requirements. The out of life unit count would decrease from 28% in 2023 to 26% - at the end of 2027, as illustrated in Figure 4.

| Proposed Funding | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $58,751,660 | $60,020,550 | $60,663,270 | $61,543,910 | $63,694,290 |
| Units Replaced | 253 | 258 | 554 | 556 | 549 | 551 | 556 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $62,506,600 | $62,643,440 | $62,844,990 | $63,017,950 | $63,166,600 |
| Annual Ownership | $34,798,810 | $33,225,780 | $37,439,450 | $41,045,210 | $44,099,020 | $46,744,460 | $49,271,810 |
| Total | $95,374,500 | $95,959,670 | $99,946,050 | $103,688,700 | $106,944,000 | $109,762,400 | $112,438,400 |
| Out of Life | 1,582 | 1,923 | 1,936 | 1,981 | 1,978 | 1,814 | 1,827 |
| Avg Age | 9.77 | 10.02 | 9.70 | 9.52 | 9.38 | 9.26 | 9.14 |

**Figure 3: Proposed Funding Projections for 2023-2027 from Utilimarc's Hydro One Fleet Lifecycle Study [9]**

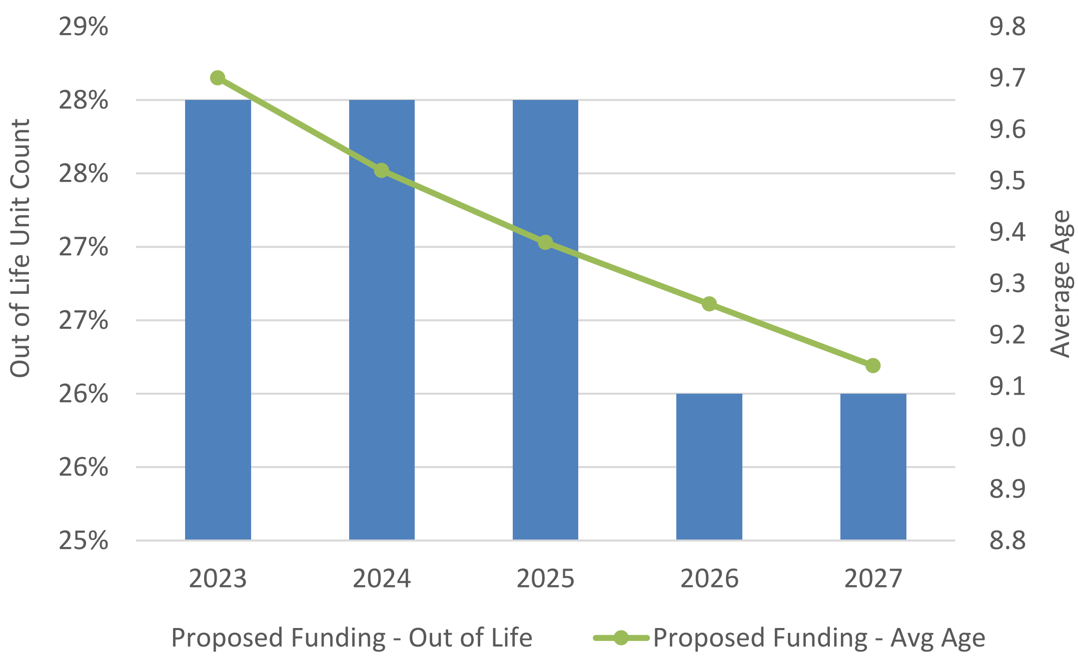


**Figure 4: Out of Life Equipment Count and Average Age of the Fleet at Proposed Investment Levels[10]**

[9] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Proposed Funding*

[10] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Proposed Funding - Out of Life, Average Age.*

As noted above, fleet replacements are based on the condition of TWE assets, which is assessed at the population-level through ESL and at the asset level through mechanical evaluations (see GSP Sections 4.2.2 and 4.7.3.1). ESL is based on manufacturer's recommendations for life expectancy and further supported by industry benchmarking recommendations.

Through the proposed 2023-2027 TWE Replacement Program, Hydro One will carry out the necessary replacements of TWE assets that have reached the replacement criteria based on age, mileage, engine hours and physical condition.

The proposed breakdown of spending over the test period is summarized in Table 1 below. Fleet Management Services performs an on-going assessment of equipment needs and the costs indicated per equipment type may be subject to change based on replacement priorities.

**Table 1 - Forecast of Acquisitions for 2023 to 2027 ($M)**

| Equipment Type | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| Light & Heavy Non-PTO[1] | 21.8 | 21.8 | 21.3 | 21.7 | 21.7 |
| Heavy PTO[2] | 25.7 | 28.3 | 25.5 | 25.8 | 28.8 |
| Off-Road[3] | 6.0 | 6.7 | 7.0 | 7.3 | 5.5 |
| Miscellaneous[4] | 5.2 | 3.3 | 6.8 | 6.7 | 7.8 |
| Small Off-Road[5] | 2.0 | 2.1 | 2.1 | 2.2 | 2.2 |
| Service Equipment[6] | 6.4 | 6.5 | 6.6 | 6.8 | 6.9 |
| **Total[7]** | **67.2** | **68.7** | **69.3** | **70.4** | **72.8** |

*[1]Light & Heavy Non-PTO – cars, SUVs, pickups, vans, highway tractors.*
*[2]Heavy PTO – service trucks, radial boom derricks (RDB), bucket trucks.*
*[3]Off Roads – rubber tire, tracked equipment.*
*[4]Miscellaneous – boats, chippers, tensioners, manlifts, forklifts.*
*[5]Small Off-Road– snowmobiles, ATVs, UTVs.*
*[6]Service Equipment – Minor Fixed Assets – Generators, compressors, etc.*
*[7]Total investment costs are based on average unit costs and relate to approximately 500 units annually.*

# D. OUTCOMES

The TWE Replacement Program will help control fleet average age and ensure equipment availability and uptime to meet work program demands and associated TWE requirements. The investment accounts for current and projected work program demands and is evaluated against the business plan on an annual basis (as explained in GSP Sections 4.2.2 and 4.7.3.1).

It is important to note that a reduction in capital investments on TWE will result in a year over year increase in out of life equipment that will have an negative impact on operating costs, ultimately resulting in increased equipment downtime and decrease in equipment reliability and safety impacting the work programs and customers.

## D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 2 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Mitigate potential fleet-related delays in response time to unplanned customer incidents, such as trouble calls and storm response. |
| **Operational Effectiveness** | • Fleet vehicles and other specialized equipment at optimal levels of availability reduce human effort and minimize risk of injury.<br>• Optimal investment levels allow employees to have the right equipment to do their job, increase employee engagement levels, and increase work satisfaction. |
| **Public Policy Responsiveness** | • Optimal fleet investment levels help to maximize equipment efficiencies and minimize Hydro One's fleet-related environmental impact.<br>• Support Hydro One's overall direction to manage our environmental footprint by GHG reductions.<br>• Vehicles will be maintained to ensure public and employee safety and to meet Ministry of Transportation standards. |
| **Financial Performance** | • Ensure savings from operational effectiveness are sustainable.<br>• Achieve operational cost savings from EV adoption.<br>• Control maintenance costs (external repair, parts and internal labour), potential rental costs and equipment rates at optimal levels. |

## E. EXPENDITURE PLAN

Table 3 below summarizes the projected spending on the aggregate investment level.

**Table 3 -Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 67.2 | 68.7 | 69.3 | 70.4 | 72.8 | 348.5 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **67.2** | **68.7** | **69.3** | **70.4** | **72.8** | **348.5** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **67.2** | **68.7** | **69.3** | **70.4** | **72.8** | **348.5** |

The internal factors influencing the cost of the investment, as detailed in GSP Section 4.7.3.1, include:

- Functionality and safety of equipment relative to operational requirements and equipment standards;
- Staff and equipment complement requiring vehicles;
- Technological improvements in the TWE industry and potential for EV adoption.

External factors influencing the cost of this investment include the pricing and availability of vehicles in the market, which are mitigated through contractual arrangements with the majority of original equipment manufacturers, as discussed in Section G below.

## F. ALTERNATIVES TO PROPOSAL

Hydro One considered the following alternatives before selecting the preferred undertaking (as described above in Section C). Figure 5 demonstrates the impact of the three investment level scenarios on expected out of life unit count. Figure 6 demonstrates the impact of the three investment levels over the planning period.

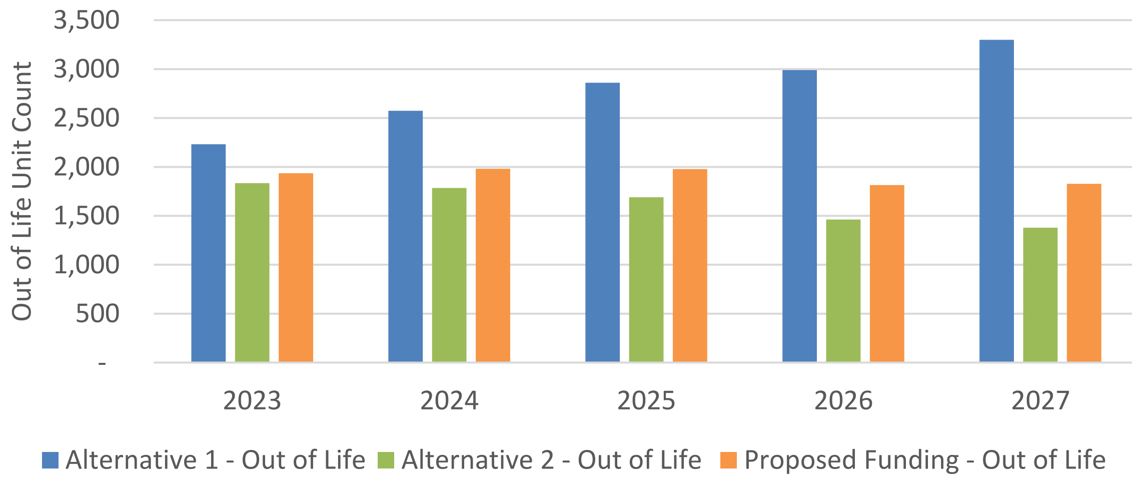


**Figure 5: Out of Life Count Based on Funding Levels[11]**

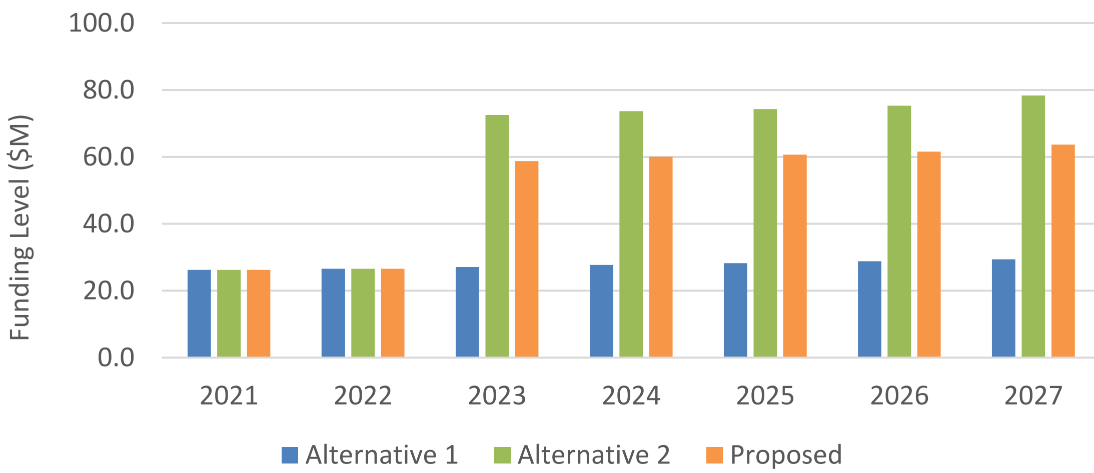


**Figure 6: Funding Levels Over the Planning Period[12]**

[11] Data Sources: Alternative 1 - Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 13, *Historic Funding - Out of Life* | Alternative 2 - Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Full Funding - Out of Life* | Proposed - Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Proposed Funding - Out of Life.*

[12] Data Sources: Alternative 1 - Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 13, *Historic Funding – Annual Capital* | Alternative 2 - Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Full Funding – Annual Capital* | Proposed - Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Proposed Funding – Annual Capital*.

**ALTERNATIVE 1: STATUS QUO**

Under this alternative, Hydro One would maintain the historical Investment levels in fleet. This alternative focuses on minimal capital spending on TWE in favour of increased operating costs, increased use of rental equipment (if available), and extended retention and maintenance of existing equipment to satisfy work program and staffing requirements.

Increased maintenance and repair costs will be incurred on the retained vehicles. Older vehicles tend to have more breakdowns and require more maintenance, which will require more technician hours to maintain the aging fleet. This will in turn lead to increased equipment downtime and decreased equipment availability to execute the work program. As illustrated in Figure 7, under this alternative, maintenance costs (outsource and internal labour and parts) will increase from $65.2M a year in 2023 to $76.4M a year in 2027. Fleet Management Services may also be required to not only increase internal labour but also increase external technician hours by 5% in 2023 to 24% in 2027. If the historic investment levels were to be continued, 47% of Hydro One's fleet will be out of life relative to the lifecycle recommended by Utilimarc by 2027.

| Historic Funding | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $27,112,210 | $27,701,380 | $28,255,400 | $28,820,510 | $29,396,920 |
| Units Replaced | 253 | 258 | 258 | 259 | 259 | 259 | 259 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $65,272,360 | $68,014,560 | $70,813,710 | $73,641,950 | $76,474,390 |
| Annual Ownership | $34,798,810 | $33,225,780 | $31,999,780 | $31,090,460 | $30,450,240 | $30,035,920 | $29,809,580 |
| Total | $95,374,500 | $95,959,670 | $97,272,150 | $99,105,020 | $101,264,000 | $103,677,900 | $106,284,000 |
| Out of Life | 1,582 | 1,923 | 2,232 | 2,574 | 2,861 | 2,989 | 3,299 |
| Avg Age | 9.77 | 10.02 | 10.37 | 10.75 | 11.14 | 11.53 | 11.90 |

**Figure 7: Historic Funding Scenario Projections for 2023-2027 from Utilimarc's Hydro One Fleet Lifecycle Study[13]**

Under this investment scenario, in order to meet work demands for 2023-2027, Hydro One will have to rely on rentals and further retentions of out of life equipment. Relying on rentals would be challenging due to the specialized equipment that needs to be specifically outfitted to Hydro

[13] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 13, *Historic Funding.*

One safety specifications. Due to inherent challenges associated with the nature of Hydro One's work activities, remote and difficult to access locations and challenging weather conditions, incremental maintenance and repairs costs would also be incurred as a result of the harsher wear and tear on the rental vehicles, which Hydro One would be responsible for. Moreover, historical costs indicate that rental costs are approximately 40% higher than owned equipment rates. Lastly, this alternative would adversely impact the availability of functional and reliable vehicles to enable work program execution, which may lead to delays in power restoration or missed outages, due to an increase in the frequency of unplanned equipment breakdowns.

**ALTERNATIVE 2: RECOMMENDED PROPOSAL**

This alternative is the recommended proposal from Hydro One as indicated in Section C above. This proposal allows Hydro One to replace approximately 50% more out of life units than Alternative 1. This Investment level is expected to minimize escalations in maintenance costs (labour and parts) year over year and lead to increased equipment availability due to reduced breakdowns and maintenance requirements overall.

| Proposed Funding | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $58,751,660 | $60,020,550 | $60,663,270 | $61,543,910 | $63,694,290 |
| Units Replaced | 253 | 258 | 554 | 556 | 549 | 551 | 556 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $62,506,600 | $62,643,440 | $62,844,990 | $63,017,950 | $63,166,600 |
| Annual Ownership | $34,798,810 | $33,225,780 | $37,439,450 | $41,045,210 | $44,099,020 | $46,744,460 | $49,271,810 |
| Total | $95,374,500 | $95,959,670 | $99,946,050 | $103,688,700 | $106,944,000 | $109,762,400 | $112,438,400 |
| Out of Life | 1,582 | 1,923 | 1,936 | 1,981 | 1,978 | 1,814 | 1,827 |
| Avg Age | 9.77 | 10.02 | 9.70 | 9.52 | 9.38 | 9.26 | 9.14 |

**Figure 8: Proposed Funding Projections for 2023-2027 from Utilimarc's Hydro One Fleet Lifecycle Study[14]**

[14] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Proposed Funding* (Figure 8 provides the same data set provided in Figure 3. This data is repeated here for reference.)

**ALTERNATIVE 3: UTILIMARC PROPOSAL**

This alternative represents the capital requirement derived by Utilimarc based on the recommended lifecycle policy (see GSP Section 4.3 Attachment 2, page 11). Under this alternative, investment levels would see an increase of 8% from $72.5M in 2023 to $78.4M in 2027, maintenance costs (outsource and internal labour and parts) are expected to decrease by 4% (from $61.6M in 2023 to $59.4M in 2027), as shown in Figure 9 below. Further, out of life units are expected to decrease in population from 26% of the total fleet in 2023 to 20% in 2027, as shown in Figure 10 below.

| Full Funding | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|
| Annual Capital | $26,238,742 | $26,580,590 | $72,528,470 | $73,676,100 | $74,307,240 | $75,281,180 | $78,360,770 |
| Units Replaced | 253 | 258 | 656 | 650 | 642 | 614 | 652 |
| Annual Maintenance | $60,575,690 | $62,733,890 | $61,609,180 | $60,940,330 | $60,351,240 | $59,777,660 | $59,377,860 |
| Annual Ownership | $34,798,810 | $33,225,780 | $39,753,910 | $45,203,070 | $49,754,950 | $53,627,540 | $57,256,690 |
| Total | $95,374,500 | $95,959,670 | $101,363,100 | $106,143,400 | $110,106,200 | $113,405,200 | $116,634,500 |
| Out of Life | 1,582 | 1,923 | 1,834 | 1,785 | 1,689 | 1,462 | 1,379 |
| Avg Age | 9.77 | 10.02 | 9.46 | 9.11 | 8.81 | 8.64 | 8.38 |

**Figure 9: Full Funding Scenario Projections for 2023-2027 from Utilimarc's Hydro One Fleet Lifecycle Study** [15]

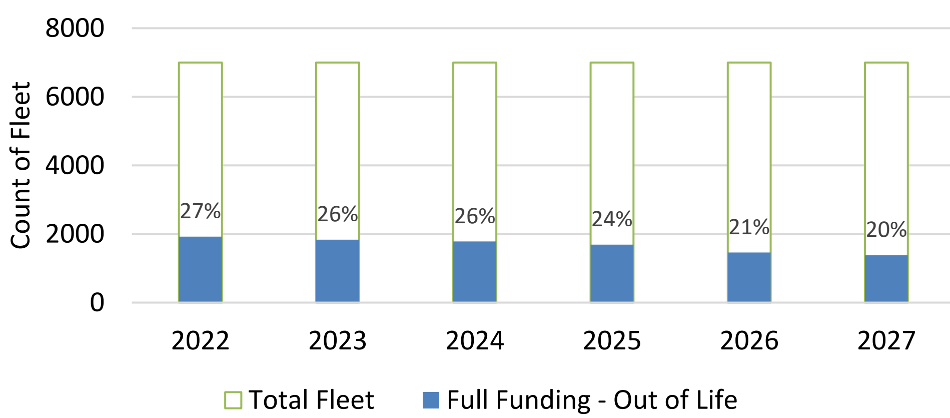


**Figure 10: Out of Life Equipment Count vs. Total Fleet Count Under Full Funding Scenario**[16]

[15] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Full Funding.*

Hydro One has analyzed all three Investment levels and considered the proposed investment level as the most balanced approach. A balanced investment will ensure that immediate and future equipment replacement requirements are optimized. A sustained replacement cycle ensures that Fleet Management Services is able to provide appropriate need forecast and equipment manufacturers are able to deliver on time. Finally, a balanced investment approach will assist in mitigating fleet maintenance costs and maintain stability in the standard fleet equipment rate.

## G. EXECUTION RISK AND MITIGATION

The TWE Replacement Program is dependent on the manufacturer's delivery and production schedule and may be impacted by market dynamics leading to limited availability. Manufacturing delays may result in delayed delivery of the asset in a budget year as planned. This risk is partly mitigated through contractual arrangements with vendors. For example, contract pricing would cover upfitting as well as the acquisition costs of the chassis, and penalties would be included for late delivery, failure of delivery, and deficiencies on arrival.

[16] Utilimarc, Hydro One Fleet Lifecycle Study (January 19, 2021) – GSP Section 4.3 Attachment 2, page 12, *Full Funding – Out of Life*

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| **G-GP-02** | **HELICOPTER RENEWAL** |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Financial Performance |

**Capital Expenditures:**

| **($M)** | **2023** | **2024** | **2025** | **2026** | **2027** | **Total** |
|---|---|---|---|---|---|---|
| **Net Cost** | 9.2 | 9.4 | 9.6 | 9.6 | 9.8 | 47.5 |

**Summary:**

This investment involves the the replacement and standardization of Hydro One's helicopter fleet in order to meet the needs of the Transmission and Distribution lines of business, including essential enhancements to the safety of flight operations as well as higher performance margins and load carrying capacity. The newer aircraft are equipped with flight data recorders, dual hydraulic flight control systems and crash resistant fuel tanks, all of which provide additional safety margins for pilots and on-board personnel. The investment is also expected to result in increased helicopter availability (as a result of less required maintenance and extended maintenance cycles of new aircraft), and operational capabilities.

## A. OVERVIEW

The Helicopter Renewal Program involves the replacement and standardization of Hydro One's helicopter fleet in order to meet the needs of the Transmission and Distribution lines of business and enhance the safety of flight operations. Hydro One is not proposing to increase the size of its fleet during the JRAP period.

Helicopters are used by Hydro One's lines of business for a range of work activities, including pole setting, insulator replacements and line patrols/inspections. They are also crucial to enabling timely storm or trouble response across a vast service territory that includes remote and hard to reach areas. The procurement of modern helicopters with higher performance margins and load carrying capacity would more effectively serve the execution needs of Hydro One's growing work program across the province and avoid the need for third party rentals where an existing older aircraft does not meet the required performance threshold (e.g., to lift heavier poles).

This investment will result in essential safety enhancements. The newer aircraft are equipped with flight data recorders, dual hydraulic flight control systems and crash resistant fuel tanks, all of which provide additional safety margins for pilots and on-board personnel. In addition, procuring newer AS350 helicopters to replace the two previous AS350 variants that are currently in use by Hydro One will allow equipped features and capabilities to be standardized across the fleet. Standardization will lead to further safety benefits (i.e. minimizing the risk of pilot error associated with frequent change of aircraft during a work week) and allow full motion simulators to be used for advanced emergency scenario exposure. The proposed investment will bring about much needed improvements in equipment capability and safety margins when operating in the low level flight environment or over urban centres.

Helicopter asset information and lifecycle strategy are detailed in GSP Section 4.2.2, and asset management and investment planning process (as applied to General Plant) in GSP Section 4.7.

The costs of the program are estimated to be $47.5M over the 2023-2027 period.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

Hydro One's current helicopter fleet is comprised of variants of the AS350 Airbus Helicopters (AS350B2 and AS350B3) that the company procured in 1990, 2002 and 2007, one twin engine Twin Star AS355NP purchased in 2014, and one single engine AS350 helicopter (H125) purchased in 2019. The oldest aircraft (AS350B2) are near end of life and are on average 25 years old. Fleet demographics is illustrated in Figure 1 below.

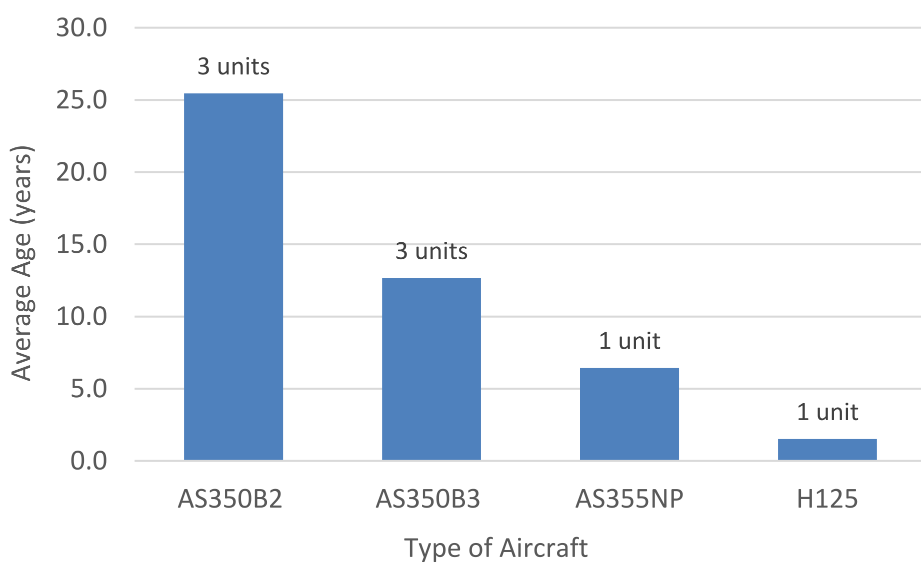


**Figure 1: Current Helicopter Fleet Demographics (Average Age and Quantity by Variant)**

Given the varied capabilities across the different variants as well as their limitations relative to work performance and safety needs, a planned helicopter replacement program is required to ensure that the fleet remains aligned with Hydro One's operational requirements and is equipped with up-to-date safety features.

Helicopters are used in line patrols, material delivery to both Distribution and Transmission rights of way, pole setting in both urban and rural areas, transporting workers into hard to access work zones, and timely response to storms and unplanned incidents. More specifically:

- As part of the forestry program, helicopters transport workers along the rights of way and deliver materials and equipment in support of the vegetation management activities.
- Helicopters are used in construction services to support line construction and repair, poles and cross arm installations, and material delivery. Currently, external service providers have to be contracted to provide heavy lift capabilities when pole weights exceed the maximum lift limits of the existing helicopter fleet (generally, anything over 2300 pounds).
- The Transmission Lines business relies on helicopters for asset inspections, including regular patrols of the lines and detailed helicopter inspections (DHI) to collect detailed data regarding bolts, cross arms, towers, conductor and insulators. In addition, helicopters help perform certain specialty work in maintaining the transmission lines infrastructure, including the insulator change programs and tower access. A patrol program using the AS355NP (twin engine aircraft) and a specialized forward looking infrared (FLIR) camera is also used to support asset management. Line decommissioning is supported by using helicopters to remove old towers and material without the need for building new roads and without increasing the overall environmental footprint.

- The Distribution Lines business leverages helicopters for services in a similar way to the Transmission Lines business. An example of Distribution Lines work is the use of a helicopter to set a series of new poles at the edge of an urban neighbourhood, where feasible and necessary to avoid substantial impact to private/residential properties. In addition, the helicopter fleet provides high value, critical support for storm and outage response activities, allowing power line crews to respond in a timely manner and thus minimizing down time for customers following storm damage. For example, a recent storm response was extensively supported by Helicopter Services with over 116 hours of flying across different regions over a five day period (as depicted by the aircraft tracking map in Figure 2 below). This response involved 5 helicopters, 104 separate flights and over 6,600 km flown – an extensive effort covering a vast geographic area that would not have been possible without a capable and safe helicopter fleet.

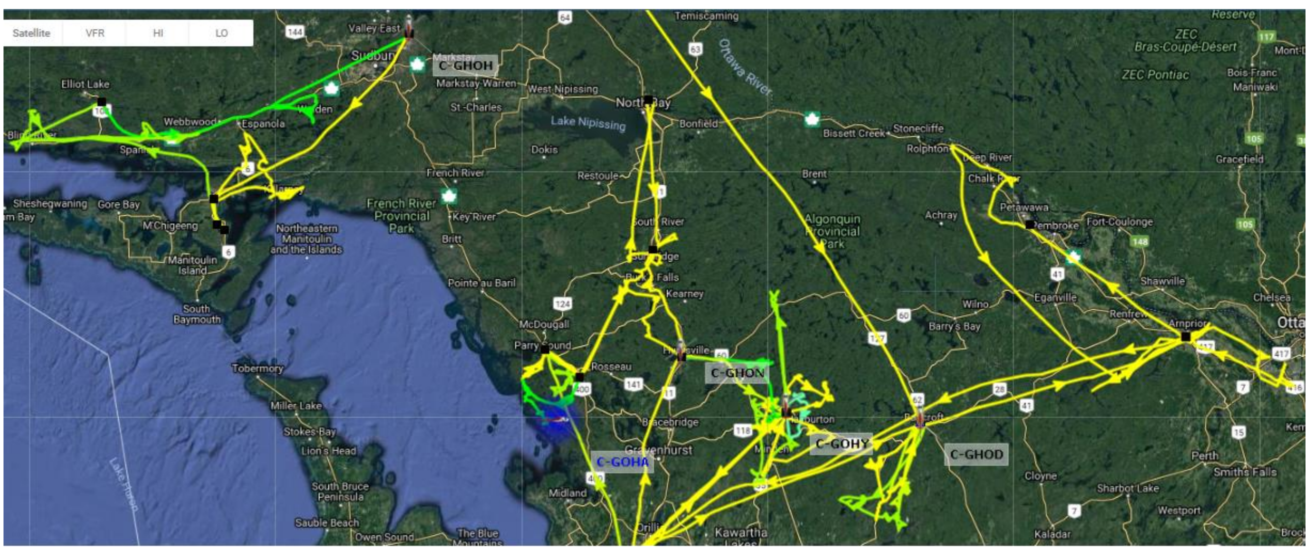


**Figure 2: Helicopter Flight Tracking Map from September 21-26, 2018 Storm Response**

Consistent with Hydro One’s corporate strategy and values, safety is a paramount consideration in the completion of work, including the procurement of tools/equipment in support of safe execution. As part of the AS350 helicopter class, the H125 is a modern, single engine variant that offers enhancements in performance and fuel management, a longer cycle between engine overhauls, and a redesigned tail-rotor for increased control and stability at low speeds or high hovers. These enhancements reduce pilot workload, contributing to less pilot fatigue and safer and more efficient pilot performance.

H125 aircraft also include a factory installed crash resistant fuel tank and dual hydraulic flight control systems. In the event of an accident or hard landing, the crash resistant fuel tank minimizes the risk of a fuel spill or post-incident fire, thereby improving survivability for personnel and reducing environmental risk. The dual hydraulic flight control system mitigates the consequence of a hydraulic failure by providing the pilot with a fully redundant system as a strong safety enhancement. None of these features can easily or economically be retrofitted onto the existing Hydro One fleet.

H125 aircraft can also lift heavier external loads and offers increased power margins for most flying activities. In this regard, standardizing Hydro One's helicopter fleet and minimizing the number of variants in use would lead to significantly improved safety margins, because it would avoid the risk of a pilot potentially operating a helicopter beyond its capabilities when switching between different variants of aircraft from flight to flight during a work week. In addition, full motion flight simulators are not available for the AS350 B2/B3 variants that are currently in use by Hydro One. Full motion simulators are available for the H125 variant, which means pilots can be exposed to advanced emergency training scenarios in a risk free environment, thereby increasing their skill levels and mitigating the risk of serious injury in the event of a major malfunction.

While it is possible to maintain older aircraft, older aircraft will require significant and costly maintenance activities and rebuilds to maintain airworthiness, such as the 12-year inspection (costing about $400,000 to complete, on a 12 year cycle) for an asset with no book value remaining and with diminishing operating capabilities. In comparison, newer aircraft such as the H125 variant have an increased mean time between overhauls (MTBO), which will help reduce the costs of maintenance parts for a 4 to 6 year period after they come into service (i.e., when a unit is within its warranty period). This amounts to an approximately 7% reduction in total helicopter fleet maintenance parts costs. Through the proposed investments, Helicopter

Services would also reduce the number of engine types being operated and maintained from four to two types, which would result in additional reduction in maintenance cost and risk. As the proposed helicopter replacements take place over time, the aforementioned cost benefits are expected to help avoid cost increases associated with the maintenance of aging units and offset limited increases in maintenance costs stemming from the introduction of twin engine helicopters, thereby keeping overall maintenance costs (labour and parts) relatively flat.

## C. INVESTMENT DESCRIPTION

The Helicopter Renewal Program involves the replacement of aging helicopter assets, starting prior to and continuing through the JRAP period. The proposed gradual replacement will result in a complete helicopter fleet renewal with the exception of the H125 purchased in 2019 by the end of 2027. The investment includes costs to replace one helicopter unit each year and approximately $0.5M annually for the replacement of major components and tools. Hydro One is not planning to expand the size of the fleet. As part of this program, Hydro One plans to purchase a mix of the H125 variant and at least two twin-engine helicopters with appropriate capabilities for tower access and other low level, low speed helicopter operations where employees experience prolonged risk exposure in such working environments.

Over the planning period, the proposed replacements will result in improved safety features and operational capabilities, as well as increased helicopter availability (as a result of less required maintenance and extended maintenance cycles of new aircraft).

## D. OUTCOMES

This investment will ensure that capable and safe helicopters are available to support Hydro One’s work programs. Helicopter Services assesses and accounts for current and projected work program demands against operational requirements on an annual basis, as explained in GSP Sections 4.2 and 4.7.

As new replacement helicopters are brought into service, the investment will also help avoid increases in fleet maintenance requirements and costs (which would otherwise be required to maintain the airworthiness of an aging fleet) as well as an associated decrease in aircraft availability due to maintenance activities.

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Support Hydro One's ability to execute Transmission and Distribution work activities that rely on helicopters and mitigate delays in response time and impact on customers during storm or trouble response. |
| **Operational Effectiveness** | • Achieve improvements in helicopter operations safety that are needed to better protect pilots and personnel.<br>• Standardization will allow for the use of full motion simulators for robust pilot training in support of more effective and safer operations. |
| **Financial Performance** | • Newer, more capable helicopters will help control OM&A expenditures and helicopter downtime associated with increased maintenance of aging aircraft. |

## E. EXPENDITURE PLAN

The forecast includes costs to replace one helicopter unit each year, plus approximately $0.5M annually for the replacement of major components and tools. These costs are based on current market rates and historic spending on major component replacement.

Table 2 below summarizes projected spending on the aggregate investment level. The forecast includes costs to replace one helicopter unit each year, plus approximately $0.5M annually for the replacement of major components and tools. These costs are based on current market rates and historic spending on major component replacement.

**Table 2 – Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 9.2 | 9.4 | 9.6 | 9.6 | 9.8 | 47.5 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **9.2** | **9.4** | **9.6** | **9.6** | **9.8** | **47.5** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **9.2** | **9.4** | **9.6** | **9.6** | **9.8** | **47.5** |

The factors influencing the cost of the investment include:

- Limited supplier availability in that Airbus Helicopters is the only company making the AS350 line of aircraft.
- Worldwide market forces may impact delivery dates for replacement aircraft.
- Due to the inherent monopolistic nature of aircraft manufacturing, there is limited to no ability to benefit from bulk purchases for the capital asset.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking.

**ALTERNATIVE 1: STATUS QUO**

Under the status quo alternative, Helicopter Services would continue to operate the existing fleet and perform increased maintenance/overhauls to maintain airworthiness. While this alternative would avoid capital investments in the short term, it would not address the lack of modern safety features, limitations in operational performance relative to Hydro One’s work execution needs, and escalating maintenance requirements associated with an aging fleet (including three AS350B2 units approaching end of their service life). Maintaining the status quo was therefore not a viable or prudent alternative.

**ALTERNATIVE 2: RENEW HELICOPTER FLEET WITH H125 VARIANT AND TWIN ENGINE HELICOPTERS (RECOMMEND ALTERNATIVE)**

As described above under Section C (Investment Description), the proposed alternative aims to gradually renew Hydro One's helicopter fleet (without increasing the overall fleet size) through a mix of the H125 variant and at least two twin engine helicopters with advanced performance capabilities for low level flying. The investment includes costs to replace one helicopter unit each year and approximately $0.5M annually for the replacement of major components and tools. Over the planning period, the proposed replacements will result in improved safety features, operational capabilities, and increased helicopter availability (as a result of less required maintenance and extended maintenance cycles of new aircraft).

**ALTERNATIVE 3: UPGRADE HELICOPTER FLEET TO ALL TWIN ENGINE HELICOPTERS**

Consideration was given to upgrading the entire helicopter operation to twin engine aircraft. Capital acquisition costs for this option would be significantly higher, with a concurrent increase in OM&A expenditures as twin engine aircraft are more expensive to operate. Furthermore, this option would also result in a higher helicopter fleet rate being recovered from Hydro One's lines of business that rely on the helicopter fleet for essential activities, which could result in a reduction of helicopter usage due to cost considerations.

## G. EXECUTION RISK AND MITIGATION

The Helicopter Renewal Program is dependent on the manufacturer's delivery and production schedule. Manufacturing delays may result in delayed delivery of the asset in a budget year. The manufacturer's delivery schedule may also be impacted by global economic dynamics, with the risk of a potential reduction in worldwide supply of aircraft and further delays in the acquisition of replacement helicopters. In the event Hydro One has to change aircraft types, this would mean changing suppliers to another sole-provider of that replacement aircraft and would drive additional costs for new tooling, inventory, spare parts, pilot and mechanic training, etc. To avoid such delays and cost impacts, Helicopter Services mitigates program execution risks through close coordination and communications with vendor, allowing sufficient lead time for planning and procurement, and staying abreast with latest industry trends and market intelligence related to procurement to inform and validate its investment plan.

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| **G-GP-03** | **FACILITIES AND ACCOMMODATIONS** |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness, Financial Performance |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Costs** | 78.5 | 79.3 | 51.6 | 48.4 | 40.8 | 298.6 |

**Summary:**

This investment involves the on-going sustainment (i.e., improvements and asset replacement) of essential building assets and structures at operation related facilities. In addition, this investment includes new facilities and major renovations/upgrades which entail the construction of new facilities to address facilities that have reached end of life condition, and/or no longer adequately suit the operational requirements of the lines of business. These investments are expected to improve operational performance, enhance health and safety, reduce the risk of asset failures resulting in business disruptions and satisfy lines of business requirements to complete their daily work.

## A. OVERVIEW

The Facilities & Real Estate (F&RE) investment program entails the (i) construction of new facilities and major renovations or upgrades (improvements and asset replacements) of existing facilities as needed, and (ii) the ongoing sustainment of facilities which are used by Hydro One's Distribution and Common line(s) of business.

The facilities addressed through this program are mainly operational related, including administrative centres, operation centres (OCs), maintenance/work centres, warehouses, central maintenance facility, helicopter hangars, fleet garages, as well as head office and other distributed office spaces. Operational facilities that provide a safe and productive working environment are essential to Hydro One's effective and efficient operations.

This investment directly enables each line of business to accomplish their objectives, complete core work programs, and accommodate known and anticipated changes in their business and operating requirements. Without the necessary capital repairs, upgrades and replacements, facility conditions will continue to deteriorate and will not meet operational and regulatory requirements, resulting in an increased risk to personnel health and safety.

Through strategic and targeted investments, Hydro One expects to achieve the following objectives: lower maintenance costs, improved operational performance, regulatory compliance, enhanced health and safety, reduced risk of asset failure resulting in business disruptions, and satisfaction of new business requirements. The level of necessary facility investment is estimated to be $298.6M over the 2023-2027 plan period.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

To provide appropriate and adequate facilities for core work programs, this investment addresses facilities that warrant capital intervention due to assets in end of life condition and facility-related operational requirements. This entails conducting capital repairs and replacements of building systems, building upgrades and additions, as well as the construction of new facilities where necessary. This investment ensures that essential and supportive improvements are made to facilities to minimize building and site related risks, including in terms of ensuring personnel health and safety and work equipment protection, addressing gaps relative to operational requirements, and promoting efficiencies in facility maintenance and operations over the long-term.

Facilities in need of capital repairs, replacements and/or upgrades are identified through preventative maintenance visits and Building Condition Assessments (BCAs), which allow Hydro One to maintain visibility over the condition of its facility asset portfolio. As presented in GSP Section 4.2.3, preventative maintenance visits are performed regularly by BGIS Global Integrated Solution Canada LP (BGIS) and involve the visual inspections and maintenance of essential facility components and equipment. BCAs are completed each year on a sample of the portfolio (based on system criticality) on a 5-year cycle and provide Hydro One with an understanding of the condition and performance of major building and site components. Most importantly, BCAs provide a detailed engineering review of facility condition, which helps to establish/verify the need and timing of investments.

BCAs account for a range of factors, including environmental issues such as mold or water treatment upgrades, adequacy for work program and space demands, security, and safety concerns for employees and first responders. Once a BCA is completed, the overall average Facility Condition Index (FCI) score for each facility and overall site is determined. The FCI score is an industry standard tool used to compare relative building conditions over a specified time frame. Typically, the calculation takes into account the maintenance cost associated with existing or deferred capital deficiencies within the next 5 years relative to the current replacement value of the building.

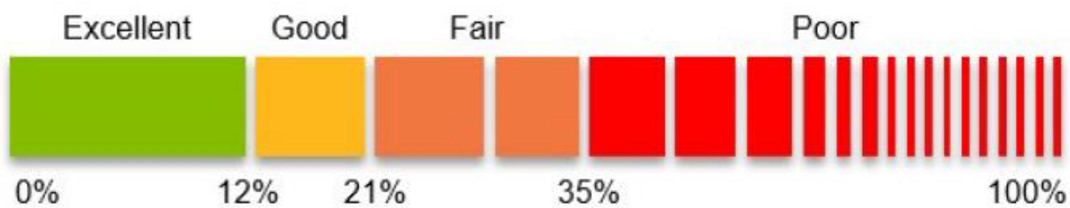



**Figure 1: FCI Index Scale**

As displayed in Figure 1, the lower the FCI score, the better the condition of the facility. As the FCI score rating increases, the facility is expected to experience an increased risk of components failing and increased operations and maintenance costs. Figure 2 shows a breakdown of the buildings that fall within each FCI category based on the recent BCAs completed.

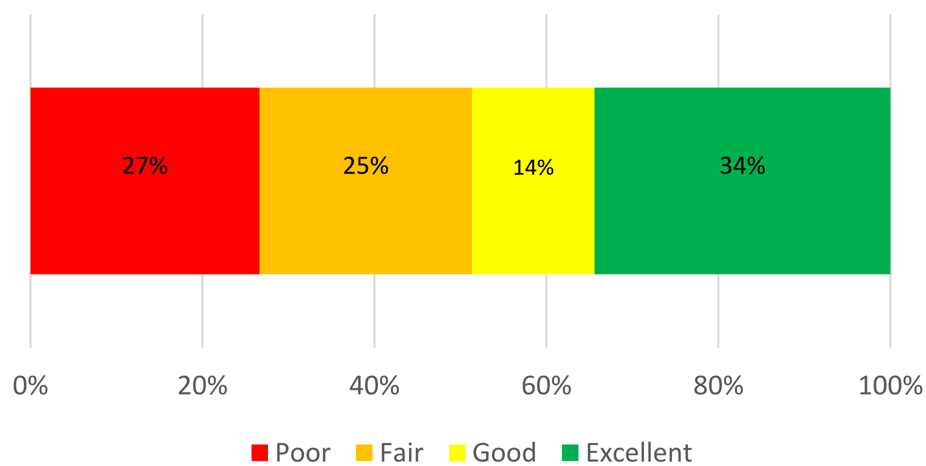



**Figure 2: FCI Results of Building Condition Assessed**

**(Distribution and Common Facility Buildings)**

In addition to asset condition, it is essential for Hydro One to assess and meet facility-related operational requirements of its various lines of business. Each line of business needs appropriate and adequate accommodations to ensure their respective work is executed in a safe and efficient manner. As discussed below in Section C (Investment Description), the local operational needs of an area can influence investment needs, particularly if there are capacity or infrastructure constraints at existing facilities that cannot be resolved by repairs or upgrades alone.

In addition to asset condition and operational demands, various external factors and obligations are also considered in the F&RE investment planning process and impact the scope of required investment solutions, including:

- Provincial and Federal building codes – Changes to construction and occupancy standards impact future improvements of existing facilities as well as future work planning to properly serve occupancy objectives. The necessity of renovation or upgrades of facilities for other reasons can become broader in work or design scope as a result of such code changes, impacting directly connected or complementary systems as well (e.g. air quality systems).

- Accessibility – Pursuant to the *Accessibility for Ontarians with Disability Act*, Hydro One is required to upgrade certain buildings or site components (including parking spaces, ramp access, door widening, workstation layouts, washroom, elevators, wayfinding and tactile cues, etc.) or ensure compliance in new construction. Existing facilities requiring upgrades or site components must be completed by January 1, 2025 in order to be compliant.

- Heritage Designated Buildings – Cultural heritage designations limit changes that can be made to buildings, often resulting in more stringent work standards and/or incremental work. Hydro One has the added obligation as a named agency under the provincial Standards & Guidelines for Conservation of Provincial Heritage Properties (the Guidelines), for any buildings that have been identified with a heritage designation. The Guidelines require assessment of buildings and structures and, where required, the development of plans for the protection for cultural heritage value.

- Environmental Regulations – Various environmental regulations affect the development or redevelopment of facilities. An example is the identification and management of designated substances (e.g. asbestos), which are common given the age of F&RE assets. Another example is the phase-out of PCB-containing light fixtures pursuant to federal regulations (as noted in GSP Section 4.6.2.2).

- Area Development Controls and/or Requirements – Development by-laws impact the siting and massing of facilities, site access, circulation and parking, connection to and provision of services, urban design/control, etc.

As facilities age and deteriorate with utilization, it is prudent to make ongoing investments to maximize the operating life of the asset and delay the necessity of major renovations and/or full asset replacement. In addition to optimizing asset life and performance, the proposed investments serve to minimize disruption to business operations, which directly and indirectly support system reliability and service to customers and communities in a timely and cost effective manner.

Taking into account asset condition data, line of business requirements, and relevant external factors, F&RE investments are established to address known deficiencies and needs. By effectively investing in these facilities, Hydro One can extend the useful life of its assets; improve health and safety conditions; mitigate higher capital spending requirements for asset replacement in the future and reduce maintenance costs; and ensure business continuity by providing adequate and appropriate spaces for all lines of business to execute their work programs.

## C. INVESTMENT DESCRIPTION

The proposed investment program for 2023-2027 includes the following categories of work:

- New facilities and major renovations/upgrades - major renovations of existing facilities and construction of new facilities to address those that have reached end of life condition and/or no longer adequately suit the operational requirements for the Line(s) of Business.
- Ongoing Sustainment - Improvements and Asset Replacements:
    - Grounds – site-related replacements and additions, including drainage; asphalt, fencing; and site services, e.g. septic/well.
    - Exterior Structures and Elements – repairs or replacement to roofs, windows, doors, cladding and other crucial/fundamental structural elements and building systems that are determined to be at end of life from BCAs and inspections.
    - Building Systems and Accommodations – repairs or replacements to heating, ventilation and air conditioning (HVAC), lighting, generators, and other equipment.

The costs associated with each category of work are presented in Table 1.

**Table 1 - Net Investments by Activity for 2023-2027 in $M**

| | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| New Facilities and Major Renovations/Upgrades | 55.2 | 56.6 | 28.1 | 27.3 | 19.3 |
| On-going Sustainment: Improvements and/ Asset Replacements | 23.3 | 22.7 | 23.5 | 21.1 | 21.5 |
| **Total Net Investments** | **78.5** | **79.3** | **51.6** | **48.4** | **40.8** |

Further details on each category of work is provided below.

## NEW FACILITIES AND MAJOR RENOVATIONS / UPGRADES

Investments in new facilities and major renovations account for the bulk (approximately 60%) of the program costs from 2023-2027. These are comprised of the nine major investments listed in Table 2 and summarized below.

Overall, the investments in new facilities and major renovations are necessary to address the end of life condition of current facilities. Without these investments, there could be an adverse impact on line of business operations and potential risks to health, safety and security of Hydro One employees. The locations for the new facility investments are strategically chosen to improve the distribution and performance of Hydro One’s facility portfolio (i.e. terminate leases, reduce operating costs etc.) and more effectively support Hydro One operations in the area. These upgraded or new facilities not only help improve the condition and performance of the F&RE portfolio, but also foster employee productivity and engagement, minimizing total asset lifecycle costs by moving away from a primarily break/fix strategy to planned replacements.

**Table 2 - New Facility & Major Renovation/Upgrades - Net Investments for 2023-2027 in $M**

| Facility | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| Orillia Warehouse | 18.9 | 18.9 | 0.0 | 0.0 | 0.0 |
| Orillia OC | 10.2 | 10.2 | 0.0 | 0.0 | 0.0 |
| Timmins OC and Timmins Transmission Lines Work Centre | 3.4 | 0.6 | 8.2 | 11.4 | 3.4 |
| Rockford OC | 7.8 | 7.9 | 0.0 | 0.0 | 0.0 |
| Peterborough OC | 0.9 | 12.7 | 12.7 | 0.0 | 0.0 |
| Peterborough Fleet Maintenance Garage | 0.4 | 5.7 | 5.7 | 0.0 | 0.0 |
| Newmarket OC | 7.7 | 0.6 | 1.5 | 15.9 | 15.9 |
| Orleans OC | 5.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total New Facilities and Major Renovations** | **55.2** | **56.6** | **28.1** | **27.3** | **19.3** |

**Orillia Warehouse ($37.8M)**

Hydro One's current warehouses in the City of Barrie are scattered across disparate facilities, with no opportunity for building and site expansion to facilitate consolidation or expansion to accommodate growth in work demands. Moreover, the leased main warehouse is a repurposed manufacturing plant that has a sub-optimal configuration and is subject to increasing maintenance requirements and operational limitations (including inability to adopt improved logistics management). Development of the Orillia Warehouse on a site acquired in 2020 will serve to address gaps in operational requirements, accommodate future growth, eliminate inefficiencies from operating across disparate facilities, and provide the opportunity to fully implement industry leading logistics practices/strategies. The Orillia Warehouse will allow for the consolidation of three facilities in Barrie (as shown below in Figure 3), with the opportunity to terminate two leases (Barrie Warehouse and Cross Dock).


**Figure 3: Locations of New Orillia Warehouse and Existing Barrie Warehouses**

**Orillia OC ($20.4M)**

Hydro One's Distribution operations for the Orillia/Oro customer area are located in multiple, disparate facilities. These facilities are sub-optimal for current operating requirements with no opportunity for the necessary building and yard expansion. This planned OC will enable the broader objective of facility rationalization (i.e., termination of leases) and operational synergies relating to materials and equipment management and crew across various lines of business. Development of the Orillia OC on a site acquired in 2020 will serve to address these requirements/objectives together while aligning to current operating practices. This OC will allow for the consolidation of five facilities as shown below in Figure 4, with the opportunity to terminate three leases in Orillia (Orillia Office, Forestry Area Office and Service Centre).

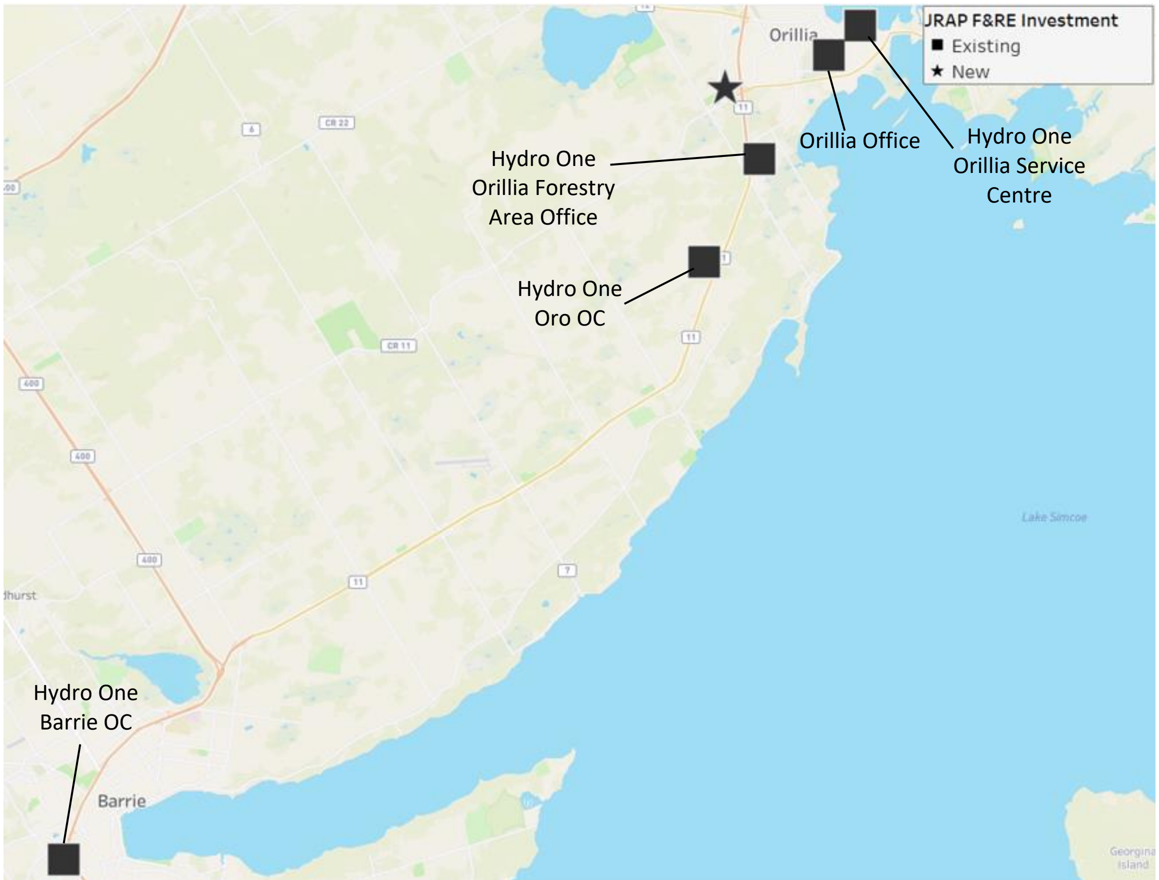



**Figure 4: Hydro One work Locations in the Barrie and Orillia/Oro Area, Including the New Location for the Consolidated Orillia OC**

**Timmins OC and Timmins Transmission Lines Work Centre ($27.0M)**

In general, Hydro One's Timmins operations serves as an operational hub for the Northeast region of Ontario. The current operations is split between the Hydro One-owned Timmins TS Maintenance Centre and a leased site, which resulted from a legacy arrangement dating back to the demerger of Ontario Hydro in the late 1990s. At the time, Hydro One was compelled to relinquish the former Timmins OC to Ontario Power Generation. This necessitated the relocation of Hydro One's Distribution Lines and Forestry crews into the current facilities on short notice. These two facilities are also shared with Transmission Lines and Stations crews, and are sub-optimal relative to operational requirements of these lines of business. The sub-optimal conditions include inadequate spaces to meet growing operational requirements, as the current structures are overcrowded and the storage facility is inadequate given the growing work program being carried out and the specialized equipment, such as mobile unit stations (MUS), being stored and serviced from this location. In addition, the collection of various structures, which were constructed as early as the 1960's, are approaching their end of life. The leased facility has also been impacted by mining activities near the area which is affecting its condition and use.

The plan is to secure a new site that would be sufficient to gradually consolidate all Hydro One operations, owned and leased, in the Timmins area, commencing with the Timmins OC. With the development of the Timmins OC, there is an opportunity to consolidate and achieve economies of scale and operational synergies through shared facilities. Hydro One intends to obtain a suitable site to accommodate Timmins Transmission Lines Work Centre. Through a phased development approach, Hydro One would be able to mitigate cost impact and maximize remaining life from existing assets before investing in new assets.

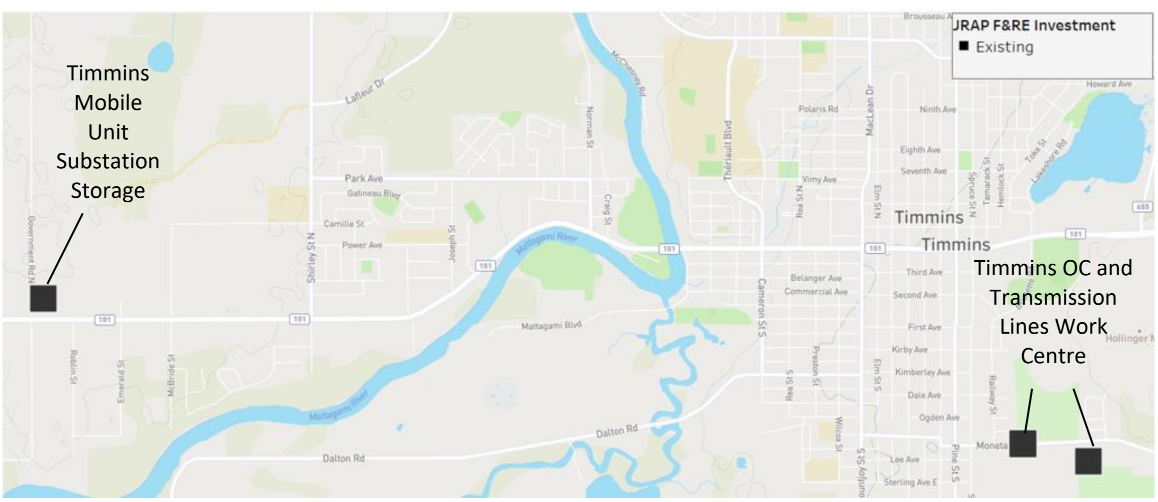



**Figure 5: Map of the Existing Timmins Work Locations; New Location is to be Determined**

**Rockford OC ($15.7M)**

When developed in the mid-1980's, the Rockford OC was intended to be a replacement for the end of life Owen Sound OC (constructed in 1946), but the full plan was not completed. The project utilized pre-engineered and modular structures within a reduced scope, which resulted in the need to still maintain the Owen Sound OC. Both the Rockford OC and the Owen Sound OC have required considerable ongoing investments to extend their life and address operational gaps, including the introduction of several trailers to offset crowded conditions from the significant operational growth (by approximately 50%) following the acquisition of Owen Sound and Meaford in 2001 (Figure 6 and Figure 7 show the different structures at each OC). The development of the new Rockford OC as an addition within the existing Rockford OC site will replace buildings reaching end of life. The BCA results for the Owen Sound OC indicate a significant portion of assets in poor condition, including the Storage Building, with poor condition roof coverings, exterior cladding, metal insulating doors, overhead doors and window units.

In addition to addressing the condition of the facilities, the investment will consolidate part of the operations from the Owen Sound OC and develop facilities aligned to current operational requirements.

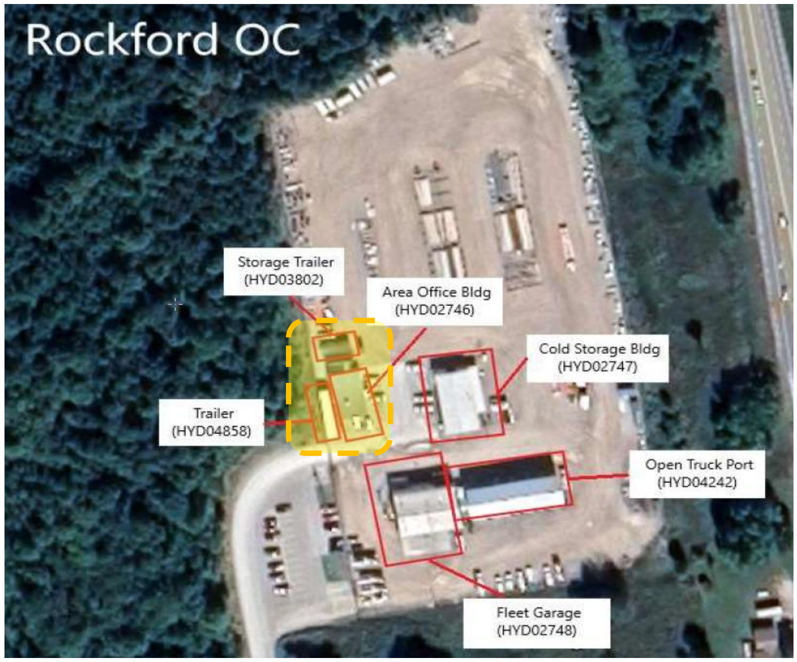



**Figure 6: Aerial View of Existing Rockford OC, the Yellow Box Outlines the Buildings that are Expected to be Decommissioned**

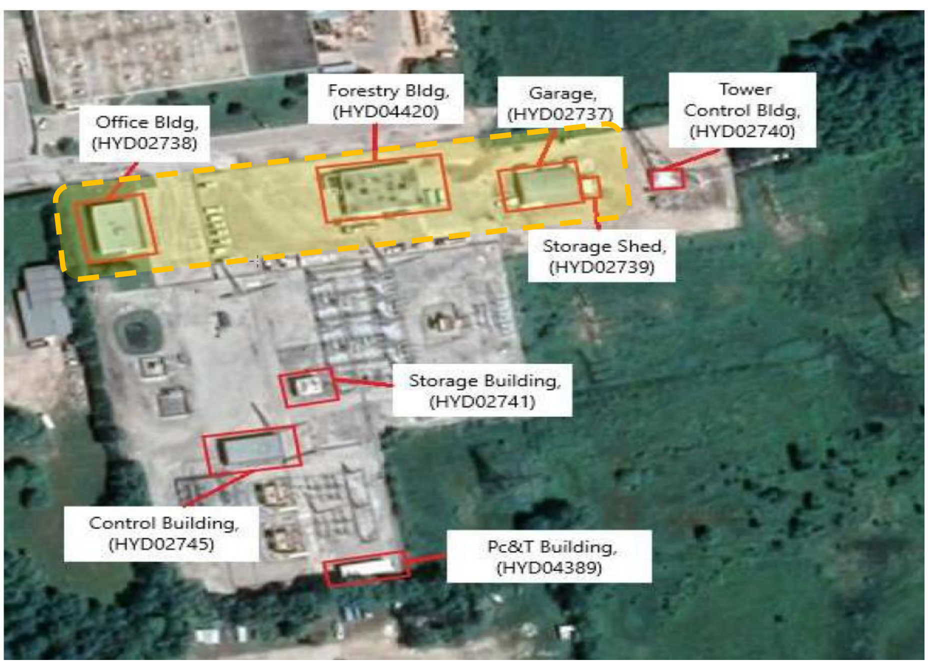



**Figure 7: Aerial View of Owen Sound TS; Highlighted Area Indicates Buildings that are Expected to be Decommissioned as Part of the Consolidation**

**Peterborough OC ($26.3M)**

The existing Hydro One Peterborough OC is reaching end of life, requires significant capital repairs, and is sub-optimally configured with reliance on several temporary structures. It is also situated within a defined floodplain with significant historical impacts. Development of the new Peterborough OC on lands acquired in 2020 will address condition concerns and facilitate operational synergies through consolidation of four facilities (the existing Peterborough OC, Peterborough Ashburnham Office, Pole Yard and Lindsay Service Centre, as shown below in Figure 8). The existing facilities subject to this consolidation are neither well located (Lindsay Service Centre is inefficiently located some distance away from the other facilities) nor capable of accommodating building and site expansion to facilitate consolidation.

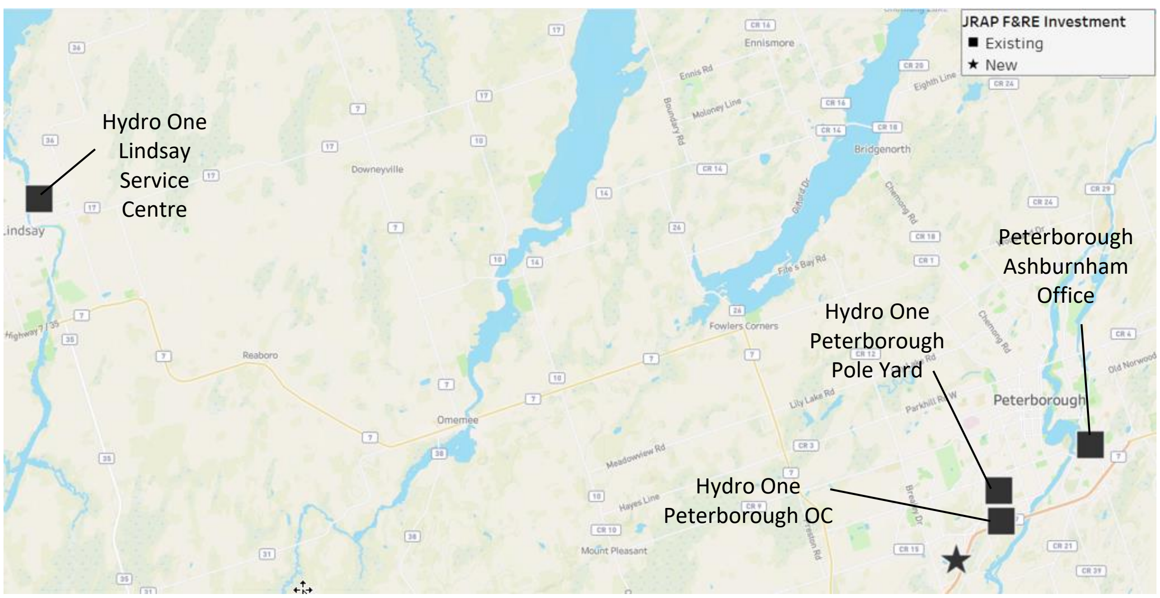



**Figure 8: Map of the Lindsay Service Centre, the Existing Peterborough Work Locations and the Location of the New Peterborough OC**

**Peterborough Fleet Maintenance Garage ($11.8M)**

The current Peterborough Fleet Maintenance Garage is located within repurposed space in the Lindsay Service Centre, which largely serves as an overflow to the current Peterborough OC and is to be eliminated and consolidated into the New Peterborough OC. Irrespective of the consolidation plan, the Lindsay Service Centre is not ideally suited for its built form, size and mixed use character (i.e. combining office, warehouse and garage) to be an effective and well-positioned long term facility. Furthermore, the acquired site for the New Peterborough OC will not accommodate a Fleet Maintenance Garage. In this case, a stand-alone garage will better meet the required, specialized space. The planned development of the Peterborough Fleet Maintenance Garage on lands acquired in 2020 will serve to effectively address operational requirements in strategic proximity to the New Peterborough OC, and facilitate rationalization in the broader region and alignment to current operating practices.

**Newmarket OC ($41.6M)**

The existing Newmarket OC, established as a lease following the sale of the former facility in 2002, has become undersized relative to the substantial operational growth in the area. To mitigate this inadequacy, area operations are supported by an off-site material storage yard and the use of the Newmarket Fleet Maintenance Garage parking, yard and office. However, these off-site facilities have now been stretched to their limits, requiring on-site mitigation measures to manage overcrowding. More importantly, the Newmarket OC is located at the south end of the customer area away from the prime area of growth to the north. The development of a new Newmarket OC will provide a facility that is right-sized in alignment with current operational demands, located in a more central location to more effectively serve customers, and able to facilitate consolidation of operations, including the Newmarket Fleet Maintenance Garage, from three existing leased facilities.

**Orleans OC ($5.9M)**

In 2013, the Orleans OC was initially developed as an interim facility (Phase 1) to immediately address the requirements of the newly created Distribution Operations Area. The intent was to develop Phase 2 when warranted by operational requirements. This threshold has been reached and Distribution Lines operations at the OC are significantly congested. The line of business cannot effectively add labour and resources to the site, which has seen almost a doubling of customers in the area it serves since Phase 1 completion. Development of the Orleans OC (design and regulatory approval) Phase 2 was initiated in 2021 for a 2022 – 2023 construction, which will leverage and retain the Storage Building from Phase 1 while replacing the Office Building (Figure 9 below shows the existing buildings).

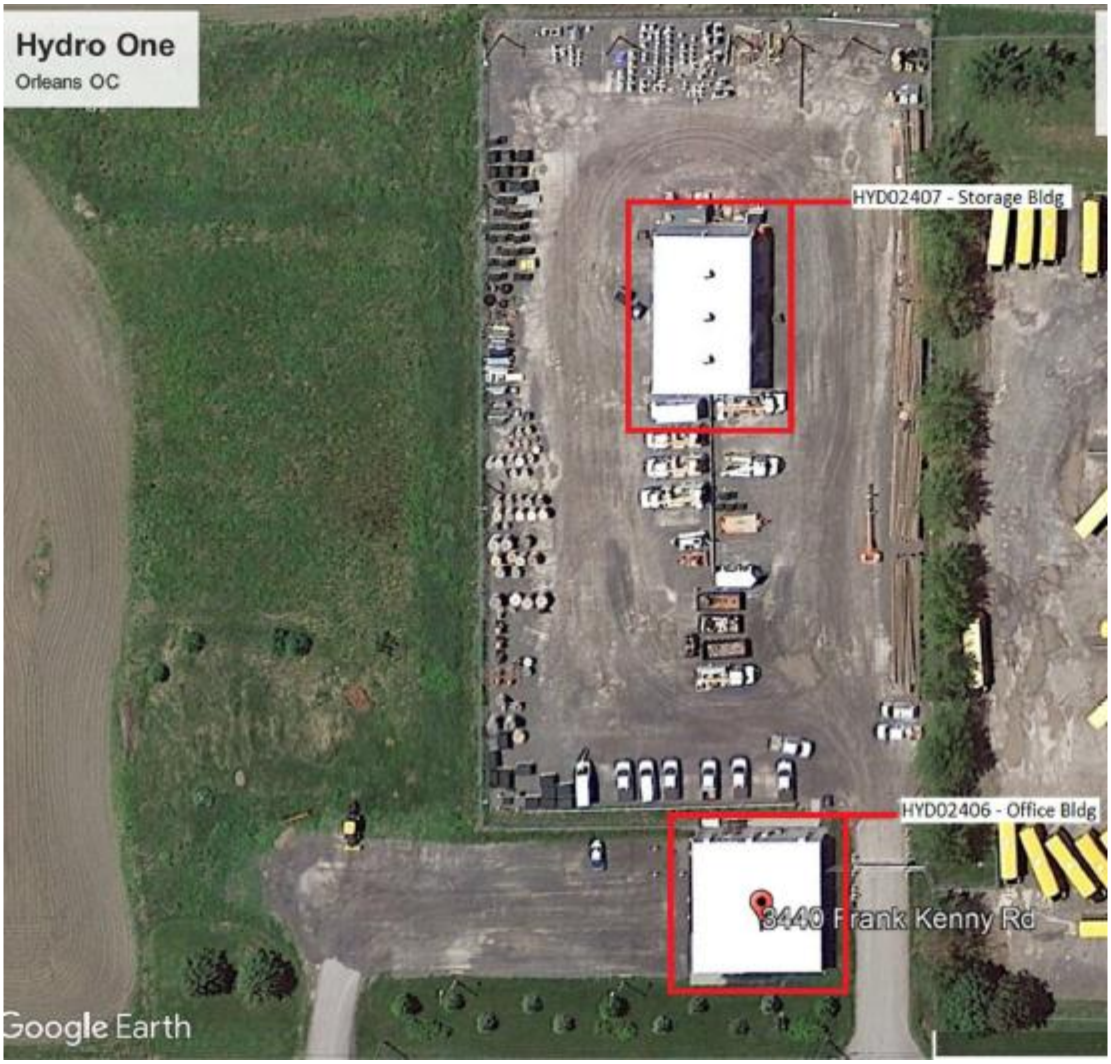



**Figure 9: Aerial View of Orleans OC**

**ONGOING SUSTAINMENT: IMPROVEMENTS AND ASSET REPLACEMENTS**

Investments in ongoing sustainment, such as improvements and asset replacement are necessary to ensure operational facilities are kept in good condition to meet line of business requirements, ensure business continuity and minimize health and safety risks. Based on line of business requirements, condition assessments and relevant external factors, F&RE develops investment plans to address known deficiencies and needs. An overarching consideration is to maximize the value of existing field facilities through ongoing operations, maintenance and sustainment investments in line with operational requirements; and facility alternatives would be examined where necessitated by facility condition and/or operational requirements.

Overall, the proposed investment level for ongoing sustainment would bring operational facilities to an acceptable state of repair and make strategic additions or replacements according to a cost-benefits analysis (taking into account relevant considerations such as trends in maintenance costs and the frequency of trouble calls in relation to the particular equipment and components).

The proposed spending for ongoing sustainment is based on estimated work to be performed over the planning period. The management of operational facilities involves the ongoing comparative evaluation of alternatives, including the expansion and/or renovation of existing facilities, the lease or purchase of suitable facilities and greenfield developments relative to the status quo configuration or condition. The specific work to be executed from year to year will be scoped and finalized based on the specific circumstances of each project. The objective is to pursue the most cost effective strategy that addresses operational requirements and mitigates risks.

## D. OUTCOMES

Benefits associated with this investment program are expected to be realized through a number of areas, including accommodation of facility-related operating requirements of lines of business, improved operational performance, regulatory compliance, reduced health and safety risks, and reduced risk of component failure resulting in business disruptions. The program will help mitigate the maintenance requirements associated with deteriorating F&RE assets through the timely replacement of major building system/components. It will also align contractual commitments (e.g. facility leases) and investments with known and emerging operating requirements.

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the OEB's RRF:

**Table 3 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Improve the ability of the lines of business to address customer needs through facilities that are commensurate with operational requirements. |
| **Operational Effectiveness** | • Maintain and improve operational effectiveness of lines of business through timely and strategic facilities investments. |
| **Public Policy Responsiveness** | • Compliance with government policy and regulatory directives (e.g. Accessibility for Ontarians with Disabilities Act).<br>• Mitigate Hydro One's greenhouse gas emissions by replacing poor condition equipment in existing facilities with more energy efficient solutions. |
| **Financial Performance** | • Cost effectiveness realized through regular BCAs, consideration of alternatives and timely investment prior to asset failure.<br>• Cost efficiency realized through facilities investments that align with current and emerging operating requirements and business decisions.<br>• Cost savings as a result of implementing more efficient equipment such as LED lighting, and remote monitored HVAC systems. |

## E. EXPENDITURE PLAN

### NEW FACILITIES AND MAJOR RENOVATIONS / UPGRADES

The estimated $186.5M investments (averaging $37.3M per year) for New Facilities and Major Renovations/Upgrades have been developed based on the anticipated replacement of existing facilities adjusted for new operational requirements, current building standards and practices, regulatory considerations and rationalisation opportunities. Cost estimates are derived with reference to historical project results and costs, including prevailing market conditions. Market considerations include the potential availability and cost of suitable sites (where land acquisition is required), regional pricing differences and broader construction industry trends. At time of development, alternate building strategies for the various investments will be considered to optimise both construction and operational savings, while employing continuous improvement and lessons learned. Where applicable, standardised approaches utilising template design and leading commercial practices have been considered.

**ON-GOING SUSTAINMENT: IMPROVEMENTS AND ASSET REPLACEMENTS**

The funding averages $22.4M per year over the 2023-27 period (total of $112.1M) to meet the operational requirements of the line of business and ensure future sustainment improvements or replacements are done in a timely manner before end of life condition gives rise to unacceptable risk and operational impact. As outlined in GSP Section 4.2.3, without adequate capital investments, it is estimated that half of the F&RE assets (includes TS facilities) will reach be in poor condition by 2027.

On-going sustainment (improvements and asset replacements) investment prioritizes roof replacements, external wall upgrades, HVAC units and investments related to drainage and septic before operational impact arises. The proposed investment plan takes into consideration potential energy efficiency initiatives to reduce environmental impacts. For example, the implementation of the Remote Command Centre (RCC) pilot program, which will assist Hydro One to enhance our operational efficiency by monitoring real time energy consumption remotely and enabling F&RE to identify root cause of failures and expedite repairs. Moreover, F&RE collaborates with other line of business in identifying and implementing efficiency initiatives within our capital plan. For example, F&RE has an important role in supporting Hydro One's planned transition to electric vehicle commercial fleets (i.e. the electric vehicle charger program).

Table 4 below summarizes the projected spending on the aggregate investment level.

**Table 4 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Costs | 80.5 | 81.2 | 53.5 | 50.3 | 42.7 | 308.1 |
| Less Removals | 1.9 | 1.9 | 1.9 | 1.8 | 1.9 | 9.5 |
| **Capital and Minor Fixed Assets** | **78.5** | **79.3** | **51.6** | **48.4** | **40.8** | **298.6** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **78.5** | **79.3** | **51.6** | **48.4** | **40.8** | **298.6** |

The development of facilities and resulting final cost of a project are influenced by various factors such as market dynamics, regulatory requirements and site availability. Supply and demand forces may limit the availability and opportunity of land where site acquisition is required and/or generate land values disproportionate to historical rates and trends. Specific site conditions, while assessed early in the site identification/ selection process, may nevertheless give rise to higher actual development cost due to geotechnical and environmental factors and the potential need for costly site investigation and treatment.

While Hydro One generally seeks to apply template building designs and standard construction methodologies, site conditions and regulatory requirements may dictate deviations and result in higher costs, e.g. on-site storm water management or urban design considerations unique to a municipality and/or setting.

Greenfield development provides Hydro One with the opportunity to adopt the template design, with greater cost estimate certainty; however, market opportunities may make it more economical to acquire or improve an existing facility, subject to inspections of specific building and site conditions.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred option.

### ALTERNATIVE 1: RUN TO FAILURE

This alternative is a “run to failure approach” for building assets and site infrastructure. This alternative represents continued operation with the current state of equipment and infrastructure at these facilities, only carrying out capital expenditure reactively after the occurrence of a failure of site infrastructure or equipment to impact building occupancy.

This alternative is not appropriate. Without the necessary, timely capital repairs, upgrades and replacements, facility conditions will deteriorate to the point where operational efficiency and personnel safety become impaired. Consequences arising from such condition risks would hamper Hydro One's ability to effectively operate its business and serve customers. Under this alternative, the required break-fix spend will increase, resulting in service disruptions and a higher cost of maintenance and repair as well as potential cascading effects on other assets (e.g., leaking roof could result in damage to equipment and HVAC within the facility). Due to the unacceptable risks associated with this alternative, it is not recommended.

**ALTERNATIVE 2: PERFORMING ON-GOING SUSTAINMENT**

This alternative funds on-going sustainment work but does not provide funding to accommodate new builds or renovations to address operational requirements.

This alternative is not sustainable. As outlined above (under Section C Investment Description), the current facilities that require replacement do not meet the lines of business operational needs, work spaces are becoming crowded, storage and warehouses spaces are reaching their capacity and facility maintenance costs are increasing. Without new facilities, existing facilities must be renovated to bring them up to a suitable conditions, which would impact business operations.

**ALTERNATIVE 3: NEW FACILITIES AND MAJOR RENOVATIONS/UPGRADES OF PRIORITY REQUIREMENTS WITH ON-GOING SUSTAINMENT: IMPROVEMENTS AND/ASSET REPLACEMENTS (RECOMMENDED)**

As presented in Section C (Investment Description), this alternative would bring field facilities to an acceptable state of repair and make strategic additions or replacements according to a cost-benefits analysis. The cost-benefits analysis incorporates relevant considerations such as trends in maintenance costs and the frequency of trouble calls in relation to the particular equipment and components.

The spending requested herein is an estimate of the work to be performed over the planning period. The management of field facilities entails an ongoing comparative evaluation of alternatives, including the expansion and/or renovation of existing facilities, the lease or purchase of suitable facilities and greenfield developments against maintenance of the status quo condition. The specific work to be executed from year to year will be scoped and finalized based on the specific circumstances of each project. The objective is to pursue the most cost effective strategy that addresses existing and future operational requirements and mitigates risks. Operational considerations are for both existing and future requirements. An overarching consideration is to maximize the value of existing field facilities through ongoing operations, maintenance and sustainment investments in line with operational requirements.

**ALTERNATIVE 4: NEW FACILITIES AND MAJOR RENOVATIONS/UPGRADES OF KNOWN FACILITY REQUIREMENTS WITH ONGOING SUSTAINMENT**

This alternative would be to upgrade and improve additional operational facilities to address needs identified by lines of business. This alternative would fully address operational requirements by all lines of business request. In addition, it would entail accelerated replacement of facilities, with less focus on retaining and maintaining current assets with useful life remaining to accommodate the growing work programs for the lines of business.

While it would more fully address the operational needs of the company and sustain the long term condition of the F&RE portfolio, this alternative does not effectively maximize the value of our existing operational facilities and components. It would also result in significant cost impact to ratepayers.

## G. EXECUTION RISK AND MITIGATION

To mitigate cost risks during execution, contracts are generally negotiated for fixed pricing to advance design with requisite investigations or detailed specification through a competitive bid process to procure the most suitable vendor, when applicable.

Cost estimates for new OCs is established through the use of a scalable template design and experience from recently completed projects. Developments are completed in accordance with applicable commercial standards and practices. In addition, Hydro One leverages value engineering methodology to lower project costs and enhance performance by evaluating available alternatives for project implementation without impacting functionality.

Development of new facilities will in many instances depend on the availability of suitable sites and ability to obtain municipal approvals, which can be managed through advance planning and acquisition. Development interests are cultivated by leveraging coordination with applicable municipal officials and departments, and effectively utilizing the services of the real estate and development community. In this regard, advance planning and engaging the right parties can allow risk to be mitigated by obtaining the requisite approvals ahead of time and proactively managing the often lengthy regulatory timelines involved in the development of sites.

The risk of potential misalignment over time with line of business needs that underpin the planned F&RE investments is mitigated through close coordination (e.g. regular reviews) with the various line of business. This ensures that the latest information regarding facility-related business needs is considered not only at the planning phase but detailed design phase.

| G-GP-04 | **TRANSMISSION FACILITIES** |
|---|---|
| **Primary Trigger:** | System Reliability |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness, Financial Performance |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 12.9 | 12.8 | 10.1 | 9.6 | 9.7 | 55.1 |

**Summary:**

This investment primarily involves the on-going sustainment (i.e., improvements and asset replacements) of essential building assets and structures at Transmission Station sites. In order to address the aging and deteriorating Transmission Station facilities across the province, funding is required to provide for necessary improvements, additions to existing facilities, and/or replacement of major building components. The Transmission Station facilities 2023-2027 work program includes new facilities and major renovations/upgrades which is limited to the construction of one new facility to address those that have reached end of life condition and/or no longer adequately suit the operation requirements for the lines of business, and on-going sustainment of existing buildings.

## A. OVERVIEW

The TRANSMISSION FACILITIES investment primarily involves the on-going sustainment (i.e., improvements and asset replacements) of essential building assets and structures at Transmission Station (TS) sites that directly serve the transmission system, so as to mitigate system reliability and safety risks associated with deteriorating and/or failing building assets. The key elements of the TS building assets include: the building envelope, roofing, HVAC systems, building auxiliary systems, and cranes. Investments are required before risks arising from poor condition of these assets materialize and adversely impact system reliability, business continuity or the health and safety of Hydro One personnel or customers. The investments will also mitigate maintenance costs associated with poor condition TS site assets and help optimize future capital expenditure through timely and cost-effective improvements and replacements.

In addition, the planned investment involves the re-development of the Hanmer Work Centre over a 4 year period. This would replace existing buildings and structures that are at or beyond end of life and do not adequately meet operational demands of the front line work crews to enable them to effectively deliver the transmission work programs.

The projected costs of these investments are estimated to be $55.1M over the 2023-2027 plan period, with 89% towards sustainment and site improvements and 11% allocated to Hanmer Work Centre.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

Hydro One Facilities and Real Estate (F&RE) currently manages infrastructure at approximately 352 TS sites across the province, with an average age of approximately 62 years. In order to address the aging and deteriorating TS facilities across the province, funding is required to provide for necessary improvements, additions to existing facilities, and/or replacement of major building components.

This investment is required to address deteriorating condition of TS building components and upgrade certain TS Work Centre facilities that no longer meet Hydro One's facility-related operational requirements. The TS buildings mainly house transformer station assets (i.e., protection and control equipment) that are crucial to the reliability of the transmission system. The TS Work Centre facilities are required to provide appropriate and adequate accommodations for crews working on core work programs. As further discussed below, Hydro One regularly assesses work demands of lines of business to identify potential gaps in the required facility accommodations, and performs inspections and Building Condition Assessments (BCAs) to identify condition-driven asset needs.

Through capital repairs and replacements of building systems, building upgrades and additions, along with the development of new facilities where necessary, this program addresses essential facility sustainment and improvement needs to mitigate building and site related risks, including to ensure personnel health and safety and the protection of work equipment and station assets, accommodate operational requirements to enable work execution, while promoting efficiencies in facility maintenance and operations over the long-term. Other external factors influencing the work to be done in this program are also discussed below.

**CONDITION DRIVEN NEEDS**

TS facilities in need of capital repairs or replacements are identified through preventative maintenance visits and BCAs. As presented in GSP Section 4.2.3 preventative maintenance visits are performed regularly and entail visual inspections and maintenance of essential equipment at regular intervals to help maintain their life expectancy until replacement.

BCAs provide a detailed engineering review to assess TS facility conditions to establish/ verify the need for and timing of investments. They account for a range of factors, including environmental issues such as mold or water treatment upgrades, adequacy for work program and space demands, security and safety concerns for employees and first responders. Once the BCA is completed, the overall average FCI score for each facility and overall site is determined. The FCI score is an industry standard tool used to compare relative building conditions over a specified time frame. Typically, buildings are assessed with an FCI score in a 5-year timeframe (to maintain the facility). The calculation takes into account the cost of existing or deferred capital deficiencies within the next 5 years over the current replacement value of the building. BCAs are completed annually, on a 5-year cycle by selecting a sample based on system criticality (i.e., operating voltage of TS, forward command post, and emergency preparedness etc.), of the portfolio and provide Hydro One with an understanding of the condition and performance of major building and site components.

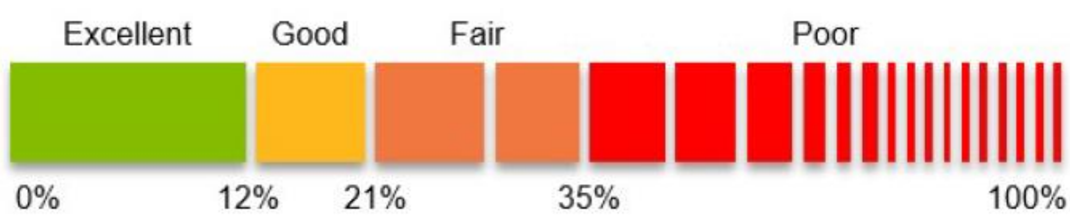



**Figure 1: FCI Index Scale**

As displayed above in Figure 1, the lower the FCI score, the better the condition of the facility. As the FCI score rating increases, the facility is expected to experience an increased risk of components failing and increased operations and maintenance costs for the facility. The FCI is a measurement calculated on the building level. Figure 2 below shows a breakdown of the buildings that fall within each FCI category based on the most recent BCAs completed.

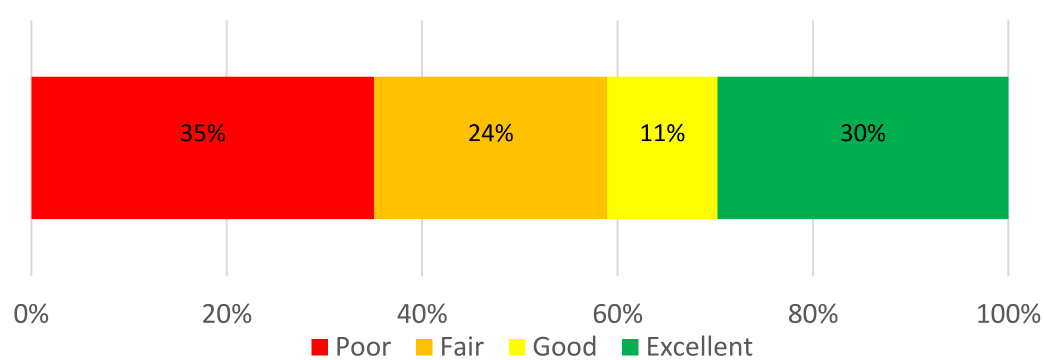



**Figure 2: TS Building FCI Results**

Preventative maintenance and BCAs are key to capturing asset condition and providing Hydro One with visibility on the condition of their portfolio.

Poor conditions at TS site buildings and components could pose significant reliability and safety risks:

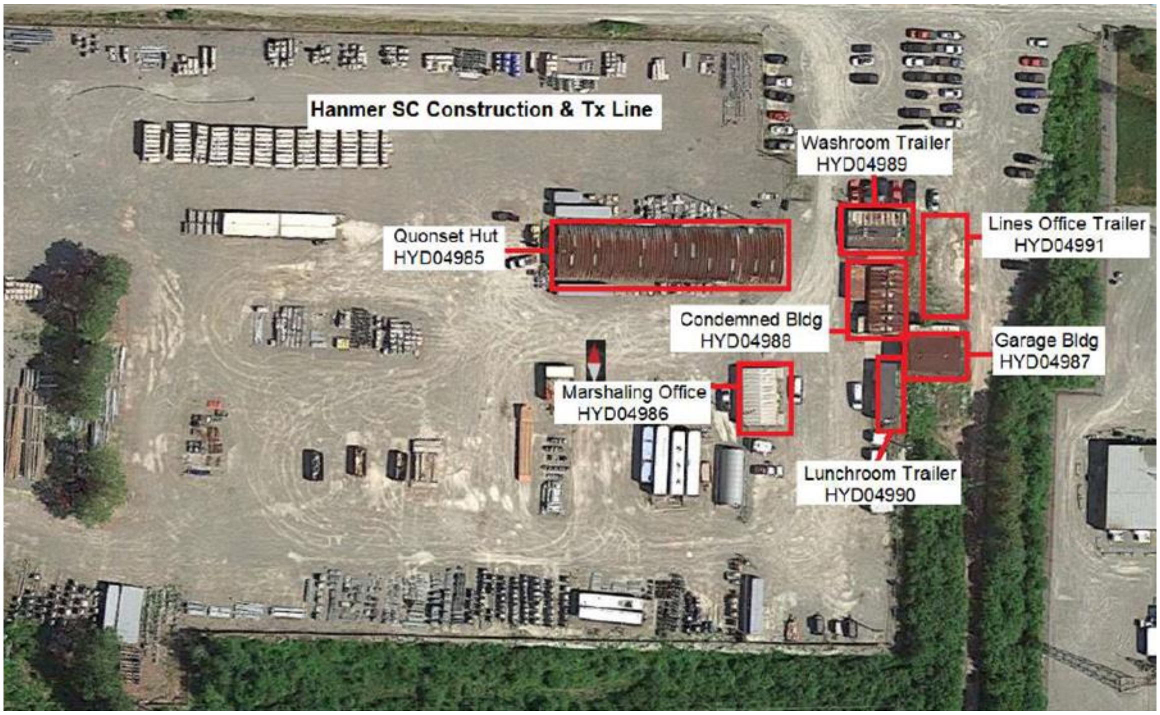
- System Reliability: Failing to address building asset components such as leaking roofs, lack of cooling for relay rooms, and other end life assets can pose reliability risk to the power system. A failed roof or failed HVAC can force an entire station from service, which is why there are programs in place to prevent roof failures, including annual roof inspections to identify timely remediation or replacement needs based on condition assessment. The risk of TS site asset failure to system reliability must be mitigated through such inspections and maintenance as well as on-going sustainment repairs, improvements and asset replacements.
- Safety: Any safety risk identified at a facility by the line of business or through an inspection or BCA is prioritized to ensure safe and reliable operations to Hydro One's customers. This also includes any emergent needs identified by the lines of business (e.g. installing of protective barriers around equipment). This approach will minimize likelihood of any safety risks posed by equipment failures and ensure operations remain uninterrupted. Safety risks posed by deteriorated building components must be mitigated by on-going sustainment (improvements and asset replacement), regular inspection, timely replacement before failure, and incorporating safety by design where possible.

**WORK PROGRAM NEEDS**

F&RE conducts regular operational assessments with various lines of business to confirm their facility requirements (including anticipated changes in building use). Each line of business is also assigned a prime contact to process requests/issues and ensure familiarity with current needs. Changes in the business may also create the need for renovations and/or expansion of existing facilities to accommodate the need for increased staff at specific transmission stations. This level of proactive assessment and close coordination equip F&RE with up-to-date information (e.g., the condition and maintenance/renewal requirements associated with major building components). This information allows F&RE to optimize its budget by prioritizing work that addresses high criticality components or high impact risks in the short term and to plan future investments in a way that limits rate impact and address longer-term risks or requirements.

The replacement of the existing Hanmer Work Centre building at Hanmer TS is required to address operational gaps and accommodate growth in the business. This Work Centre is a hub for a material stock and float marshaling yard and supports construction crews in the north of the province, where approximately 100 employees service an area from Wawa to the Quebec border. Materials are delivered to the stockyard in large quantities and are re-deployed to various project sites in the north. In the absence of a functional and adequate storage facility, the next closest site would be in the GTA, which mean immense shipping costs and time requirements to store unused equipment (that may also have to be re-deployed in the north) and transport materials out to crews in the North. The second function of the Hanmer Work Centre is the office space (board room and common workspace). Currently, there are no permanent bathrooms, both the yard and office space utilize temporary trailer bathrooms.

As shown in Figure 3 and Figure 4 below, the current Hanmer Work Centre has evolved over time into a collection of independent buildings and structures, including numerous trailers and containers, many now in deteriorated and rusted condition. Based on the BCA for this site, the overall condition on three primary structures (Quonset Hut, Garage and Condemned Building) were identified as being in poor end of life condition. Given the condition and sub-optimal state of the assets, sustainment improvements will not suffice to meet operational requirements in a cost-effective manner. The proposed new build is required to accommodate the growth of the lines of business while keeping existing assets (trailer or containers) that are still in good operating condition.




1 **Figure 3: Aerial View of the Hanmer SC Construction and Transmission Lines Site.**

2

3 **Figure 4: Ground View of Current Hanmer Work Centre Showing from the Left: Quonset Hut,**
4 **Washroom (White) Trailer and Condemned Building on the Right**

**EXTERNAL FACTORS**

While not the primary basis of F&RE investment decisions, a number of external factors are also considered in the F&RE investment process, including:

- Provincial and Federal building codes – Changes to construction and occupancy standards impact future improvements of existing facilities as well as future work planning to properly serve occupancy objectives. Ongoing renovation or upgrades can become broader in work or design scope as a result of such changes, impacting directly connected or complementary systems as well (e.g., air quality systems).
- Accessibility – Pursuant to the *Accessibility for Ontarians with Disability Act*, Hydro One is required to upgrade certain buildings or site components (including parking spaces, ramp access, door widening, workstation layouts, washroom, elevators, wayfinding and tactile cues, etc.) or ensure compliance in new construction. Existing facilities requiring upgrades or site components must be completed by January 1, 2025 in order to be compliant.
- Heritage Designated Buildings – Cultural heritage designations limit changes that can be made to buildings, often resulting in more stringent work standards and/or incremental work. While such designations are applied to Hydro One buildings, the company has the added obligation as a named agency to the provincial Standards & Guidelines for Conservation of Provincial Heritage Properties (the Guidelines). The Guidelines require assessment of buildings and structures and, where required, the development of plans for the protection for cultural heritage value.
- Environmental Regulations – Various environmental regulations affect the development or redevelopment of facilities. An example is the identification and management of designated substances (e.g. asbestos), which are common in buildings that are constructed pre-1985 and is present in approximately 35% of F&RE assets. Another example is the phase-out of PCB-containing light fixtures pursuant to federal regulations (as noted in GSP Section 4.6.2.2).
- Area Development Controls and/or Requirements – Development by-laws impact the siting and massing of facilities, site access, circulation and parking, connection to and provision of services, urban design/control, etc.

- Security - F&RE ensures doors, walls and windows are properly functional and maintained to safegurad Hydro One employees and assets. At work center locations that are next to fenced TS site areas, F&RE would also ensure the security parameters are appropriately maintained to protect our assets.

## C. INVESTMENT DESCRIPTION

The TS facilities 2023-2027 work program includes the following categories:

- New facilities and major renovations/ upgrades - major renovations of existing facilities and construction of new facilities to address those that have reached end of life condition and/or no longer adequately suit the operation requirements for the lines of business.
- Ongoing Sustainment - improvements and replacements of TS facility infrastructure prioritizing assets that are in deteriorated condition and pose significant reliability or safety risks. This investment has a focus on the following:
    - Exterior Structures and Elements – repairs or replacement to roofs, windows, doors, cladding and other crucial/fundamental structural elements and building systems that are determined to be at end of life from BCAs and inspections.
    - Building Systems and Accommodations – repairs or replacements to heating, ventilation and air conditioning (HVAC), lighting, generators, and other equipment.
    - Drainage and Septic- repairs or replacement to help prevent water damage.

The costs associated with the two categories are presented in Table 1.

**Table 1 - Net Investments by Category for 2023-2027 in $M**

| | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| New Facilities and Major Renovations / Upgrades (Hanmer Work Centre) | 3.2 | 2.9 | 0.0 | 0.0 | 0.0 |
| On-going Sustainment: Improvements and Asset Replacements | 9.7 | 9.9 | 10.1 | 9.6 | 9.7 |
| **Total Net Investments** | **12.9** | **12.8** | **10.1** | **9.6** | **9.7** |

Further details on each work category is provided below.

## NEW FACILITIES AND MAJOR RENOVATIONS / UPGRADES

Investments in new facilities and major renovations are comprised of the one project for Hanmer Work Center. The investment costs for the 2023-2027 period are shown in Table 3 and summarized below.

### Hanmer Work Center ($6.1M)

As noted above, the current Hanmer Work Centre is the main hub for construction crews serving the northern region of the province. Three primary structures (see Figure 5) have been identified as being end of life and in poor condition, including cracks in structural foundations, and deteriorated roofing.

In addition, the site drainage and yard condition need to be enhanced with the installation of asphalt and/or concrete as significant water ponding occurs along unpaved/gravel areas (within the property) that leads to surface ice formation during the cold weather season and uneven gravel across the area due to snow ploughing.

The new proposed facility would replace and consolidate these existing buildings and structures and provide for the increased work and warehouse space required to support the continually growing work program. The expansion will allow Hydro One to consolidate disparate operations and staff from other locations, such as Transmission Lines at the Sudbury Operations Centre and Transmission Station Construction at Martindale Transformer Station, both overly congested facilities and under serving operational demands. This new facility will also improve the condition and performance of the Work Centre, foster employee productivity and engagement.

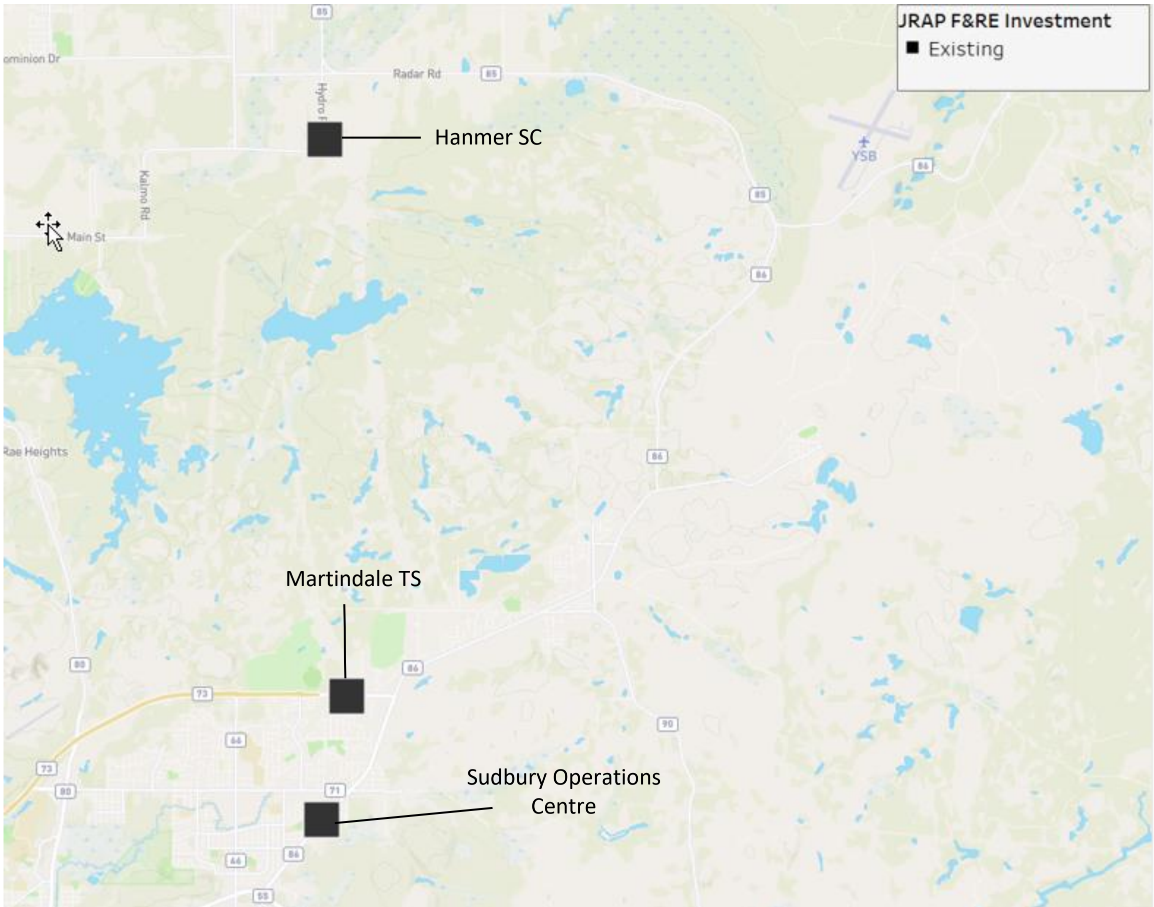



**Figure 5: Shows the Location of Hanmer SC, with the Existing Sudbury Operations Centre and Martindale TS.**

**ON-GOING SUSTAINMENT: IMPROVEMENTS AND ASSET REPLACEMENTS**

Investments in ongoing sustainment include improvements and asset replacement as necessary, to ensure TS facilities are kept in appropriating condition to maintain system reliability, meet the line of business operational requirements, ensure business continuity and to mitigate any health and safety risks.

The key investment activities at TS facilities pertain to:

- Timely replacement of major building system/components, including roof structures; windows and cladding; HVAC systems; electrical, lighting and control systems; and other crucial/fundamental structural elements and building systems before becoming a high reliability or safety risk;
- Site replacements and additions, including drainage, septic/well (servicing), and water treatment upgrades to improve quality and reliability of water supply, including conversions to municipal supply where feasible and cost effective; and
- The addition and renovation of existing facilities and development of new facilities to address existing and anticipated accommodation requirements.

Overall, to ensure reliable operations to Hydro One's customers, Hydro One assesses the condition of facility assets based on condition ratings derived from BCAs and preventative maintenance. Asset replacements occur when defects are identified during preventative maintenance or BCAs, which may pose a significant risk (e.g. failing equipment that jeopardize supply of service through the TS or pose health and safety risks). Building upgrades that are not driven by the condition of the facility include interior modifications such as changes to accommodate disabled employees, or modifications to create work space for additional staff as a result of organizational and operational changes.

## D. OUTCOMES

Outcomes associated with this investment include: reduced risk of component failure resulting in business or system disruptions, protection of health and safety, lower operating and maintenance costs, improved operational performance of facility assets in line with operational demands, and regulatory compliance. The program will help mitigate the maintenance requirements associated with deteriorating F&RE assets through the timely replacement of major building system/components. It will also align contractual commitments (e.g. facility leases) and investments with known and emerging operating requirements.

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the OEB's RRF:

**Table 2 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Support the ability of the lines of business to address customer needs through facilities that are commensurate with operational requirements.<br>• Minimize customer interruptions due to TS equipment outages associated with poor condition TS building assets. |
| **Operational Effectiveness** | • Maintenance and improvement of operational effectiveness of the lines of business through timely and strategic facilities investments that are aligned with operational requirements.<br>• Minimize reliability and safety risks posed by poor condition TS building assets. |
| **Public Policy Responsiveness** | • Compliance with government policy and regulatory directives (e.g. *Accessibility for Ontarians with Disabilities Act*).<br>• Mitigate Hydro One's greenhouse gas emissions by replacing poor condition equipment in existing facilities with more energy efficient solutions. |
| **Financial Performance** | • Cost effectiveness realized through regular BCAs, consideration of alternatives, and timely investment prior to failure.<br>• Cost efficiency realized through facilities investments that align with current and emerging operating requirements. |

## E. EXPENDITURE PLAN

### NEW FACILITIES AND MAJOR RENOVATIONS / UPGRADES

The estimated $6.1M investments for the New Facilities and Major Renovations/Upgrades have been developed based on the anticipated replacement of existing facilities adjusted for new operational requirements, current building standards and practices, regulatory considerations and rationalisation opportunities. Cost estimates are derived with reference to historical project results and costs, including prevailing market conditions. Market considerations include regional pricing differences and broader construction industry trends. At time of development, alternate building strategies for Hanmer Work Centre will be considered to optimise both construction and operational savings, while employing continuous improvement and lessons learned.

**ON-GOING SUSTAINMENT: IMPROVEMENTS AND ASSET REPLACEMENTS**

For on-going sustainment work, the funding averages $9.8M per year over the 2023-27 period (total of $49M) to meet the operational requirements of the line of business and ensure sustainment improvements or replacements are completed in a timely manner. Cost estimates are based on costs from previous similar projects and estimates from building engineers carrying out the BCAs. The details obtained from the BCAs assist in prioritizing investments that have been identified in poor condition that should be addressed to ensure business continuity. Sustainment work for the assets in good/fair condition into future years. On-going sustainment (improvements and asset replacements) investment targets key building assets that are likely to pose significant reliability or safety risks in the vent of failure, for example:

- Given the high risk to operational equipment posed by roof failures, roof replacements continue to be a focus area.
- HVAC maintenance is done during the spring start up and fall shut down for the switch from heating to cooling. Proper maintenance can help to increase the HVAC lifespan, prevent emergency repairs (that could be more costly) and identify replacement or repair. If HVAC issues arise, it will be prioritized and addressed to maintain health and safety along with the comfort levels of the occupants.

The proposed investment plan takes into consideration, ways to invest in energy efficiency initiatives to reduce environmental impacts over the long-term. F&RE collaborates with other line of business in identifying and implementing efficiency initiatives within our capital plan. For example, F&RE has an important role in supporting Hydro One's planned transition to electric vehicle commercial fleets (i.e. the electric vehicle charger program).

Table 3 below summarizes projected spending on the aggregate investment level.

**Table 3 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 13.7 | 13.6 | 11.0 | 10.5 | 10.5 | 59.3 |
| Less Removals | 0.8 | 0.9 | 0.9 | 0.8 | 0.8 | 4.3 |
| **Capital and Minor Fixed Assets** | **12.9** | **12.8** | **10.1** | **9.6** | **9.7** | **55.1** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **12.9** | **12.8** | **10.1** | **9.6** | **9.7** | **55.1** |

The development of facilities and resulting final cost of a project are influenced by various factors, which for the Hanmer Work Center is restricted to regulatory requirements and siting conditions. Specific to site conditions, while assessed early in the planning process, detailed investigation may give rise to higher actual development costs due to geotechnical and environmental factors with the potential need for costly site investigation and treatment.

While Hydro One generally seeks to apply template building designs and standard construction methodologies, site conditions and regulatory requirements may dictate deviations and result in higher costs, e.g. on-site storm water management or urban design considerations unique to a municipality and/or setting.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred option.

### ALTERNATIVE 1: RUN TO FAILURE

This alternative is a “run to failure approach” for building assets and site infrastructure at TS facilities. This alternative represents continued operation with the current state of equipment and infrastructure at these facilities, only carrying out capital expenditure reactively after the occurrence of a failure of site infrastructure or equipment.

This alternative was rejected as it is likely to undermine Hydro One's ability to support system reliability, pose undue risks to business operations, and result in non-compliance with regulatory requirements and corporate policies. A run to failure approach ultimately increases the likelihood of unplanned system outages and emergency situations that will have a negative impact on system performance, operational efficiencies and costs, health and safety, and customer service/value. Typically, TS buildings house critical assets, and would directly impact service to customers (e.g. the case of a roof leak or a heating/cooling system failure could trigger power system asset outages). Non-compliance with respect to regulatory requirements or other building code violations could also result if these facility assets are run to failure.

**ALTERNATIVE 2: PERFORMING ONGOING SUSTAINMENT**

This alternative funds on-going sustainment work but does not provide funding to accommodate new builds or renovations to address operational requirements.

This alternative is not sustainable. As outlined above (under Section C Investment Description), the replacement of the existing Hanmer Work Centre is required to address operational gaps and accommodate growth in the business. Given the overall condition (three main structures are in poor condition) and sub-optimal state of the assets, sustainment improvements will not suffice to meet operational requirements in a cost-effective manner.

**ALTERNATIVE 3: NEW FACILITIES AND MAJOR RENOVATIONS/UPGRADES OF PRIORITY REQUIREMENTS WITH ON-GOING SUSTAINMENT: IMPROVEMENTS AND/ ASSET REPLACEMENTS (RECOMMMENDED)**

As presented in Section C (Investment Description), this alternative would bring the Hanmer Work Centre to an acceptable state by replacing building assets that are not easily serviceable and have exhausted their operational/performance life by carrying out timely and cost effective site improvements at TS facilities.

The spending requested herein is an estimate of the work to be performed over the planning period necessary to keep these assets from reaching failure and causing service disruptions and creating potential health and safety risks. Cost estimates are based off of costs from previous similar projects and estimates from building engineers carrying out the BCAs. The objective is to pursue the most cost effective strategy that addresses operational requirements and manages risk. Each substantial investment will be subject to analysis and approval based on its cost/operational benefit prior to implementation.

The prime consideration throughout is to maximize the value of existing TS facilities through ongoing operations, maintenance and sustainment investments in line with operational requirements.

**ALTERNATIVE 4: NEW FACILTIY AND MAJOR RENOVATIONS/UPGRADES OF KNOWN FACILITY REQUIREMENTS WITH ONGOING SUSTAINMENT**

This alternative would be to upgrade and improve additional operational facilities to address needs identified by lines of business. This alternative would fully address all lines of business request, irrespective of the operational cost or benefit. In addition, it would entail a wholesale replacement of Hanmer Work Centre instead of keeping trailers that are in good condition to accommodate the growing work programs for the lines of business.

While it would more fully address the operational needs of the company and sustain the long term condition profile of the F&RE portfolio, this alternative does not effectively maximize the value of our existing TS facilities and components. It would also result in significant cost impact to ratepayers.

## G. EXECUTION RISK AND MITIGATION

To mitigate cost risks during execution, contracts are generally negotiated for fixed pricing to advance design with requisite investigations or detailed specification through a competitive bid process to procure the most suitable vendor, when applicable.

A potential risk is the unavailability of outages that are sometimes required to perform certain types of work such as roof replacement inside a TS. To mitigate this risk, outage requests will be submitted well in advance of the project dates and the required facilities outages will be scheduled in combination with outages required for power assets.

The risk of not delivering planned investments are mitigated through due diligence process by means of proper planning and the results from the BCAs. Before any project is executed or selected, a BCA is conducted to validate the need for the investments. The results from the BCAs help develop a comprehensive and accurate scope of work with project charters that address detailed upfront project scope, schedule, risks, milestones and other project deliverables. These project charters help track the progression of investments and prepare for any potential risks that may arise. In addition, the proper Project Management protocols are followed.

It's also important to follow Hydro One procedures and standards ensuring that there is proper buy-in, acceptance and awareness of all requirements from stakeholders on the TS side of the business. Facilities redundancy and low value investments are managed by conducting regular reviews with the various lines of business to understand and align with current and emerging work programs and identify common requirements and workplace synergies. Furthermore, planning is integrated with utility acquisition strategies and objectives to identify opportunities, create flexibility and manage facilities investments.

| **G-GP-05** | **INFORMATION TECHNOLOGY SERVICES ENABLEMENT** |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 19.5 | 21.9 | 27.2 | 28.9 | 24.9 | 122.4 |

**Summary:**

This investment involves refreshing infrastructure assets consisting of data center servers, storage, backup systems, and networks to help ensure the availability, uptime and reachability of IT applications to operate Hydro One. When applications and networks have outages, employee productivity is reduced and customer service is negatively impacted. The investments are expected to reduce applications and network outages so maximum uptime is available to internal users and customers.

## A. OVERVIEW

The investments in this ISD replace end of life information technology (IT) hardware and software, and upgrade existing enterprise tools in Hydro One's data centre infrastructure and corporate networks. The enterprise-level assets replaced or updated under this ISD include servers, storage, network systems, applications and tools used to support the IT Infrastructure. This ISD also funds the renewal of IT minor fixed assets (MFA) used by personnel across the company, such as laptops, printers, and monitors.

The investments made under this ISD sustain Hydro One's IT systems, maintain the reliability of critical applications, and help ensure the reliability and availability of critical IT systems. These investments replace IT assets that are at end of life.[1] By replacing end of life IT assets, Hydro One can reduce the risk of prolonged system outages and reducing the costs of unplanned investments to resolve failures. These investments provide the foundation on which the Company's other IT solutions are built.

The systems addressed by these expenditures are critical for the reliable operation of Hydro One's other IT solutions, such as those presented in GSP Section 4.11, G-GP-06 Corporate Services Enablement, G-GP-07 Customer Services Technology Enablement and G-GP-08 Work and Asset Management Enablement. The forecast costs of the project are estimated to be $122.4M over the 2023-2027 planning period.

[1] End of life for software is when the vendor will no longer support the product when encountering issues or provide security updates. For physical assets the end of life is when support is no longer provided and coincides with higher hardware failures.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

The investments planned under this ISD are needed to maintain three categories of IT assets:

i. Data centre infrastructure that Hydro Ones relies on to provide effective, secure, reliable IT services across the company;
ii. MFA that Hydro One staff rely on to perform their duties every day (specifically the everyday computing assets and voice/networking assets); and
iii. Enterprise tools that provide critical functions across the company.

The needs driving replacements in each category are set out in the subsections below.

#### I. DATA CENTRE INFRASTRUCTURE

Hydro One must continually maintain and update the data centre systems that enable critical business functions across the company to ensure ongoing reliable operations. These systems include data center servers, storage, backups, and networking technologies in two geographic data centres hosting enterprise applications. Hydro One has 2,320 virtual servers, 523 physical servers and 5 PB of storage. Hydro One has 140 branch offices and four Greater Toronto Area (GTA) locations that are interconnected to provide 8,000 users access to the enterprise applications residing in the company's data centres.

The company's data centre infrastructure provides the physical computing infrastructure on which many of Hydro One's critical applications operate. Critical enterprise business applications include SAP Enterprise Resource Planning software suite, enterprise Geographic Information System (GIS) system, and the Computer Telephony Integration (CTI) technology platform that is the essential workforce management and work routing engine for the Hydro One contact centres.

Hydro One considers data centre infrastructure to be end of life when they are no longer vendor supported. Hydro One must maintain vendor support for both the underlying IT infrastructure hardware and associated server operating systems such as Microsoft, Linux, and Unix server operating systems. Operating systems must also be in a vendor-supported state to function effectively and to maintain necessary cyber-security measures. All IT applications running on data center infrastructure must continually be maintained and supported to allow the applications to maintain connectivity and accessibility, and otherwise continue to function as required.

IT infrastructure in data centers also provides data backups which allow applications and systems to be restored if required for data center disaster recovery. Maintaining vendor support and an appropriate hardware lifecycle is especially important in the context of data storage and backup systems. If these assets are not appropriately supported, the risk of lost data increases. Lost data could have significant impacts on the Company's operations, customer performance, and employees' ability to perform their work. Accordingly, data backup infrastructure is critical in restoring IT infrastructure and applications during a data center disaster.

Planned investments in data centre systems over the 2023-2027 period are driven by a combination of infrastructure and systems reaching end of life. While the investments in this ISD are driven by the life cycle of current assets, newer replacement equipment may bring new benefits, since the emergence of new technological solutions can allow Hydro One to operate more effectively, efficiently, and to deliver improved outcomes. Hydro One continually evaluates the benefits that new infrastructure technologies can provide. For example, Hydro One has increasingly employed "virtualized" systems, in which applications are built on virtual server technology which simplifies application management and increases application uptime. This approach is more scalable, more cost effective to support and maintain, and provides greater security relative to conventional, non-virtualized systems.

Data Centre Infrastructure spend is driven by vendors' asset support lifecycles, which are typically five years. As the various data centre infrastructure components were purchased at different times, these costs are spread out over the 2023-2027 period to reflect the end of life timing for each specific component. For example, the higher costs in 2025-2026 are driven by the recently completed enterprise application upgrades for SAP and CTI, along with the refresh of mid-to-large server infrastructure. These recent investments are expected to reach end of life between 2025 and 2026, and thus drive the increased spending in infrastructure refresh during these years. In addition, Hydro One considers the evolving needs of its IT landscape in these investments. Storage capacity needs, for example, continue to expand year over year as Hydro One continues to generate, gather, and utilize an increasing volume of data (see GSP Section 4.11, G-GP-06 for a discussion of planned investments in Data Modernization and Automation).

## II. MINOR FIXED ASSETS (MFA)

To ensure ongoing reliable operations this ISD funds the renewal of the everyday IT assets that Hydro One relies on to function on a daily basis. The MFA investments planned under this ISD cover a range of assets, including:

i. Everyday computing equipment such as laptops, printers, and monitors, and
ii. Voice and networking systems.

### EVERYDAY COMPUTING MFA

Hydro One renews everyday computing equipment based on the assets' lifecycle. Everyday MFA renewal is also heavily dependent on the technology evolution of these MFA and the applications running on them. To maintain vendor support Hydro One maintains an MFA asset lifecycle of approximately five years. These assets need to be supported by vendors in order to remediate IT issues and perform maintenance. They also require current, supported software such as a Microsoft operating system and firmware. Ensuring supported operating systems and firmware are maintained on these assets is critical for optimal asset performance and to reduce IT security risks on these devices. Not having vendor supported hardware and software can result in increased failure, more costly remediation if failures occur, and prolonged outages experienced by the users for those failures. These failures reduce employee productivity by not having the assets available to use for the employees to conduct their work.

**VOICE AND NETWORKING SYSTEMS**

Voice and networking MFA include routers, switches, firewalls, phone systems, and phone sets that comprise Hydro One's corporate IT network. Key infrastructure in the voice and networking domain are Hydro One's routers, switches, VOIP phones, and Firewalls which comprise the majority of the telecom enablement funds.

These assets are deployed throughout Hydro One offices for voice connectivity, and to connect users to corporate applications. Employees connect their laptops, printers, and other devices to the IT corporate network to access the IT corporate applications on Hydro One premises and on cloud data centers. These systems are vital to ensure that employees can communicate effectively, whether working remotely or on Hydro One premises. The need for effective, reliable communication and networking systems is also critical in emergency situations.

Hydro One replaces voice and networking system assets based on the MFA asset refresh lifecycle and is also heavily dependent on vendor software refreshes running on these assets. To maintain vendor support, Hydro One adheres to an MFA asset lifecycle of approximately five years to ensure these assets are vendor supported and maintained for optimal asset performance and to reduce IT security risks. Hydro One must maintain vendor-support for voice and networking hardware and software. Failing to maintain support for these systems would result in increased asset failures, which in turn places employees at risk during emergency situations and reduces employee productivity by not having connectivity from their office location to access corporate applications such as email, SAP, and SharePoint. Maintaining vendor support is also critical to Hydro One's ability to mitigate cyber security risks. Lack of vendor support could expose the company's voice and network systems to greater security risks.

## III. ENTERPRISE TOOLS

Enterprise tools include systems and services supporting all lines of business, and specifically the Company's Systems Development Life Cycle (SDLC) tools; infrastructure monitoring and automation; and data analytics repository and related tools. These assets are summarized below:

- **Systems Development Life Cycle:** Hydro One is currently transforming its IT services to increase the efficacy and cost-effectiveness of the services it provides. The transformation focuses on offering an agile services delivery methodology. The IT sector has increasingly adopted the agile software delivery methodology, which improves the velocity at which solutions are deployed, the quality, and delivers more value sooner to the business with lower risk. The methodology requires a series of software products, linked together into what is known as a tool chain, which manages the work backlog, software versions, testing, and deployment of code releases to the business with a high degree of automation. These capabilities are essential to Hydro One's ability to reduce delivery timelines and development and support costs.

- **Infrastructure Monitoring and Automation:** Real time monitoring of systems and applications is vital in order to understand the performance, availability, incidents and other IT events to ensure that the business can operate successfully and customers have ready access to information to make well-informed decisions. Monitoring information is collected from infrastructure and applications in near real time supporting Hydro One's ability to take proactive actions to prevent degradation of service and to understand performance challenges and long-term trends to make informed investment decisions based on performance and system stability. In addition, the introduction of Robotics Process Automation (RPA) will allow Hydro One to automate specific IT functions and reduce system outages.

- **Data Analytics Repository and Tools:** To make sound business decisions, leaders require access to information from numerous operational and planning applications. These applications are known as the systems of record (SOR) and contain information in numerous formats both structured and unstructured. The challenge is access and having the right tools in order to gain deep insights in order to make sound business decisions. To address this, Hydro One has invested into technology that supports the convergence of information from systems of record into a single source of truth repository (SSOT). Further investment is required to address the end of life of this technology during the 2023-2027 period. Hydro One also requires investments into tools that allow the business to gain the insights from the data in this repository. These tools allow the business to view the data to understand what has happened (descriptive), what might happen (predictive) and what needs to happen to prevent something from occurring (prescriptive). These tools in conjunction with the data repository will lead to better-informed decisions to improve the reliability of the power network, increase the efficiency of our staff and improve the over-all safety of Hydro One workers.

## C. INVESTMENT DESCRIPTION

Across each category of IT assets described above, Hydro One adheres to IT industry standard practices of managing assets through a lifecycle program ensuring vendor support is available and decreasing the likelihood of failure. Funding decisions are made based on software lifecycles, vendor schedules, reliability requirements, and experience with similar initiatives/projects. The subsections below summarize the basis of planned investments in each category of IT hardware and software in this ISD.

**I. DATA CENTRE INFRASTRUCTURE**

Investments in data center infrastructure consist of refreshing servers, storage, backups, networking technologies and applications. As discussed above in Section B.1.II, these investments are driven by vendors' asset support lifecycles, which are typically five years. During the 2023-2027 forecast period, Hydro One will continue to replace these components as they reach their end of life. Notable systems, applications and tools that will be addressed in this timeframe include:

- upgrades relating to infrastructure supporting enterprise applications such as SAP and CTI;
- refreshes of mid-to-large server infrastructures;
- refreshes to important tools such as:
    - vROPS (vRealize Operations) used to monitor, troubleshoot and manage the health and capacity of our virtual environments,
    - ESX (Elastic Sky X) which is a server virtualization platform,
    - DNS (Domain Name System) for device to IP address resolution, and
    - DHCP (Dynamic Host Configuration Protocol) used for dynamic device IP address allocation;
- refreshes in operating systems such as Microsoft Sever 2012 to Microsoft Server 2019; and
- version upgrades to database software.

This investment also includes data centre infrastructure upgrades required to support applications' evolving infrastructure needs. Vendors that supply data centre infrastructure are constantly introducing better-performing hardware and software to allow the applications that run on these systems to continue operating effectively and responsively as processing and storage requirements increase. Corporate application upgrades can require data center infrastructure upgrades due to the amount of compute and storage a particular application requires.

Over the 2023-2027 period, Hydro One plans to invest approximately $50.8M in data centre infrastructure.

**II. MINOR FIXED ASSETS (MFA)**

Planned investments in MFA over the 2023-2027 period are to replace aging hardware and software to ensure all assets are in a vendor supported state. To help maximize the value of these assets over their lifetime, Hydro One replaces these assets as they approach end of life.

IT MFA typically reach end of life after five years. However, other factors such as performance issues or the lifecycle of the underlying operating system may also drive replacement. A summary of the core IT MFA is shown in Table 1 below.

**Table 1 - IT Core Minor Fixed Assets**

| Description | Quantity | Average Age (Years) |
|---|---|---|
| Enterprise Physical Servers | 583 | 4.0 |
| Desktop Computers | 1,195 | 5.4 |
| Laptop Computers | 7,075 | 2.3 |
| Tablets | 1,748 | 4.6 |
| Printers and Plotters | 1,218 | 5.8 |
| Volume of Enterprise Data Storage (TB) | 5,000 | 2 |

Voice and networking MFA are refreshed based on the age of assets, and supporting software on the asset. Since Hydro One's most densely staffed offices are in the GTA, Hydro One prioritizes voice and networking investments in the GTA offices. This strategy is designed to mitigate the risk of a network outage in a GTA office, which would leave hundreds of employees without connectivity to corporate applications in company data centres. Such outages can effect employee productivity and can potentially create health and safety issues, since field business offices are the central points for the field workers to get their work instructions for the day and are central hubs in emergency storm situations. A summary of the IT business telecom MFA is shown in Table 2 below.

**Table 2 - IT Business Telecom Minor Fixed Assets**

| Description | Quantity | Average Age (Years) |
|---|---|---|
| Network Routers | 169 | 9.2 |
| Network Switches | 604 | 7.1 |
| Firewalls | 26 | 3.8 |
| UPS Systems | 253 | 4 |
| Cisco IP Phones | 9,724 | 8 |
| Wireless Access Points | 550 | 4.9 |
| Load Balancers | 12 | 4.2 |

Over the 2023-2027 period, Hydro One plans to invest approximately $36.4M in MFA.

## III. ENTERPRISE TOOLS

Over the 2023-2027 period, Hydro One plans to invest in each of the three categories of Enterprise Tools described in Section B.1 III above. The planned investments in these technologies are as follows:

- **Systems Development Life Cycle (SDLC) Tools:** Over the 2023-2027 period, Hydro One is transforming its software development methodology from waterfall to agile. As described previously, this transformation is expected to support Hydro One’s ability to deliver capabilities to the business faster, with higher quality and achieve better business value. The agile methodology requires the implementation of infrastructure and software to support the planning, development and deployment of software in an automated fashion. This investment covers the implementation of the supporting hardware and software into what is known as a “tool chain.” This tool chain will cover the entire end-to-end development life cycle supporting the objectives of the transformation.

- **Infrastructure Monitoring and Automation:** Hydro One will replace end of life monitoring software and hardware for the core tool SPLUNK and expand the amount of infrastructure and applications to be monitored in the 2023-2027 period. This investment will increase the visibility to the health of the IT operations to avoid degradation or loss of service to both the business users and customers. Hydro One will also upgrade the RPA tools and from UIPATH and invest in new automation tasks performed today by people increasing Hydro One's efficiency and reducing outages to the business and customers when hardware and software interruptions are detected.

- **Data Analytics Repository and Tools:** Hydro One Analytics Data Repository is growing due to the data demand from the business in order to gain deeper insights in how the business is performing to enable better-informed decisions. This investment will upgrade to the existing data repository (SAP Sybase IQ) as it becomes end of life in 2025 and increase the storage capacity. Further investment into existing data tools such as Tableau (data visualization), IBM SPSS (statistical and predictive analytics) and SAS (statistical and predictive analytics) will be made to perform upgrades, as these tools will come to end of life during the 2023-2027 period. This investment will ensure that the business has the data that they need and the tools to perform the deep insights.

Over the 2023-2027 period, Hydro One plans to invest approximately $35.2M in Enterprise Tools.

## D. OUTCOMES

The investments planned under this ISD allow Hydro One to maintain the IT hardware and software assets necessary to operate the business and deliver a range of outcomes for customers. An appropriate IT asset fleet reduces the risk of prolonged IT system outages, reducing the costs of unplanned investments for problem resolution. By keeping IT systems up-to-date and vendor supported, Hydro One enables reliable access to the technologies that support customer service and the daily activities of Hydro One's operations.

The investments planned in this ISD are also necessary to ensure the IT infrastructure can provide availability for enterprise applications. They effectively provide the foundation to enable the implementation and reliable operation of other IT solutions, such as those presented in G-GP-06 Corporate Enablement, G-GP-07 Customer Services Technology Enablement and G-GP-08 Work and Asset Management Enablement. Finally, this investment will help ensure that Hydro One has applications that are secure, up-to-date, and positioned to effectively reduce cyber-security risks.

## D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 3 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Improves customer experience by reducing interruptions to customer IT applications that provide access to important information such as power usage and billing and improving the stability and performance of systems that support customer service activities. |
| **Operational Effectiveness** | • Maintains the reliable operation of data centre infrastructure, MFA and enterprise applications to support optimal uptime as designed and provide Hydro One employees with the information and tools they require to perform their daily work. |
| **Public Policy Responsiveness** | • Maintains the efficacy of the IT systems that interact with market participants and support the IESO in its market oversight mandate. |

## E. EXPENDITURE PLAN

Table 4 below summarizes projected spending on the aggregate investment level.

**Table 4 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 19.5 | 21.9 | 27.2 | 28.9 | 24.9 | 122.4 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **19.5** | **21.9** | **27.2** | **28.9** | **24.9** | **122.4** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **19.5** | **21.9** | **27.2** | **28.9** | **24.9** | **122.4** |

The pacing of these investments are driven by the replacement of end of life assets. The amounts are informed by historical costs, with year over year fluctuations driven by the end of life timing of individual assets. As discussed above in Section B.1.I, the higher costs in 2025-2026 are driven by the recently completed enterprise application upgrades for SAP and CTI, along with the refresh of mid-to-large server infrastructure.

The factors influencing the cost of the investment include:

- Refinement of planning estimates as projects near execution (see GSP Section 4.10.4 for additional details on project delivery governance)
- Scope changes as line of business needs evolve and technology advancements become available that offer additional capabilities and value to the lines of business.
- Changes to regulatory policies or security requirements at the time of implementation.
- System or landscape changes that proceed in parallel that may add or reduce technical complexity at the time of implementation.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking.

**ALTERNATIVE 1: DEFERRING INVESTMENTS**

This alternative would defer the replacement of assets due for refresh. This alternative was rejected as it would result in operational issues and interruptions across Hydro One's IT landscape due to system failures, and an unacceptable increase the Company's security risk profile.

Extending the timeline of the current lifecycle asset refresh strategy and delaying replacement of assets makes Hydro One out of line with industry practice and significantly increases risk to the business in the following areas:

- Increases in employee dissatisfaction and decreased productivity due to frequent and/or prolonged service outages;
- Degraded regulatory relationship from disruptions to market operations of IT systems that interact with market participants;
- Decrease in customer satisfaction due to failure of enterprise wide applications such as SAP, ihub/Tivoli, Microsoft Exchange, mobile applications, customer billing, relationship management, and call centre systems;
- Higher costs to support and service applications without vendor support; and
- Increased security risk as Hydro One would not be running on the latest supported systems by the vendors and therefore would not have access to the latest security patches.

**ALTERNATIVE 2: PURSUE EXTENDED SUPPORT (WHERE AVAILABLE)**

Depending on the specific system, its age, and the practices of the vendor, extended support may be available for a period after a product ceases to be officially supported by the vendor. Extended support is a higher cost solution, not universally available, and if available, it is only offered for a comparatively short period after official vendor support ends.

Hydro One rejected an extended support approach for investments within this ISD for the following reasons:

- Deferral of system updates comes with a higher operating cost in the short term (vendors typically charge escalating rates for support beyond standard product lifecycles, if even available) and often will be more expensive to replace in the future as standards and integration patterns change over time;
- Even with extended support, functionality and security risks increase as products become obsolete and are no longer added to or patched in order to avoid issues or mitigate security issues; and
- Pursuing extended support would create a backlog of prudent work, deferring incremental improvements to business functions that come with newer versions of software or platforms.

**ALTERNATIVE 3: PROCEED WITH PLANNED REPLACEMENTS (RECOMMENDED)**

Proceeding with the investments as described in this ISD will allow Hydro One to continue to sustain Hydro One's IT systems, maintain the reliability of critical applications, and help ensure the reliability and availability of critical IT systems. In turn, these investments reduce the risk of prolonged system outages and the costs of unplanned investments to resolve failures.

## G. EXECUTION RISK AND MITIGATION

No unique concerns are foreseen with completing the investments in this ISD beyond generic project risks, such as schedule delays, business disruption, and system outages. Hydro One mitigates such risks through project governance (as described in GSP Section 4.10.4), which proactively communicates risks, evaluates options, and employs appropriate project and program governance approaches.

| G-GP-06 | CORPORATE SERVICES ENABLEMENT |
| --- | --- |
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Operational Effectiveness, Financial Performance |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
| --- | --- | --- | --- | --- | --- | --- |
| **Net Cost** | 24.4 | 18.1 | 18.3 | 16.9 | 16.6 | 94.3 |

**Summary:**

Hydro One plans to replace, update and introduce various technologies that support the Company's Corporate Services (such as Finance, Supply Chain, and Real Estate), and to invest in new technologies that will enable and enhance Hydro One's Corporate Services.

The Information Technology (IT) investments planned under this ISD are organized into three categories:

1. Updating SAP Finance Modules,
2. Optimizing Logistics in Supply Chain & Real Estate Operations, and
3. Data Modernization and Automation.

## A. OVERVIEW

Over the 2023-2027 period, Hydro One plans to replace, update and introduce various technologies that support the company's Corporate Services (such as Finance, Supply Chain, and Real Estate), and to invest in new technologies that will enable and enhance Hydro One's Corporate Services. The Information Technology (IT) investments planned under this ISD are organized into three categories:

i. Updating SAP Finance Modules,
ii. Optimizing Logistics in Supply Chain & Real Estate Operations, and
iii. Data Modernization and Automation.

The sub-sections of this ISD are divided between these three categories.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

The investments planned under this ISD are driven by a combination of the need to replace or update technologies that at the end of life (i.e., at or approaching the end of vendor support), and the opportunity to improve corporate services outcomes through the efficient use of new technologies.

#### I. UPGRADING SAP CORPORATE MODULES

A major investment planned under this ISD over the 2023-2027 period is upgrading the Company's SAP corporate modules to the new SAP S/4HANA version. This upgrade is in alignment with the larger Hydro One SAP Transformation (discussed in GSP Section 4.2.4) to update its SAP Enterprise Resource Planning (ERP) software suite to the current standard, replacing the Company's current version (R3).

SAP has announced that the R3 versions will not be supported by SAP beyond 2027. In response to this, Hydro One is updating its SAP implementation to the S/4HANA version to maintain support. Implementing S/4HANA will also allow Hydro One to benefit from various new features and performance improvements, which will enable the company to execute corporate functions more effectively. These benefits include faster processing times, more automated processes to reduce employee time spent on administrative data-mining tasks, enhanced data integrity and auditability, improved visibility on the investments and maintenance costs allocated to assets, business controls, and more reliable compliance reporting.

The S/4HANA investments in this ISD relate to Hydro One's corporate management functions in SAP. Specifically, these investments will update or implement the following SAP modules: SAP FI/CO (Financial Accounting and Controlling), SAP Treasury Management, SAP Analytics, SAP BW (Business Warehouse), SAP BPC (Business Planning and Consolidation) and SAP EHSM (Environment, Health and Safety Management). Updates to other modules are included under GSP Section 4.11, G-GP-07 (Customer Service Technology Enablement) and G-GP-08 (Work and Asset Management Enablement).

By 2025, Hydro One will be in the advanced stages of implementing the updated ERP. In addition to updating core systems nearing their end of vendor support, this transition will bring multiple benefits to the enterprise including greater visibility into data, faster data processing, and a more robust, interconnected data model. It will also enable Hydro One to more easily adapt new capabilities in the future, move closer towards best practices, and enhance overall management decision-making. The update of modules supporting corporate functions is presented in this ISD, as it represents a discrete set of corporate management processes and capabilities within SAP.

## II. OPTIMIZING LOGISTICS IN SUPPLY CHAIN & REAL ESTATE OPERATIONS

This ISD includes investments to enable Hydro One's Supply Chain and Real Estate services. New technologies are now available that will allow the company to enhance its services in these essential functions. Historically, Hydro One's Supply Chain and Real Estate management has largely relied on manual, labour-intensive processes to conduct various operational and procurement activities. While effective relative to the historically available alternatives, the

Company's operational effectiveness in these areas will be enhanced through the prudent implementation of new technologies.

Current Supply Chain processes do not provide advanced analytics on operational data and procurement spending, and are not directly connected to the supply and demand systems that underlie the investment plan. By providing better visibility and insights into future procurement spend, Hydro One will be in a better position to anticipate future supply needs and arrange for cost efficient agreements with vendors. The current procurement processes also lack mobile capabilities for field workers, requiring multiple individuals across multiple lines of business to procure and receipt materials. This can create delays in receiving materials and presents operational and administrative challenges. By implementing new technologies, more elements of these processes can be automated, enabling field crews to more quickly procure their materials and reduce administrative activities across the Company.

The Supply Chain-related expenditures planned under this ISD for 2023-2027 will introduce new capabilities that will make Hydro One's Supply Chain practices more effective and efficient. These investments will:

- enhance decision making capabilities through the use of new data related to vendors, purchasing and supplier risk.
- better integrate planning and collaboration between Hydro One's procurement functions and other lines of business,
- reduce employee time spent procuring items by simplifying the purchasing process steps within the system, and
- enable procurement in the field, making it easier and more efficient to find contract details and buy materials.

The Real Estate-related technologies in this ISD will enable Hydro One to potentially unlock as much physical space available in Hydro One's current Real Estate portfolio and limit the potential increase of lease costs by effectively managing the portfolio and making data driven Real Estate decisions. In addition, by introducing new technologies to support Real Estate administration, Hydro One expects to streamline property lease administration by creating a single repository of all Hydro One leased assets. Hydro One also intends to introduce new space optimization software which will create new capabilities in assessing and optimizing the physical space being used on company properties.

Details of the planned Supply Chain and Real Estate-enabling investments are set out in section C.II below.

### III. DATA MODERNIZATION AND AUTOMATION

This ISD includes investments in IT solutions to leverage the growing volume of data that is available to Hydro One across the enterprise. Data Modernization and Automation investments over the 2023-2027 period will allow the company to conduct more comprehensive and insightful analysis of data, leading to a range of improvements in business planning and operation decision-making. As described in section C.III below, these investments will leverage machine learning and predictive analytics to assess and improve operations across the company, leading to performance improvements and increased efficiency.

## C. INVESTMENT DESCRIPTION

### I. UPGRADING SAP CORPORATE MODULES

The corporate modules of the SAP ERP suite that are being upgraded through this investment are core to the management and reporting processes for finance, human resources, and health and safety. These modules were originally implemented between 2008 and 2014, and the current mix of applications are either at end-of-life or will be end-of-life by 2027. In addition, SAP will no longer provide vendor support for these modules beyond 2027. The investments presented in this document are to update or enable the following SAP modules:

- SAP FI/CO (Financial Accounting and Controlling),
- SAP Treasury Management,
- SAP Analytics,
- SAP BW (Business Warehouse),
- SAP BPC (Business Planning and Consolidation) and
- SAP EHSM (Environment, Health and Safety Management).

In addition, this investment includes funding in 2026 and 2027 for updates to Hydro One's SAP S/4HANA Success Factor module, which is currently being implemented to replace Hydro One's SAP HR module. As this module is one of the first to be converted to S/4HANA as part of Hydro One's SAP Transformation, minor updates are planned in these later years to ensure proper integration with the other modules.

These corporate modules are the backbone of the current application landscape, which all other key systems interface and synchronize data.[1] As part of the transition to S/4HANA, significant changes are required to the structure of Hydro One's data. For example, the SAP FI/CO data model no longer uses the concept of sub-ledgers. This requires a complete restructuring of Hydro One's general ledger, chart of accounts, and profit and cost centers to create a more accurate and flexible environment for financial reporting and management. As this platform is a critical function of the lifecycle management of Hydro One's financial operations, it must be updated to maintain and extend these functions into the future.

The move to S/4HANA comes with the opportunities to better harmonize data between SAP and other WAM applications, which will (i) reduce the manual effort required for work planning and execution, (ii) improve the integration between asset management and the associated financial reports, (iii) reduce the manual efforts required to produce financial reports, and (iv) reduce architectural complexity and harmonize data flow across the landscape.

[1] For example, Hydro One's invoice management system (Taulia) and safety data capture system (Intellex) both rely on the backbone that these corporate modules provide.

The S/4HANA update for corporate functions will include financial planning data, financial organizational structural elements, and cross functional data structures. These financial data structures and hierarchies frequently interface with WAM data structures and hierarchies. These hierarchies must be designed in a holistic way that allows the many inter-connected corporate and WAM applications to exchange data. Accordingly, the updates in the finance modules will be performed in tandem with the WAM modules presented in G-GP-08.

S/4HANA comes with new capabilities that Hydro One currently relies on other applications to perform. By shifting these functions to SAP, Hydro One will have fewer applications to maintain and should therefore result in improved data. In addition to the new modules listed above such as SAP Treasury Management, SAP Analytics and SAP EHSM, Hydro One will continue to assess the capabilities of other new modules and functions, such as Group Reporting for Consolidation, Universal ledger as the single source of truth, Profitability and Performance Management for complex business rules and allocations, SAP Receivable Management, Cash Management and Intercompany Matching and Reconciliation.

By 2025, Hydro One will be in the advanced stages of implementing the updated ERP, with the Finance modules and the WAM Enterprise Asset Management modules being the first steps in the ERP replacement. Over the 2023-2027 period, Hydro One plans to invest $27.8M in updating SAP corporate modules.

## II. OPTIMIZING LOGISTICS IN SUPPLY CHAIN & REAL ESTATE OPERATIONS

Planned investments in Supply Chain & Real Estate Operations will introduce new capabilities that will alleviate manual labor intensive processes, establish defined digital workflows, and ensure data-driven decision making.

The Supply Chain and Real Estate investments are divided into the following categories, each of which is detailed in the sub-sections below:

- **Category 1:** Enable end-to-end user-driven procurement processes in Ariba and transition from the legacy platform (Taulia)
- **Category 2:** Improve procurement capabilities and supplier risk
- **Category 3:** AMI Warehouse Optimization
- **Category 4:** Facilities and Real Estate Technology Transformation

Over the 2023-2027 period, Hydro One plans to invest $24.5M in optimizing logistics within Supply Chain and Real Estate operations.

**CATEGORY 1: END-TO-END USER-DRIVEN PROCUREMENT PROCESSES**

Investments in this category fall into three sub-categories: (i) Commerce Automation, (ii) Supplier Risk Management, and (iii) Guided Buying and Procurement Desk. Each sub-category is detailed below.

**I. Commerce Automation, Guided Buying and Procurement Desk**

Hydro One currently uses the Taulia platform to introduce electronic Purchase Order (PO) delivery and Electronic Invoicing. Since it was introduced in 2014, Taulia has helped Hydro One improve these functions in several respects, including fully digital PO delivery, electronic invoicing and electronic payments. However, the SAP Ariba Commerce Automation solution that Hydro One plans to implement is able to perform these same tasks and have features that Taulia lacks. For example, the SAP module comes with additional capabilities for Goods Receipting, Advanced Shipping Notices and Order Confirmations. This investment will allow for the rationalization of applications by removing Taulia while enabling additional features.

This investment will implement the SAP Ariba Commerce Automation solution along with Guided Buying to increase supplier collaboration and transparency throughout the entire supply chain, thereby reducing multiple supplier portals by consolidating into a single Ariba platform. It will also introduce features such as Order Confirmations which would eliminate the need for manual, Excel-based processes and allow for a seamless supplier collaboration experience. This process automation will help ensure adherence to Supply Chain procurement policies and substantially reduce the number of manual steps required for good receipting.

Implementation of SAP Ariba's Guided Buying solution to streamline the front-end procurement process and providing users an automated buying-channel. As part of this rollout, unique landing pages will be created for various users across the enterprise, resulting in an enhanced user experience. These landing pages will guide all purchases through to the correct channel, contract and preferred supplier. This will also introduce a consumer-like shopping experience extended to all users and devices, including mobile devices. This will result in reduction of off-contract spend and increased user compliance through guided requisitions guiding users to the correct buying channels.

**II. Supplier Risk Management**

This component includes the implementation of the SAP Ariba Supplier Risk solution and integrating it with third party risk management data. Currently there is no supplier risk management program or system in place at Hydro One. Supplier risk is currently managed in a decentralized manner, with supplier financial risk managed by the Supply Chain governance team, while category and contract risk is managed by the Category Management teams. Using Ariba's Risk Management module, supplier risk data will be directly linked to the supplier information module which is currently in use at Hydro One. This will allow buyers and sourcing leads to quickly determine which suppliers can be safety transacted with.

**III. Guided Buying and Procurement Desk**

This includes implementation of SAP Ariba's Guided Buying solution to streamline the front-end procurement process and providing users an automated buying-channel. As part of this rollout, unique landing pages will be created for various users across the enterprise, resulting in an enhanced user experience. These landing pages will guide all purchases through to the correct channel, contract and preferred supplier. This will also introduce a consumer-like shopping experience extended to all users, including through mobile devices. This will result in reduction of off-contract spend and increased user compliance through guided requisitions to the correct buying channels.

**CATEGORY 2: PROCUREMENT CAPABILITIES AND SUPPLIER RISK**

Investments in this category fall into two sub-categories: (i) Planning and Collaboration, and (ii) Tail Spend Automation, both of which are detailed below.

**I. Planning and Collaboration**

Hydro One's current Asset Planning process is not directly tied to the overall demand and supply plan. The lack of direct integration between these systems requires dedicated effort to ensure the asset planning and supply chain data are aligned. As part of this investment, Hydro One plans to implement integrated planning and collaboration systems with key suppliers, which will allow the companies to share forecasts, inventory and establish purchase commitments. This enhanced collaboration will require the implementation of SAP's Planning and Collaboration tool along with the Integrated Business Planning tool to synchronize planning and execution across the extended supply chain. It will also introduce a Supply Chain Monitor system for those who purchase goods to enable real time updates on order exceptions and alerts about inventory and forecasts.

**II. Tail Spend Automation**

The majority of purchases less than $100,000 (referred to as "tail spend") are made as required on an ad-hoc basis. This non-repetitive type of spend is time consuming to track and process. Over the 2023-2027 period, Hydro One is planning to implement a technology to standardize these tail spend procurements on a preliminary basis. The planned IT solution will aggregate discrete tail spend purchases, targeting the spend profile across select categories for purchases less than $500,000 and greater than $50,000. Introducing sophisticated methods, such as artificial intelligence and machine learning to capture additional savings on tail spend purchases.

**CATEGORY 3: AMI WAREHOUSE OPTIMIZATION**

In 2017, Hydro One implemented SAP Ariba and FieldGlass solutions. These technologies were integrated into the company's ERP system which created new capabilities around Sourcing, Contracts, Supplier Information and Procurement Services. As a result of these implementations, new opportunities of growth, process enhancements, increased efficiencies and overall better warehouse management have emerged.

In conjunction with the planned Orillia Warehouse investment (noted in G-GP-03), a thorough discovery is planned in which an end-to-end examination of current warehouse management processes, technologies and logistics management will take place. It is expected that through this discovery, new technologies will be required to enable enhanced warehouse technology functionality such as: mobile receipting, a devise-agnostic inventory platform, and an upgrade to the current end of life radio-frequency gun technology used to receipt and deploy AMI equipment. The current handheld barcode scanners being used at the AMI warehouse have been deemed as end of life, prone to failure and no longer supported by the vendor. This investment will ensure that consistent, standard technologies are being leveraged across the Orillia Warehouse facility and the AMI warehouse. These new solutions will allow for seamless receipt and deployment of AMI units. In addition, enhancements to field ordering, overall material management and field inventory control are expected to be achieved.

**CATEGORY 4: FACILITIES AND REAL ESTATE OPTIMIZATION**

The investments in this ISD will deploy new technologies and digitize various elements of Hydro One's Facilities and Real Estate (F&RE) division, enabling improved management of Hydro One's real estate assets. The facilities and real estate industry has seen significant technology developments in recent years, creating opportunities for significant improvements to improve and streamline Hydro One's management of these assets.

Currently, various aspects of Hydro One F&RE operations are conducted using manual methods, including lease administration, move management and space utilization. These manual processes are necessarily slower, less efficient, and capture fewer data points than possible using digital solutions. In addition, key capabilities surrounding move management and space optimization almost fully depend on manual assessments.

Planned F&RE technology investments focus on technology enablement, process improvements and enhanced delivery of core real estate services through the implementation of new technologies. Investments under this ISD will create a single lease management system providing an easily accessible resource for all lease information and documentation. This solution will integrate with existing corporate systems such as SAP and are expected to improve lease payment and collection, track key lease data, and manage rent and other property payments. Additionally, this system will provide financial control by creating a comprehensive overview of all lease transactions in a single repository.

This category of investment also includes space management technology to better utilize existing Hydro One real estate assets. Currently, Hydro One relies on manual methods to determine the physical space being occupied at work locations. This process allows only a small number of variations of physical space usage to be assessed. Also, the majority of existing sites have not been evaluated to better understand whether space utilization is being optimized. This investment will introduce new technologies to optimize workspaces through evaluation of flexible floor plans and scheduling technology which will improve employee-to-desk ration and ultimately reducing real estate operational costs.

### III. DATA MODERNIZATION AND AUTOMATION

Recent advances in technologies such as robotics, data analytics, and machine learning have introduced significant efficiency and process enablement opportunities. Investments in Data Modernization and Automation are intended to drive better decision making capabilities and increase the level of process automation throughout Hydro One. Ultimately, Hydro One expects that improved data analytics and automation will help the company improve core operations, optimize the workforce, better address customer needs and respond more quickly to emerging market conditions.

Hydro One's investments in data modernization and automation are organized into two categories:

- **Category 1**: Machine Learning;
- **Category 2**: Advanced Robotic Process Automation and Intelligent Automation.

Over the 2023-2027 period, Hydro One plans to invest $42.0M in Data Modernization and Automation.

**Category 1: Machine Learning**

While the volume of data available to Hydro One has grown exponentially in recent years, the technologies available to track, analyze, and leverage that data are catching up with the volume of information available. Over the past 15 years, a growing number of operational processes have been digitized and a significant volume of transactional data has become available. While Hydro One strives to leverage available data when making business decision on a daily basis, certain limitations exist based on the volume of the data that can be analyzed within appropriate time and cost considerations. Sophisticated methods of analyzing data, such as machine learning, allow for a much quicker pace in delivering deeper insights into operations, customers, and responses to changing business conditions.

Machine learning algorithms have progressed in recent years, especially through the development of deep learning concepts and models. In addition, compute capacity has become readily available to handle more complex data models much faster. This compute capacity introduces vast processing potential at Hydro One to analyze substantial amounts of data at speeds far in excess of what was historically possible.

This investment will introduce technologies that will support new machine learning capabilities at Hydro One. Successful adoption of machine learning tools are expected to enhance operational performance, increase productivity, improve accuracy, as well as expand the discovery of new value propositions in various parts of the business. Analytical approaches comprising of predictive models and machine learning will drive better decision making, reduce costs and increase efficiencies.

**Category 2: Advanced Robotic Process Automation & Intelligent Automation**

Various operational processes require employees to manually input data into multiple systems. These processes are often repetitive in nature, time consuming and typically lack scale or value to warrant automation via large scale technology transformation. However, Robotic Process Automation (RPA) uses technology to complete these tasks, without having to invest in large-scale transformation. RPA is best suited for processes with repeatable, predictable interactions with IT applications. RPA tools can improve the efficiency of these processes and the effectiveness of services without fundamental process redesign.

RPA software, known as “BOTs”, perform routine business processes by mimicking the way employees interact with applications through a user interface and follow simple rules to make decisions. Entire end-to-end processes can be performed by these BOTs with very little human interaction. This in-turn will deliver decreased cycle times and improved throughput of teams, improved accuracy of data and allowing employees to focus on more demanding and creative tasks, rather than repetitive processes.

In addition to RPA, Hydro One will seek to implement an Intelligent Automation (IA) solution that will automate non-routine tasks that involve intuition, judgement or problem solving. The decreasing costs of data storage and processing power are driving rapid developments in the field of artificial intelligence and cognitive technologies with human-like capabilities such as recognizing handwriting, identifying images and natural language processing. When combined with RPA and analytics, these cognitive technologies can form intelligent automation solutions that either directly assist employees in performing non-routine tasks or automate those task entirely. RPA combined with IA will allow Hydro One to automate various tasks and processes, reducing or eliminating manual administrative work, reducing costs, making better use of resources, and increasing productivity.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Operational Effectiveness** | • Maintains vendor support for SAP, a critical enterprise application<br>• S/4HANA provides faster processing times, more automated processes to reduce employee time spent on administrative data-mining tasks, enhanced data integrity and auditability, improved visibility on the investments and maintenance costs allocated to assets, business controls, and more reliable compliance reporting.<br>• Analytical approaches comprising of predictive models and machine learning will drive better decision making, reduce costs and increase efficiencies.<br>• Improve the operational effectiveness of all Supply Chain services by improving inventory management, reducing overall supply chain planning costs, and driving procurement efficiency.<br>• Greater visibility into data, faster data processing and a more robust, interconnected data model, enable transformation towards best practices, and enhance overall management decision-making.<br>• Optimize the use of physical space available in Hydro One's current Real Estate portfolio and limit the potential increase of lease costs by effectively managing the portfolio and making data driven Real Estate decisions. |
| **Financial Performance** | • Modernize financial management and reporting, enhance data integrity and auditability, and facilitate accountability reporting and enhance overall controls using new platform capabilities. |

## E. EXPENDITURE PLAN

Table 2 below summarizes projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 24.4 | 18.1 | 18.3 | 16.9 | 16.6 | 94.3 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **24.4** | **18.1** | **18.3** | **16.9** | **16.6** | **94.3** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **24.4** | **18.1** | **18.3** | **16.9** | **16.6** | **94.3** |

The investment costs outlined in Table 2 are paced such that the first half is focused on the upgrades to the SAP corporate modules, and the latter years are focused on data modernization and automation.

The bulk of the upgrades to the SAP corporate modules are required in 2023-2024 for several reasons:

- to ensure these modules are updated prior to the end of vendor support in 2027;
- to align with the timing of the WAM module upgrades; and
- to ensure that sufficient resources are available for investments in the later years.

Factors that influence the cost of this investment include:

- Refinement of planning estimates as projects near execution (see GSP Section 4.10.4 for additional details on project delivery governance).
- Scope changes as line of business needs evolve and technology advancements become available that offer additional capabilities and value to the lines of business.
- Changes to regulatory policies or security requirements at the time of implementation.
- System or landscape changes that proceed in parallel that may add or reduce technical complexity at the time of implementation.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking. Due to the unique considerations for upgrading the SAP corporate modules, these alternatives are discussed separately from the other corporate enablement investments.

### SAP ALTERNATIVES

**SAP Alternative 1: Status Quo**

As the R3 versions will not be supported by SAP beyond 2027, status quo is not an option. Hydro One must maintain vendor support to mitigate disruptions to its SAP systems and the subsequent impacts on its corporate operations, including the tracking, reporting and record keeping of its financial activities.

In terms of timing, the option of deferring this investment to later years is not acceptable as any extended support from SAP is limited and will be costly, and deferrals to this investment will increase the risk of not having available resources from the vendor to support the transition to S/4HANA. SAP has indicated that extended support will be available up to 2030, but for additional cost. This is not a beneficial option as these incremental extended support costs increase the overall lifecycle costs for the product and Hydro One is not able to realize the additional capabilities and benefits from the S/4HANA version.

**SAP Alternative 2: Brownfield Approach**

This option essentially migrates the existing database and functionalities from the R3 version to S/4HANA, without leveraging any of the new benefits offered by the latter. This is usually the lowest cost option as it does not seek any improvements to process, data organization, or configuration. Instead, the focus is on transitioning the current data and processes directly into SAP S/4HANA, with minor adjustments as needed to facilitate the conversion. This option is not acceptable for the SAP corporate modules as this would not adequately address the needs of the lines of business and it does not maximize the value of transitioning to SAP S/4HANA.

**SAP Alternative 3: Greenfield Approach**

This alternative is a brand new implementation that seeks fully reconfigure Hydro One's corporate modules. This is usually the highest cost option as it is a holistic revisit of the design and a rebuild of Hydro One's system. This requires converting all master data and open transaction items to the new configurations, and programming any required customization. While this option provides the opportunity to change any and all business processes, it is not acceptable because of the high cost impacts to rates.

**SAP Alternative 4: Selective Data Transition Approach (Recommended Alternative)**

This alternative is a balance between the brownfield and greenfield approaches discussed above. With this approach, Hydro One evaluates its customizations and keeps only those that are required to meet regulatory obligations, and its master data and open transactions generally keep the same configurations. This approach reduces the design time related to a greenfield approach but still leverages the best practices related to a leaner, more standard SAP system. This approach requires a discovery to look at how the system is designed today and to find the things that can be improved from both a process and data perspective. The discovery is followed by a detailed design, then build phase. The main benefits of moving closer to SAP standardization are that it will reduce sustainment efforts, environment management costs and the time to implement future upgrades and patches; enable Hydro One to more easily introduce and build new project environments in SAP; and improve the data integration between Asset Management, Work Management, and Financial Management. These benefits, in turn, allow for faster processing and improved efficiency for Hydro One's processes.

**SAP Alternative 5: Non-SAP Software**

Hydro One also considered replacing SAP with an ERP or suite of similar applications from another vendor. This option was rejected because of the risks associated with implementing a completely new application, the costs, complexities and lost productivity from managing the change across the company and the fact that this would not leverage the value of Hydro One's experience and expertise with SAP.

**OPTIMIZING LOGISITICS IN SUPPLY CHAIN AND REAL ESTATE OPERATIONS**

**Alternative 1: Do Nothing**

Not proceeding with this investment will limit Hydro One's ability to increase strategic souring capabilities which would lead to inefficiencies in the overall Supply Chain. In addition, Hydro One's enterprise risk level around cyber security and reputation in relation to suppliers also increases. Hydro One also considered not proceeding with the Real Estate related technologies – this would also introduce further risk to real estate operations surrounding lease administration and space optimization. For these reasons, this alternative has been rejected.

**Alternative 2: Partial implementation**

Hydro One also considered implementing either the AMI Warehouse Optimization technologies or the SAP Modules supporting supply chain operations and not proceeding with both investments. Due to the interconnected dependencies between the supporting technologies, this would create inefficiencies in either of the implementations and create ineffective redesigned processes. The additional SAP modules will introduce enhanced material management capabilities that are required to be leveraged for improving warehouse technologies. For these reasons, this approach was rejected.

**Alternative 3: Recommended Alternative**

Planned investments in Supply Chain will introduce new capabilities that will alleviate manual labor intensive processes, establish defined digital workflows, and ensure data-driven decision making. These investments will enable field driven procurement processes and optimize current AMI Warehouse technologies. Due to the interdependent nature of the supporting technologies it is best suited to implement these solutions from a holistic perspective. This will ensure that all downstream and upstream processes are in synchronization and will result in superior Supply Chain and AMI warehouse management.

**ADVANCED DATA MODERNIZATION AND AUTOMATION**

**Alternative 1: Do Nothing**

By not proceeding with the planned investments in Advanced Data Modernization and Automation, Hydro One will be limited in the extent of information available to make the most optimal decisions, which in turn will result in foregone opportunities to improve the effectiveness and cost-efficiency of Hydro One's Corporate Services. Accordingly, Hydro One rejected this approach.

**Alternative 2: Partial Implementation (Not Recommended)**

Hydro One has also considered implementing either machine learning technologies or Advanced Robotic Process Automation, but not both. This alternative was rejected due to the missed opportunities of efficiency gains that both technologies introduce if implemented together. For example, aggregation and deep insights into Hydro One's data leveraging Machine Learning will expose operational inefficiencies that can potentially be remediated leveraging automation. This automation can be in the form of RPA or intelligent automation. In addition, advanced automations will often leverage data points that are generated through the establishment of data models and algorithms that require machine learning toolsets. For these reasons, this alternative was rejected.

**Alternative 3: Recommended Alternative**

Data is the foundation upon which Hydro One will build better customer experiences, improve operational efficiencies and deliver value for the Company and customers. Ultimately, this approach will bring Hydro One's data together in a way that better informs decisions and drives higher performance across the Company. It will create opportunities through machine learning models that provide insights into how Hydro One operates. These insights will be used to identify potential automation opportunities which will further increase efficiencies.

## G. EXECUTION RISK AND MITIGATION

The risks of not following the investment timing for this ISD will result in resource or capability constraints needed to execute the planned investments. Hydro One must also manage a limited pool of resources with the relevant skills. In order to avoid project resource conflicts, the investments have been paced to allow for certain activities to take place in optimal sequence, with the SAP S/4HANA investments preceding the implementation of some other investments in this ISD.

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| G-GP-07 | CUSTOMER SERVICE TECHNOLOGY ENABLEMENT |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 4.1 | 18.7 | 18.1 | 35.1 | 33.0 | 109.0 |

**Summary:**

This investment is to replace or update Customer Service Operations systems at Hydro One. These systems are critical to key customer-related activities such as meter-to-bill functions, customer communications and customer relationship management. The update, replacement or modernization of these technologies is necessary because they are either end of life, will be end of life, or do not offer modern capabilities for services that customers expect. The primary trigger of the investment is business support sustainment. The investment is expected to improve the service experience for Hydro One customers, and lower transactional and support costs for applications.

## A. OVERVIEW

The investments in this ISD are to update certain Hydro One Customer Service Operations technologies. These investments include updating the company's Customer Information System (CIS) for meter-to-bill functionality (CIS Billing) due to end of life status as identified by the vendor, replacing or updating other legacy Customer Service technologies, and continued digitization of services for customers.

## B. NEED AND OUTCOME

### B1. INVESTMENT NEED

The investments in this ISD are needed to replace or update legacy Customer Service Operations systems. These technologies directly support Customer Service functions for Hydro One, including the contact centre, online experiences for customers, as well as the back-office functions supporting billing, collections and settlements. These functions must be flexible in order to address service needs of customers, including non-paper based transactions, as well as being supported and maintained for 24x7 availability.

The largest investment planned under this ISD over the 2023-2027 period is to update the company's CIS Billing system to the new SAP standard product for utilities (S/4HANA) and to modernize the operations for meter to bill using the platform's new capabilities. This update is in alignment with the larger Hydro One SAP Transformation (discussed in GSP Section 4.2.4) to update its SAP ERP (Enterprise Resource Planning) software suite to the current standard, replacing the company's version (R3).

SAP has announced that the R3 versions will not be supported by SAP beyond 2027. In response to this, Hydro One is updating the company's SAP implementation to the S/4HANA version to maintain support. Implementing S/4HANA will also allow Hydro One to benefit from the various features and performance improvements in S/4HANA, which will enable the company to execute future work more effectively and avoid or reduce operating costs. The investments presented in this document include updates to Hydro One's customer relationship management (CRM) and billing functions in SAP, specifically the SAP CRM and SAP ISU (Industry Specific Utilities) modules. Updates to corporate functions such as finance are included under GSP Section 4.11, G-GP-06, while updates to work and asset management functions are included under G-GP-08.

The remainder of the planned investments in Customer Service Technology in the 2023-2027 period address two needs:

- replacing and upgrading legacy systems, and
- the change of systems to support digitization of legacy paper-based processes.

The specific needs driving the investments planned over the 2023-2027 period are set out in Section C, as applicable to each category of investment.

## C. INVESTMENT DESCRIPTION

### I. UPDATING CUSTOMER INFORMATION SYSTEM

CIS Billing is critical to Hydro One's customer management and meter-to-bill processes. This system allows the company to manage the customer lifecycle (move-in, start service, meter, bill, collect payments and manage filed services) for Hydro One's approximately 1.4 million customers. It allows customer service and field administrative staff to manage the customer requests, update information and coordinate field demand work on behalf of the customer, and to meter customers electricity usage and produce customer bills over 13 million times a year with 99.36% billing accuracy in 2020.

CIS Billing is a key meter-to-bill function in Hydro One's customer service application portfolio, which Hydro One plans to replace under this investment. CIS acts as the customer system-of-record for all other systems and applications at Hydro One, and is therefore a backbone in the current information landscape where all other key systems (e.g., Hydro One's outage management system and online self service tools such as *my*Account) retrieve or sync their information. The last system was first implemented in 2013, and the current mix of applications are either at end of life or will be end of life by 2027.

As detailed in GSP Section 4.2.4, Hydro One is planning to transition the company's core enterprise resource planning (ERP) system to a new version, SAP S/4HANA. By 2025, Hydro One will be in the advanced stages of implementing the updated ERP. In addition to updating core systems at Hydro One, this transition will bring benefits to the enterprise from greater visibility into data, faster data processing and a more robust, interconnected data model. CIS Billing is the last step in that program of ERP replacement. The CIS implementation is presented in this ISD, as it represents a discrete set of customer billing-related processes and capabilities within SAP.

The investment in this ISD will replace this collection of applications, which is required for Hydro One's billing functions to connect with the SAP S/4HANA ecosystem. This interconnection is critical for the effective functioning of both the CIS Billing system and the broader S/4HANA ERP system. The connection between these systems allows for (i) consolidated financial reporting, (ii) common data objects for customer management (e.g., sharing customer information such as name, address, etc., between asset management and customer service management), (iii) work routing integration (e.g., issuing orders to field workers from the contact centre), and (iv) customer reporting.

The S/4HANA solution for utilities' billing operations will allow Hydro One to maintain critical customer management information and functions used by the contact centre and field administrative staff. It will manage the customer lifecycle, from move-in to meter reading, billing, service order management (including linkages to Hydro One's mobile field work management solution), payment and collections activity, as well as common customer service needs such as issuing correspondence (electronic or paper) related to the customer's account. Integration with Ontario retail market transactions will be retained, along with the ability to conduct settlements and financial reconciliations with the market operator.

The move to SAP's latest CIS Billing product comes with additional benefits. For example, Hydro One expects that most customer management functions will be provided within SAP S/4HANA and will not require an add-on or secondary Customer Relationship Management (CRM) system to manage activities such as moves or field service orders (as is required under the current CIS software). This more unified application architecture will reduce errors in the hand-off between systems, subsequently reducing the risk of system errors affecting customers and the services they receive.

Utilities that have moved from the same legacy SAP product to S/4HANA have reported faster user access times for common contact centre and administrative staff tasks, resulting in lower average handling times for transactions such as calls, emails or back office exceptions. They have also reported shorter batch cycle and reporting timelines with the new system, which reduces maintenance overheads. Further, S/4HANA streamlines exception handling, effectively allowing utilities to perform the same activities in less time, providing opportunities to avoid errors and catch-up activities or recovery efforts.

The application management cycle workload should also be lower, as using a single system for customer management, orders, billing, and collections means that less regression testing would be needed between systems during periodic patching cycles for security and other functional updates (once or twice each year).

Over the 2023-2027 period, Hydro One plans to invest $62.0M in updating the CIS Billing system.

## II. REPLACING AND UPDATING LEGACY SYSTEMS

Hydro One's Customer Service functions are delivered through a range of systems that collectively allow the company to provide (i) online self-service, (ii) customer information management, and (iii) customer messaging. These systems also provide core meter-to-bill functionality required to bill customers in a timely, accurate, efficient manner. Investments in each category are discussed in this section.

Over the 2023-2027 period, Hydro One must replace or update several of these systems which have reached end of life, or will reach end of life over the period. This also includes the implementation of the 2023-2027 rates, to address new rates and rates structures in our CIS and compete successful system testing.

**ONLINE SELF-SERVICE**

Planned investments in online self-service will address the end of life rebuild of the core infrastructure of our public-facing websites and self-service portals that serve Hydro One customers, which will be 10 years old at the time of replacement. Hydro One's customer website infrastructure must be updated in order to maintain compatibility with customer devices, to function effectively on modern computers, and to address security risks.

Companies typically refresh website technologies every four to five years, as the technologies involved to support the Internet, browsers and mobile apps are continually evolving. Over time, the evolution of browsers, operating systems and other internet technologies results in incompatibilities with older website technologies. To continue effectively serving customers, Hydro One must update its systems to address these issues (including new and emerging cyber-security threats), meet current coding standards, and otherwise effectively function with modern customer technologies.

In addition, the replacement systems will allow Hydro One to consider potential use of new cloud capabilities that were not available at the last time they were replaced, such as the availability of "Software as a Service", rather than the "Infrastructure as a Service" model on which the current websites were built. This will allow new capabilities to be brought to the customer such as auto-scaling services that ensure no slowness or downtime in critical periods of high usage (e.g., storms) and will enable Hydro One to lower its ongoing infrastructure maintenance and service costs as a result of not having to manage and own our own infrastructure and hardware.

These investments will also help protect Hydro One from evolving cyber-security threats. Cyber threats are an ever-evolving landscape that becomes more and more difficult to mitigate as technologies age and become obsolescent. Increasingly, vendors of software or cloud-service providers are offering less time in their product lifecycles, and are replacing software versions or technologies faster than in the past in order to minimize security risks to themselves and their customers. This results in a need for Hydro One to adopt newer versions of software or platforms in order to keep up with these evolutions, or risk being stranded at a point with no security updates or patches being available.

These investments will also allow the company to enhance the customer service and efficiency of the company's public-facing websites. The planned investments will allow Hydro One to introduce newer security features such as facial recognition sign-in, and to offer other features to improve the customer experience. Support for this kind of investment was found in the customer engagement results, specifically if they "help find efficiencies and reduce customer costs and help customers better manage their usage". [1]

**CUSTOMER INFORMATION MANAGEMENT**

Hydro One plans to replace and consolidate various CRM systems in use today that need to be replaced before the CIS replacement begins in 2025, as discussed in Section E below. This consolidation investment follows the architecture principles stated in GSP Section 4.2.4.

Hydro One has a number of CRM systems that are either end of life, will be at end of life as product lines evolve (e.g. from on premise versions to cloud subscription versions), or are otherwise unsupported. This situation leads to a fragmented view of each customer, preventing Hydro One from being able to have a comprehensive view of a customer's information. This informational limit is a barrier to providing services to customers, and limits future options to enhance the experience of Hydro One customers.

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[1] Innovative Research Group, Hydro One Customer Engagement Report (December 2020) – SPF Section 1.6, Attachment 1, page 16.

CRM systems are a critical connection between various Hydro One functions and customers. For example, Hydro One uses CRM systems to manage:

- the intake and contract management functions for generators,
- key account activity, including commitments made to customers for system upgrade work,
- customer complaints within the domain of the contact centre, or the company Ombudsperson,
- Customer communication preferences related to billing, outage notifications and *my*Account registrations, and
- Customer damage claims.

Hydro One currently uses multiple separate CRMs to manage the company's relationships with an individual customer. The use of multiple CRMs naturally increases the potential for customers to receive overlapping information and a higher-volume of discrete contacts from Hydro One. Consolidating these platforms will ensure that customer relationships are maintained and managed through in a central system, providing a higher quality customer experience (such as an agent dealing with a customer calling into the contact centre that has previously dealt with a forestry issue, would be aware of the previous contact and could address additional questions about the service) and will help to lower transactional and support costs.

Updating the company's CRM in advance of implementing the CIS will ensure that the associated customer management functions are replaced before implementing new systems related to the core meter-to-bill processes**.** Consolidation of these platforms will ensure that customer preferences can be maintained and respected in a central system, rather than multiple, and will help lower transactional and support costs.

Over the 2023-2027 period, Hydro One plans to invest $40.8M in Replacing and Updating Legacy Systems.

## III. DIGITIZATION OF SERVICES

Planned digitization investments over the 2023-2027 period will move processes that serve customers from paper- or human-based approaches into digital or self-service capabilities.

Investments in contract management and storage systems over the 2023-2027 period will focus on contract management for generation customers. Currently, these transactions are based entirely on paper contract exchanges and manual handling. These manual processes are less efficient than modern, automated solutions. They also causes challenges for customers due to documentary requirements that are increasingly uncommon (e.g., having to fax a document rather than upload it to a portal or email it). The planned contract management and storage investments will remove manual effort and artifacts associated with these business processes.

For commercial and industrial customers, planned investment in digitized billing will overhaul their available billing options (both individual accounts as well as summary billing) and allow them to conduct billing-related transactions via self-service channels (such as a "*my*Account" style service as currently available to residential customers) or by email.

Planned investments to digitize customer communications will address a lack of functionality for customers when issuing correspondence from Hydro One's CIS, where a large amount is produced on paper for mailing. Other associated processes also issue paper communications where customers have indicated a preference for digital communications (e.g., e-billing) but Hydro One is unable to satisfy that preference because the message template has not been converted to an automated, digital form. This investment will address these issues and reduces costs for paper and postage.

Over the 2023-2027 period, Hydro One plans to invest $6.1M in systems digitization.

## D. OUTCOMES

Planned investments to replace and upgrading legacy systems will result in a consolidated set of supported systems offering more secure, up-to-date infrastructure that also has benefits to customers, such as simplified customer preference and information management, more online transactions and better security.

The investments specific to digitization of services are expected to deliver lower operational costs for paper and postage, more timely delivery of communications and increased customer satisfaction with service.

**OEB RRF OUTCOMES**

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Improve customer satisfaction with customer self-service tools by enabling additional services online.<br>• Modernize operating platforms to offer increases customer satisfaction. |
| **Operational Effectiveness** | • Ensure continued vendor support for customer service and billing functions to maintain reliable performance and availability.<br>• Consolidated view of the customer across lines of business<br>• Update or consolidate operating platforms to reduce ongoing costs in similar services for customers.<br>• Reduce spending on paper and postage. |

## E. EXPENDITURE PLAN

Table 2 below summarizes projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 4.1 | 18.7 | 18.1 | 35.1 | 33.0 | 109.0 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **4.1** | **18.7** | **18.1** | **35.1** | **33.0** | **109.0** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **4.1** | **18.7** | **18.1** | **35.1** | **33.0** | **109.0** |

Over the period, investments are expected to ramp up starting in 2024 as Hydro One prioritizes investments in customer communications, online services and CRM replacement ahead of CIS Billing. This ramp up of investments will free up resources for CIS implementation, as well as ensuring that interconnected systems are in place before the CIS upgrade.

Factors that influence the cost of this investment include:

- Refinement of planning estimates as projects near execution (see GSP Section 4.10.4.1 for additional details on project delivery governance).
- Scope changes as line of business needs evolve and technology advancements become available that offer additional capabilities and value to the lines of business.
- Changes to regulatory policies or security requirements at the time of implementation.
- System or landscape changes that proceed in parallel that may add or reduce technical complexity at the time of implementation.

## ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking. Due to the unique considerations for updating CIS Billing, these alternatives are discussed separately from the other corporate enablement investments.

## CIS BILLING ALTERNATIVES

### CIS Billing Alternative 1: Status Quo

As the R3 versions will not be supported by SAP beyond 2027, status quo is not an option. Hydro One must maintain vendor support to mitigate disruptions to its SAP systems and the subsequent impacts on its critical customer management and meter-to-bill processes.

In terms of timing, the option of deferring this investment to later years is not acceptable as any extended support from SAP is limited and will be costly, and deferrals to this investment will increase the risk of not having available resources from the vendor to support the transition to S/4HANA. SAP has indicated that extended support will be available up to 2030, but for additional cost. This is not a beneficial option as these incremental extended support costs increase the overall lifecycle costs for the product and Hydro One is not able to realize the additional capabilities and benefits from the S/4HANA version.

### CIS Billing Alternative 2: Brownfield Approach (Recommended Alternative)

This option essentially migrates the existing database and functionalities from the R3 version to S/4HANA, without leveraging any of the new benefits offered by the latter. This is usually the lowest cost option as it does not seek any improvements to process, data organization, or configuration. Instead, the focus is on transitioning the current data and processes directly into SAP S/4HANA, with minor adjustments as needed to facilitate the conversion.

Given that Hydro One's billing accuracy has been greater than 99.4% from 2018 through 2020, this option is acceptable for the CIS Billing update. As it presents the lowest, acceptable cost option, this is Hydro One's preferred alternative.

### CIS Billing Alternative 3: Greenfield Approach

This alternative is a brand new implementation that seeks fully reconfigure Hydro One's Customer Management and Billing Modules. This is usually the highest cost option as it is a holistic revisit of the design and a rebuild of Hydro One's system. This requires converting all master data and open transaction items to the new configurations, and programming any required customization. While this option provides the opportunity to change any and all business processes, it is not acceptable because of the high cost impacts to rates.

**CIS Billing Alternative 4: Selective Data Transition Approach**

This alternative is a balance between the brownfield and greenfield approaches discussed above. With this approach, Hydro One evaluates its customizations and keeps only those that are required to meet regulatory obligations, and its master data and open transactions generally keep the same configurations. From a cost perspective, this solution is more expensive than CIS Billing Alternative 2: Brownfield Approach. Since Hydro One's billing accuracy has been greater than 99.4% from 2018 through 2020, the relative improvements in billing accuracy that could be obtained from this selective data transition Approach are immaterial in comparison to its higher costs. Thus, CIS Billing Alternative 2: Brownfield Approach is recommended instead of this selective data approach.

**CIS Billing Alternative 5: Non-SAP Software**

Hydro One also considered replacing SAP with an ERP or suite of similar applications from another vendor. This option was rejected because of the risks associated with implementing a completely new application, the costs, complexities and lost productivity from managing the change across the company and the fact that this would not leverage the value of Hydro One's experience and expertise with SAP.

**ALTERNATIVES FOR THE NON-SAP CORPORATE ENABLEMENT INVESTMENTS**

**Alternative 1: Status Quo (Do Nothing)**

For the system updates and replacement investments (with the exception of CIS Billing), failing to replace the technologies identified in this ISD will impact customer service. Systems may become increasingly unreliable, unavailable or have the risk of having support discontinued, which causes customer complaints and dissatisfaction. Customer Service Satisfaction will be impacted if further efforts are not made to digitize our operations and remove paper-based processes.

Ultimately a “do nothing” approach would not be appropriate, as the systems described above would be beyond the end of life, resulting in cessation of vendor support, increasing cyber security risks, increasing risk of incompatibility with client devices and other systems, and negative impacts on customer service and experience.

**Alternative 2: Defer Planned Investments**

Hydro One examined and rejected an approach deferring the planned investments, as the collision with CIS later in the 2023-2027 period would constrain resources and technical environments too much to complete this work. It would also impact CIS design, as some of these investments are expected to be complete before the CIS update, in order to not have that project scope included in CIS.

**Alternative 3: Pursue Extended Support (Where Available)**

Extending support for some or all of these systems was examined but rejected. Depending on the specific system, its age, and the practices of the vendor, extended support may be available for a period after a product ceases to be officially supported by the vendor. Extended support is a higher cost solution, not universally available, and if available, it is only offered for a comparatively short period after official vendor support ends.

Hydro One rejected an extended support approach for investments within this ISD for the following reasons:

- Deferral of system updates comes with a higher operating cost in the short term (vendors typically charge escalating rates for support beyond standard product lifecycles, if even available) and often will be more expensive to replace in the future as standards and integration patterns change over time;
- Even with extended support, functionality and security risks increase as products become obsolete and are no longer added to or patched in order to avoid issues or mitigate security issues, and

- Pursuing extended support would create a backlog of prudent work, deferring incremental improvements to business functions that come with newer versions of software or platforms.

**Alternative 4: Proceed With Planned Investments**

Proceeding with the investments as planned and discussed above under Section C will allow Hydro One to deliver the outcomes described in the body of this evidence. This approach will allow Hydro One to continue to meet customer demands for digital, mobile-enabled customer service transactions, and allow the company to consolidate customer information into a common platform that will enable better insights into customer behaviour and allow the company to offer more tailored service to customers. This plan will also reduce our risks against obsolete or deprecated systems and will avoid customer service impacts from unreliable or unavailable systems.

## F. EXECUTION RISK AND MITIGATION

The risks of not following the investment timing for this ISD will result in resource or capability constraints needed to execute the planned investments. For example, Customer Service and ISD resources that serve the Customer Service area are usually engaged in these projects and form a common pool of people and have finite capacity in a given year.

Hydro One must also manage a limited pool of resources with the relevant skills. For example, the resources with specific meter-to-bill, CRM or digital expertise are typically the same individuals. In order to avoid project resource conflicts, the investments have been paced to allow for certain activities to take place which lead naturally up to the replacement of CIS Billing and avoids the common draw on resources from other initiatives (such as the other SAP S/4HANA work).

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| G-GP-08 | WORK AND ASSET MANAGEMENT ENABLEMENT |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Financial Performance |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 37.3 | 42.0 | 36.1 | 22.8 | 16.7 | 155.1 |

**Summary:**

This investment is to replace, update and introduce new technologies that enable asset management, work planning and program execution. Hydro One uses these technologies to perform various key functions, including identifying and prioritizing investments, and managing delivery of the work program including scheduling, communication of work plans, and monitoring progress and accomplishments. Investments are necessary to update, replace and extend technologies that are either end of life, will be end of life during the 2023-2027 period, or do not offer modern capabilities for key work and asset management functions. The investments in this ISD are expected to improve outcomes related to work planning and work execution capabilities in Hydro One including customer service and demand work, resulting in better performance for Hydro One customers, and lower transactional and support costs for applications.

## A. OVERVIEW

Hydro One’s Work and Asset Management program (WAM) comprises a range of technologies that enable Hydro One to plan and execute the company’s work programs for both transmission and distribution, including customer service and demand work. These technologies are increasingly critical to the company’s ability to effectively deliver the large work programs needed to support the transmission and distribution systems, and to achieve outcomes that customers expect.

Over the 2023-2027 period, Hydro One plans to invest in WAM technologies that are directly related to distribution and transmission work planning, design, and execution, as well as applications that support customer service functions. As set out below, these investments are necessary to replace and update technologies that are at end of life, and to provide new functions that are necessary for Hydro One to plan and deliver the investments in the transmission and distribution systems over the period.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

This investment addresses four types of needs:

i. **Replacing and Upgrading SAP Work and Asset Management Modules** – These SAP modules will no longer be vendor supported beginning in 2027. This is part of the larger SAP Transformation described in GSP Section 4.2.4. For details on other SAP investments in other functional areas, please refer to GSP Section 4.11, G-GP-06 for corporate functions, and G-GP-07 for customer functions.

ii. **Replacing and Upgrading Other Legacy Systems** – This addresses various systems that will reach their end of life or become obsolete before the end of the planning period.

iii. **Investment Planning Technology** – These applications are used by planners to identify and prioritize investment needs in the transmission and distribution systems.

iv. **Work Execution Technology** – These systems help Hydro One execute transmission and distribution work programs, including scheduling, communication of work plans, and monitoring progress and accomplishments.

This ISD is organized into sub-sections that describe the respective needs and planned investments in each of these four categories.

## I. REPLACING AND UPGRADING WORK AND ASSET MANAGEMENT SAP MODULES

The largest investment planned under this ISD over the 2023-2027 period is to update the company's Enterprise Asset Management (EAM) system to the new SAP standard product for utilities (S/4HANA) and to modernize the operations for planning and work management using the platforms new capabilities. This update is in alignment with the larger Hydro One SAP Transformation (discussed in GSP Section 4.2.4) to update its SAP Enterprise Resource Planning (ERP) software suite to the current standard, replacing the company's current SAP system, version R3.

The EAM system is used to manage all the data about Hydro One assets, including age, installation data, location, cost, and asset condition information. The system is the backbone of the company's application landscape – all other key WAM systems, such as the Geographic Information System (GIS), interface and synchronize data through the EAM system. It is also the system-of-record for operational transactions and activities that feed the overall corporate planning, management reporting and statutory and regulatory compliance requirements. The EAM portion of the company's current ERP suite is over a decade old, and the current mix of applications are either at end of life or will be end of life by 2027. End of life for applications signifies the time when the vendor no longer provides support and security packages for the application's cyber protection.

SAP has announced that it will not support the R3 versions beyond 2027. Accordingly, Hydro One is updating its SAP implementation to the vendor's current S/4HANA version to maintain support. Implementing S/4HANA will also allow Hydro One to benefit from the various features and performance improvements in S/4HANA, which will enable the company to execute future work more effectively. The investments presented in this document include updates to Hydro One's EAM functions in SAP, specifically the modules of the SAP EAM suite:

- SAP PM (Plant Maintenance),
- SAP MM (Material Management),
- SAP WM (Warehouse Management),
- SAP SD (Sales & Distribution),
- SAP PS (Project System), and
- SAP IM (Investment Management).

Updates to corporate functions such as finance are included under G-GP-06, while updates to customer functions are included under G-GP-07.

## II. REPLACING AND UPGRADING LEGACY SYSTEMS

Over the 2023-2027 period, Hydro One must replace or update several of these systems which have reached end of life, or will reach end of life over the period. Like all IT systems, WAM technologies require investments to update systems to address a variety of needs that are driven by a technology's lifecycle. While the specific driver of the investment varies with the details of individual technologies, investments in this category are unified by the need to replace or update these existing, legacy systems.

In addition to addressing issues that are inherently linked to the lifecycle of the technologies (e.g., lack of vendor support, lack of advanced functionality, incompatibility with upgraded technologies, cyber-security risks), investments in replacing and upgrading legacy systems often bring additional benefits in the form of new or enhanced functionality. These benefits result in improved workflows and processes, such as:

- Automated workflows that remove administrative burdens and reduce data inconsistencies to enable improved business processes,
- Improved communication and work program visibility across lines of businesses,

- Faster processing times and the ability to manage larger quantities of data, freeing up time for employees to focus on analyzing data rather than on data-mining,
- More integrated technologies that enable seamless exchange of data between systems, improving the timeliness and consistency of information sharing between connected systems, and
- Higher user satisfaction and reduced employee training time due to the improved ease of use and responsiveness that comes from using up-to-date systems.

## III. INVESTMENT PLANNING TECHNOLOGY

Hydro One relies on investment planning technologies to effectively and efficiently identify and prioritize necessary investments in the transmission and distribution systems. One such technology is the Asset Analytics tool, which is an SAP-powered application that calculates the asset risk factors that the company uses to consistently measure and model transmission and distribution assets risks. The Asset Analytics tool collects asset-related information from SAP and other non-SAP interfaces, and uses the data to calculate Risk Factor scores that provide a means to assess and compare assets across the province. These results are, in turn, used to identify assets that are in need of replacement or repair.

Over the 2023-2027 period, Hydro One plans to introduce a new investment planning technology: Virtual Asset Inspection. To manage Hydro One transmission and distribution assets and identify safety, maintenance and reliability issues, Hydro One employs a number of inspection and patrol techniques to acquire information. These include ground and air patrols of lines assets, and site visits to Hydro One stations (many of which are unmanned). These processes include travel and patrol costs, but, until recently, have been the best or only option available. As described in the Investment Description section below, technological advances in aerial data capture using remote sensing methods, automation, robotics, and other areas now provide a more cost-effective solution with higher quality results. This allows increased condition-based maintenance and increased patrol capability coverage, while reducing costs to do so. In addition, reduced need for travel will also reduce safety risks to Hydro One employees who will be required to take fewer remote trips.

**IV. WORK EXECUTION TECHNOLOGY**

WAM technologies enable Hydro One to execute its work program each year. As Hydro One continues to renew and modernize the Transmission and Distribution networks, new and enhanced technologies are playing an increasing role in the way the company schedules work, coordinates resources, and monitors its progress relative to plan.

The Work Execution Technology investments planned for the 2023-2027 period will allow Hydro One to enhance mobile technologies and processes currently used to deliver aspects of distribution and forestry work programs. The company's distribution and forestry operations currently use a work execution system that is supported by SAP Work Manager, a comprehensive mobile application. This system allows remote workers to create and update asset data from the field, and to access, transfer, complete, and manage their assigned work orders and customer service requests. These distribution systems continue to evolve as Hydro One further integrates the system with planned work and demand activities, driving further efficiencies in field work and better response time, supporting Distribution's focus on customer reliability.

Over the 2023-2027 period, Hydro One plans to extend mobile technology capabilities to transmission remote workers. These investments would enable construction crews to report on construction progress, improve accuracy of time keeping and establish work scheduling and resources reporting. Poor data quality resulting from late or inaccurate reporting has a negative impact on work program execution and Inconsistent scheduling processes for crews can result in inefficient use of resources.

As described in Section C below, planned investments in Work Execution Technology will allow Hydro One to transition to digital, timelier work accomplishment reporting from construction teams to schedulers, enable improved project cost estimating for better project controls, and provide enhanced scheduling capabilities. These technologies will be particularly important for the company's ability to deliver the large work programs planned for the 2023-2027 period.

## C. INVESTMENT DESCRIPTION

As described in the sub-sections below, planned investments in WAM technologies over the 2023-2027 period will sustain the functions of legacy systems that are at or are approaching end of life, provide a critical new planning tool to enable enhanced asset management functions, and enable the company to execute the work program planned for the 2023-2027 period through enhanced digital and mobile-capable services.

### I. REPLACING AND UPGRADING WORK AND ASSET MANAGEMENT SAP MODULES

The EAM portion of the SAP ERP suite that Hydro One plans to replace under this investment is core to the Company's asset planning and work execution processes, hosting both the Company's asset master data and work management system. Hydro One uses the EAM system in planning the distribution and transmission work programs; in designing new stations, power lines, IT systems; and in the construction and maintenance of the assets that transmit and deliver power to customers.

The EAM is a platform that consists of the core SAP application and a suite of add-on applications that perform specific functions in the work and asset management area, such as work scheduling. SAP EAM exchanges data with other asset management systems and these will need to be modified to accommodate the changes to be made to the EAM master data structures. As this platform is a critical function of the lifecycle management of Hydro One's asset construction and maintenance operations, it must be updated to maintain and extend these functions into the future.

The investment in this ISD will optimize the add-on applications required for Hydro One's WAM functions to connect with the SAP S/4HANA ecosystem. This interconnection is critical for the effective functioning of both the EAM system and the broader S/4HANA ERP system, since the connection between these systems allows for (i) consolidated financial reporting, (ii) common data objects for asset management (e.g., sharing customer information between asset management and customer service management), (iii) work routing integration (e.g., issuing orders to field workers from the contact centre), and (iv) work accomplishment reporting.

The WAM-related components of the new S/4HANA solution for utilities will include planning data, asset master data, and work management data. Many Hydro One functions rely on these systems, including Asset Management, Engineering, Construction, Transmission Stations and Lines, Distribution Stations and Lines, Forestry and common functions such as Information Technology and Supply Chain.

Hydro One will introduce the SAP Master Data Governance (MDG) module to improve its data hierarchy management and processes for Finance, WAM and Customer data. This approach provides the opportunities to better harmonize Hydro One data between SAP and other WAM applications, reducing the manual effort required for work planning and execution, improving the integration between asset management and the associated financial reports, reducing manual effort required to produce analytics, and improving project monitoring and cost reporting.

As part of the transition to S/4HANA, Hydro One will adopt current best practices for processes and data structures in the new ERP. S/4HANA has a standard asset data model that harmonizes data between SAP modules and eliminates redundancies and corresponding issues related to data integrity and reliability throughout the whole asset lifecycle. Hydro One plans to adopt this data model for the company’s asset hierarchy to improve asset reporting. Hydro One also plans to adopt S/4HANA best practices related to function locations, work breakdown structure, data quality, work and financial reporting, and work management processes.

Moving to S/4HANA will introduce new capabilities that Hydro One may leverage to perform activities that are currently being performed in other applications, offering the opportunity to rationalize and reduce its total number of applications. Hydro One will also assess the capabilities of other modules that were released with S/4HANA: SAP Geo Enablement

Framework, SAP Linear Asset Management, SAP C-Project for Planning and SAP Mobile Asset Manager.

Over the 2023-2027 period, Hydro One plans to invest $58.3M in updating the EAM systems including SAP Master Data Governance capabilities. By 2025, Hydro One will be in the advanced stages of implementing the updated ERP, with EAM and Finance (as presented in G-GP-06) being the first steps in the ERP replacement.

## II. REPLACING AND UPGRADING LEGACY SYSTEMS

The largest single legacy system replacement planned in this category is an upgrade to Hydro One's GIS Enterprise Platform. Hydro One's current GIS system requires a lifecycle upgrade to secure continuous vendor support and the appropriate cyber security controls to mitigate cyber security risks. In addition, GIS infrastructure and software need to be updated to take advantage of a new utility network data model that supports multiple views of network connectivity (such as the current "as built" state and the future planned state of the network), which in turn allows Hydro One to execute distribution grid modernization initiatives (described in DSP Section 3.6.3.3) to help plan, design, and build the grid of the future.

Hydro One's GIS is a critical enterprise system that enables a variety of business processes including, but not limited to, distribution engineering design, transmission and distribution planning, outage management, work management, and real estate. The GIS system enables a digital view of Hydro One's electrical network that is represented by the geospatial location of assets, includes the interconnectivity between physical assets, and provides the assets' properties and condition. Having a detailed, accurate record of asset information facilitates planning and outage management, supports mobile workforce management through more effective crew routing, manages real estate records and Hydro One property, and provides the underpinnings for distribution reliability reporting.

Geospatial technology and the underlying network connectivity model is also key to supporting distribution grid modernization initiatives such as the deployment of network devices to enable remote control of Hydro One's distribution network. This strategy relies on Hydro One's Outage Response Management System (GSP Section 4.11, G-GP-17) and Distribution Management System (GSP Section 4.11, G-GP-18), advanced metering infrastructure (DSP Section 3.11, D-SR-12), advanced system planning, and asset management. Enterprise GIS is a foundational technology underpinning this vision, since all of these enhanced grid management functions rely on an extensive, detailed, and accurate record of the location, configuration, and connections between Hydro One network assets.

Hydro One's current GIS technology is a combination of software versions that are at least eight years old, and are increasingly experiencing compatibility and performance issues due to their age and the customized configurations required to connect the various components. Differences in software versions within the suite of technologies is introducing compatibility issues with more advanced GIS products and third party software. The performance of the current GIS software is limited, requiring significant time to perform required functions. This slow performance increases the time required to perform day-to-day tasks and creates a backlog of work in various functions.

Hydro One currently uses GIS software called ArcGIS, which includes a tool called ArcMap that Hydro One uses for map creation, editing and analysis. The vendor of ArcGIS, ESRI, has introduced a new version of the tool called ArcGIS Pro, and announced that it will continue to support the legacy software that Hydro One uses until 2026. ESRI has also discontinued ArcMap, and will not be replacing the program. Accordingly, Hydro One must replace both ArcGIS and ArcMap during the 2023-2027 period in order to maintain vendor support and the associated security controls to protect against cyber threats, and to replace the functionality that will be unavailable due to the discontinuation of ArcMap.

It is also important for Hydro One to introduce a "utility network" feature within the updated GIS, which will allow the system to more effectively support the Company's distribution grid modernization efforts. The utility network GIS feature provides advanced asset modeling capabilities and analysis tools that simplify the asset information collection process performed by field crews. This improvement will result in increased efficiencies in field crews' daily operations as less time will be spent on asset information collection. In addition, the utility network feature will produce more detailed asset data, which in turn will enhance Hydro One's planning capabilities.

As a matter of ongoing lifecycle management of technology assets, Hydro One will continue to invest in replacing and upgrading legacy systems over the 2023-2027 period. The company must regularly invest in IT assets to replace legacy and outdated technologies with modern, more efficient applications to support critical business capabilities and enable business outcomes.

Over the 2023-2027 period, Hydro One plans to invest $35.6M in Replacing and Upgrading Legacy Systems.

## III. INVESTMENT PLANNING TECHNOLOGY

Hydro One plans to invest in Investment Planning Technology over the 2023-2027 period. Specifically, the company plans to introduce a Virtual Asset Inspection solution that will enable efficiencies in asset monitoring, inspections and assessments via the implementation of advanced technologies for unmanned and aerial asset condition data collection and processing.

To manage its assets, Hydro One employs a number of inspection techniques to identify and acquire information on safety, maintenance, and reliability issues. Hydro One's assets, including transmission and distribution line components and transmission and distribution stations equipment, are inspected and assessed by field staff through either ground-based or aerial activities. Ground-based inspection requires field crews to travel to the site for asset data collection and visual asset condition assessment. Aerial data collection utilizes highly skilled pilot resources to fly over linear infrastructure corridors.

With technological advances, including developments in sensors, robotics, unmanned vehicles, satellite imagery and wireless data communications, automated/unmanned implementation of inspection technologies is a viable, near-term approach for asset monitoring, inspections and assessments. The new technologies enabling this approach include drones and advanced censors, allowing aerial reading of Hydro One's linear transmission and distribution infrastructure. Drones can collect high-fidelity photographs or other types of reads such as thermal imaging to locate hot spots in the network that require asset managers' attention. Data from these aerial inspections will be stored in a central Hydro One data repository. The data will be analyzed using new, advanced tools (i.e., machine learning and artificial intelligence software), providing insights that are more detailed, faster, and more efficient than prior, manual process. These insights will allow asset managers and planners to make better decisions, more quickly.

This investment is planned for the latter part of the planning period (2025-2027), in part due to current regulatory constraints limiting use of drones to visual line of sight. If restrictions on drone usage are modified, Hydro One may accelerate use of unmanned drones for virtual inspections and other data collection.

Over the 2023-2027 period, Hydro One plans to invest approximately $19.9M in Investment Planning Technology.

## IV. WORK EXECUTION TECHNOLOGY

Hydro One will be investing in range of Work Execution Technologies over 2023-2027 to continue enablement and support of work execution activities across the organization.

The two largest initiatives in this category for Distribution are:

i. the extension of the call centre technology to field support services that plan, schedule and administer the work for the field crews; and
ii. the resource planning and management solution for improved visibility into resource capacity.

Hydro One plans to improve the call centre technology used by field support services by leveraging the capabilities and infrastructure of the recently upgraded Customer Contact Centre solution. The Field Business Centres (FBC) and Barrie Administration Service Centre (BASC) execute critical customer facing interactions and requests that require field services engagement, such as new connections, service upgrades, and disconnects/reconnects. These interactions are currently managed via phone calls and emails, and have limited visibility and tracking options. By extending the call centre technology to these centres, field support services will have access to improved capabilities such as call routing and automated call back options.

The call centre technology provides the opportunity to automate manual processes and systems, such as the ability to forward workflows to appropriate departments, track customer interactions and escalations, conduct live chat/self-serve capabilities, provide a one-stop shop for customer account data, improve integration with SAP and automate notifications to customers. These capabilities will drive efficiencies and provide greater visibility and insight into Hydro One's ability to meet customer commitments, resulting in improved customer service levels and overall customer experience.

Another key initiative for Distribution is in the area of resource management, which currently includes various time-consuming, manual processes to perform analysis and lacks automated visualization tools that could assist with identifying resource constraints. Advances in technology have led to improved resource management solutions that enable better resource tracking and offer improved analytics and visualization. Planned investment will allow Distribution Operations to proactively and more efficiently identify and address both resource constraints and opportunities, as well as mobilization and deployment of resources. The planned investment also supports more informed prioritization discussions across the organization.

The two largest initiatives in this category for transmission are:

i. the extension of the existing scheduling technologies to Transmission Lines' field crews; and
ii. the work status and accomplishment reporting solution for improved visibility into work progress.

Hydro One plans to extend its existing scheduling technologies, currently used by its Stations and Distribution Lines field forces, to its Transmission Lines field crews. Due to the different nature of work between distribution and transmission, the solution for Transmission Lines will require some modifications from those solutions already in use. For example, while distribution field forces typically complete more than one job in a day, travelling from site to site, transmission field forces tend to complete work at one site for an extended period of time that can span over days, months, and sometimes even years for large transmission initiatives.

The work scheduling solution for Transmission Lines will incorporate their unique work scheduling needs and the various work activities performed by this organization, which span from capital project and program work to maintenance of the transmission lines assets. Hydro One will leverage as many as the existing capabilities as possible to limit customizations and minimize additional complexity to Hydro One's technology landscape.

To manage its workforce, Hydro One's construction project delivery team employs a number of different techniques to capture the progress of the work. These techniques heavily rely on the on-site project status meetings with team members in presence, or in virtual settings when possible. Work accomplished is reported verbally or via email, and captured in project management tracking sheets, typically Microsoft Excel or PowerPoint.

The work status and accomplishment reporting solution aims to enable mobile options for field foremen to remotely report on progress of planned and scheduled work. This will enable better financial tracking of construction projects, faster responses to changes in schedule, and improved ability to evaluate what progress was made in a day, including progress on individual tasks as well as the overall project.

Hydro One expects that investments in planning and work execution technologies will improve the performance and efficiency of planning and executing work functions for both Transmission and Distribution. Expected benefits of these investments include improved customer satisfaction, better visibility of available resources, more timely delivery of work, improved scheduling capabilities, and more efficient and timely work status and accomplishment reporting. These will increase Hydro One's agility by enabling more timely modifications to execution and resource plans, ultimately resulting in improved work program delivery.

Over the 2023-2027 period, Hydro One plans to invest approximately $41.3M in Work Execution Technology.

## D. OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Improvements in distribution operations technologies to enable more efficient field crew coordination, reducing outage duration and increase in power system reliability.<br>• Investments in call centre technology for field administration offices supporting field crews will enable better customer insights, increase customer satisfaction and improve first contact resolution. |
| **Operational Effectiveness** | • Ensures continued vendor support for applications to maintain reliable performance, compatibility and supportability in the event of any issues.<br>• Improves capabilities in Hydro One's EAM solution to enable lines of businesses to execute future work more effectively.<br>• Equips work execution teams with required technology investments to enable improved project controls, contract management, work execution scheduling and accomplishment reporting for the growing transmission and distribution capital work programs.<br>• Insights enabled through virtual asset inspection technologies will allow asset managers and planners to make better decisions more quickly, resulting in better planning for replacements or required maintenance actions on Hydro One's assets.<br>• Investments in replacing and upgrading legacy systems, including SAP work and asset management modules will support critical business capabilities and enable business outcomes. |
| **Financial Performance** | • Virtual asset inspections and vegetation management will improve planning for asset replacement and maintenance, mitigating risks of outages due to asset failures and improving outage response and restoration efforts. |

## E. EXPENDITURE PLAN

The expenditure plan outlined below is largely driven by the timing of the GIS upgrade and transition to SAP S/4HANA, both of which are planned for in 2023-2025. Investments in Virtual Asset Inspection and work execution technologies are expected to drive expenditures in 2025 through 2027, along with investments in other WAM applications to support their lifecycle management.

Table 2 below summarizes projected spending on the aggregate investment level.

**Table 2 – Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 37.3 | 42.0 | 36.1 | 22.8 | 16.7 | 155.1 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **37.3** | **42.0** | **36.1** | **22.8** | **16.7** | **155.1** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **37.3** | **42.0** | **36.1** | **22.8** | **16.7** | **155.1** |

The factors influencing the cost of these investments are provided below.

- Refinement of planning estimates as projects near execution (see GSP Section 4.10.4 for additional details on project delivery governance).
- Scope changes as line of business needs evolve and technology advancements become available that offer additional capabilities and value to the lines of business.
- Changes to regulatory policies (as in the case of drones) or security requirements at the time of implementation.
- System or landscape changes that proceed in parallel that may add or reduce technical complexity at the time of implementation.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking. Due to the unique considerations for updating SAP to S/4HANA, these alternatives for that investment are discussed separately from the other WAM investments.

**SAP ALTERNATIVES**

**SAP Alternative 1: Status Quo**

As the R3 versions will not be supported by SAP beyond 2027, status quo is not an option. Hydro One must maintain vendor support to mitigate disruptions to its SAP systems and the subsequent impacts on its WAM operations, including the planning of distribution and transmission work programs; designing new stations, power lines, IT systems; and the construction and maintenance of the assets that transmit and deliver power to customers.

In terms of timing, the option of deferring this investment to later years is not acceptable as any extended support from SAP is limited and will be costly, and deferrals to this investment will increase the risk of not having available resources from the vendor to support the transition to S/4HANA. SAP has indicated that extended support will be available up to 2030, but for additional cost. This is not a beneficial option as these incremental extended support costs increase the overall lifecycle costs for the product and Hydro One is not able to realize the additional capabilities and benefits from the S/4HANA version.

**SAP Alternative 2: Brownfield Approach**

This option essentially migrates the existing database and functionalities from the R3 version to S/4HANA, without leveraging any of the new benefits offered by the latter. This is usually the lowest cost option as it does not seek any improvements to process, data organization, or configuration and may result in costly enhancements for similar improvements in the future. Instead, the focus is on transitioning the current data and processes directly into SAP S/4HANA, with minor adjustments as needed to facilitate the conversion. This option is not acceptable for the SAP WAM modules as this would not adequately address the needs of the lines of business and it does not maximize the value of transitioning to SAP S/4HANA.

**SAP Alternative 3: Greenfield Approach**

This alternative is a brand new implementation that seeks fully reconfigure Hydro One's WAM Modules. This is usually the highest cost option as it is a holistic revisit of the design and a rebuild of Hydro One's system. This requires converting all master data and open transaction items to the new configurations, and programming any required customization. While this option provides the opportunity to change any and all business processes, it is not acceptable because of the high cost.

**SAP Alternative 4: Selective Data Transition Approach (Recommended Alternative)**

This alternative is a balance between the brownfield and greenfield approaches discussed above. With this approach, Hydro One evaluates its customizations and keeps only those that are required to meet regulatory obligations, and its master data and open transactions generally keep the same configurations. This approach reduces the design time and cost related to a greenfield approach but still leverages the best practices related to a leaner, more standard SAP system. This approach requires a discovery to look at how the system is designed today and to find the things that can be improved from both a process and data perspective. The discovery is followed by a detailed design, then build phase. The main benefits of moving closer to SAP standardization are that it will reduce sustainment efforts, environment management costs and the time to implement future upgrades and patches; enable Hydro One to more easily introduce and build new project environments in SAP; and improve the data integration between Asset Management, Work Management, and Financial Management. These benefits, in turn, allow for faster processing and improved efficiency for Hydro One's processes.

**SAP Alternative 5: Non-SAP Software**

Hydro One also considered replacing SAP with an ERP or suite of similar applications from another vendor. This option was rejected because of the risks associated with implementing a completely new application; the costs, complexities and lost productivity from managing the change across the company; and the fact that this would not leverage the value of Hydro One's experience and expertise with SAP.

**OTHER INVESTMENT CATEGORY ALTERNATIVES**

**Alternative 1: Status Quo (Do Nothing)**

For the investments that fall under replacing and upgrading legacy systems (with the exception of SAP S/4HANA transformation), a "do nothing" approach would negatively impact Hydro One's ability to plan and execute the work program. Systems may become increasingly unreliable, unavailable or be at risk of not being supported by the vendor. This may cause inability to plan and/or schedule work and in turn, lead to unaddressed asset defects and maintenance requests, negatively impacting reliability.

Ultimately a "do nothing" approach would not be appropriate, as the systems described above would be beyond end of life, resulting in cessation of vendor support, increasing cyber security risks, increasing risk of incompatibility with client devices and other systems, and negative impacts on network reliability and customer experience.

**Alternative 2: Defer Planned Investments**

Deferral of planned investments will reduce Hydro One's opportunity to realize the benefits of executing the work program more effectively through technological solutions. With the increasing size of the capital work programs for transmission and distribution, effective management becomes even more important to ensure that investments are being prudently implemented. Key investments in the GIS enterprise system upgrade are timed to support Hydro One's Distribution Management System life cycle upgrade; these investments cannot be differed due to cyber security risks to the distribution grid that would arise if security patches were not available due to cessation of vendor support.

**Alternative 3: Pursue Extended Support (Where Available)**

Extending support for some or all of these systems was examined but rejected. Depending on the specific system, its age, and the practices of the vendor, extended support may be available for a period after a product is ceases to be officially supported by the vendor. Extended support is a higher cost solution, not universally available, and if available, it is only offered for a comparatively short period after official vendor support ends.

Hydro One rejected an extended support approach for investments within this ISD for the following reasons:

- Deferral of system updates comes with a higher operating cost in the short term (vendors typically charge escalating rates for support beyond standard product lifecycles, if even available) and often will be more expensive to replace in the future as standards and integration patterns change over time;
- Even with extended support, functionality and security risks increase as products become obsolete and are no longer added to or patched in order to avoid issues or mitigate security issues, and
- Pursuing extended support would create a backlog of prudent work, deferring incremental improvements to business functions that come with newer versions of software or platforms.

**Alternative 4: Recommended Solution**

Proceeding with the investments as described above in Section C will allow Hydro One to continue to meet the Company's work program execution targets with improved planning, scheduling and execution processes enabled by technology and mobile capabilities for the field work force.

## G. EXECUTION RISK AND MITIGATION

No unique concerns are foreseen with completing the Work and Asset Management Enablement program beyond generic project risks, such as schedule delays, business disruption, and system outages. Any project risk is mitigated through stakeholders and modification of scope to reach desired business outcome. Through project governance, risks are proactively communicated, evaluated, and managed by project/program leadership and/or a steering committee, when applicable.

Any risks around resourcing, with respect to specific skillset requirements, will be addressed with service providers, internal or external, prior to initiating the project. The planning cycle of the project will ensure proper expertise is maintained during the life of the project and is well documented as part of the execution scope.

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| G-GP-09 | OPERATING TECHNOLOGY CYBER SECURITY EQUIPMENT REPLACEMENT |
|---|---|
| **Primary Trigger:** | Compliance |
| **OEB RRF Outcomes:** | Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 5.7 | 3.4 | 2.8 | 6.0 | 7.9 | 25.9 |

**Summary:**

This investment involves the replacement of end of life operating technology (OT) cyber security equipment. The primary trigger of the investment is compliance with NERC CIP Cyber Security Standards. The investment is expected to mitigate risks inherent to the operation of power system equipment on Hydro One's transmission system.

## A. OVERVIEW

The planned investments in Operating Technology (OT) Cyber Security Equipment Replacement under this ISD are to replace of end of life cyber security equipment. This equipment protects the networks used at the Back-up Ontario Grid Control Centre and Integrated System Operations Centre to control the operation of the transmission system in Ontario from cyber security risks. The assets addressed through these investments include Intrusion Detection/Prevention equipment, Authentication, Authorization and Accounting technology, Electronic Security Perimeter equipment (firewalls), log collection and retention technology, and cyber vulnerability assessment technology.

As an operator of a Bulk Electric System (BES), Hydro One is required to comply with the reliability standards established by the North American Electric Reliability Corporation (NERC) to ensure the integrity of the interconnected North American BES. NERC Critical Infrastructure Protection (CIP) Reliability Standards provide a comprehensive set of requirements to protect the BES from malicious cyber-attacks. Responsible entities, such as Hydro One must have minimum security management controls in place to protect critical cyber assets. As such, completing these investments is integral to Hydro One’s ability to address evolving cyber threats as required to ensure ongoing regulatory compliance, reliability and operational effectiveness of the systems controlling the Ontario transmission network and North American BES.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

Hydro One operates one of the largest transmission systems in North America. Hydro One’s transmission system extends to most of the province and operates in diverse geographic and climactic conditions. Hydro One’s transmission system must comply with reliability standards established by the NERC to ensure the integrity of the interconnected North American BES. The reliability framework for Ontario’s electricity transmission system is based on the reliability standards established by NERC, which have been adopted and are enforced in Ontario by the Independent Electricity System Operator.

The NERC CIP standard provides a cyber-security framework for the identification and protection of critical cyber assets that directly protect, control or affect the reliability of North America's BES. The CIP Cyber Security Standards are mandatory and enforceable across all regulated entities, including Hydro One. The investments in this ISD are tied to at least one of the following CIP Cyber Security Standards:

- **CIP-005-6 – Cyber Security – Electronic Security Perimeters**: Requires the identification and protection of an electronic security perimeter and access points. The electronic security perimeter is to encompass the critical cyber assets identified pursuant to the methodology required by CIP-002-2.
- **CIP-007-6 – Cyber Security – Systems Security Management**: Requires a responsible entity to define methods, processes, and procedures for securing the systems identified as critical cyber assets, as well as the non-critical cyber assets within an electronic security perimeter.
- **CIP-008-6 – Cyber Security – Incident Reporting and Response Planning**: Requires a responsible entity to identify, classify, respond to, and report cyber security incidents related to critical cyber assets.
- **CIP-009-6 – Cyber Security – Recovery Plans for Critical Cyber Assets**: Requires the establishment of recovery plans for critical cyber assets using established business continuity and disaster recovery techniques and practices.

The planned investments are needed to address the end of life cyber security equipment for the OT systems used at Hydro One Control Centers. In this context, "end of life" assets are those that have reached operational obsolescence due to technology limitations, end of manufacturer support (including the ability to obtain ongoing security patches and firmware updates), or increased risk of equipment failure due to equipment age. These investments are used to keep technology deployed for the security of the grid control infrastructure within support windows of the various technology vendors. Cyber security equipment generally has a lifecycle of five years, considering vendor end of sale, vendor end of support/patching and increased equipment failure. Keeping the cyber equipment current is essential to addressing emerging vulnerabilities and maximizing the protection of Hydro One systems and data.

## C. INVESTMENT DESCRIPTION

The investments under this ISD are to replace end of life cyber security equipment for OT. This investment will refresh the cyber security equipment that helps protect, detect, and respond to cyber security threats, including:

- **Firewalls** to monitor incoming/outgoing network traffic between core control systems based on a set of security rules in order to detect and block malicious traffic like viruses and unauthorized users. Firewalls are discrete network connected devices that rely heavily on continuing vendor updates to properly identify the network signatures of known malicious traffic.
- **Authentication and identity access management technology** such as password vaults, intermediate access systems and multi-factor authentication systems. These software based systems form the backbone for secure access to critical control systems. Vendor support, ongoing security testing and application patches for these systems are crucial ensure the highest level of security for all those who need to access control systems.
- **Network visibility and traffic monitoring technology** to quickly identify when critical systems have been changed and not functioning according to the approved design baseline for those systems. These systems achieve and maintain compliance reporting for critical systems over time with monitoring that verifies systems continue to meet all regulatory requirements.
- **Advanced threat detection and file integrity monitoring** solutions such as a secure electronic file transfer service. Controlling, inspecting and logging all file movement in and out of production systems allows for the advanced identification of malicious content contained in files prior to the files being moved into a critical system environment.

- **Vulnerability management systems** to provide an ongoing consolidated view of all systems in the environment. Monitoring of a consolidated system view allows for a defense in depth strategy and provides a consolidated source of record to provide for regulatory compliance evidence.

Investments in the systems listed above are planned based on a rolling five-year life cycle.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The cyber security technologies addressed under this ISD are essential to mitigate risks inherent to the operation of power system equipment on Hydro One's transmission system. There are two risks associated with failure of this equipment. Failure of these systems can affect the ability of Hydro One controllers to control transmission system equipment. For example, a firewall failure would not allow the control systems at the control centres to communicate to field equipment. This could prevent a critical control action from being executed when required, and loss of visibility of key power system operating parameters.

The planned investments are also necessary to maintain systems that are required to satisfy regulatory requirements. Specifically, in the planned investments under this ISD will help ensure that Hydro One remains able to comply with the company's NERC obligations. For example, failure of the logging system could result in loss of historical system logs. NERC CIP standards require that logs for such systems are kept for a minimum of 90 days.

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 1 - RRF Outcome Summary**

| | |
|---|---|
| **Operational Effectiveness** | • Maintain the applications and systems controlling the grid to ensure safe, reliable operation of the transmission network. |
| **Public Policy Responsiveness** | • Comply with mandatory NERC-CIP requirements. |

## E. EXPENDITURE PLAN

Specific cyber security equipment lifecycles vary by system and by individual product vendor with a typical planned lifecycle of five years. The replacement of end of life equipment is scheduled based on the varying end of support windows for each discrete technology vendor to maximize benefit of existing equipment.

Table 2 below summarizes projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 5.7 | 3.4 | 2.8 | 6.0 | 7.9 | 25.9 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **5.7** | **3.4** | **2.8** | **6.0** | **7.9** | **25.9** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **5.7** | **3.4** | **2.8** | **6.0** | **7.9** | **25.9** |

## F. ALTERNATIVES

As the investments in this ISD are non-discretionary, no alternatives have been considered. Failure to address obsolete, unsupported systems will put Hydro One in a position where it will not be able to meet regulatory obligations or provide adequate cyber security protection which would result in non-compliance. In addition, this would result in jeopardizing system reliability by leaving it exposed to cyber security risks. As a result of replacing end of life cyber security equipment, the Project will meet regulatory compliance obligations and ensure operational effectiveness of the systems used in the control of the Ontario transmission network.

## G. EXECUTION RISK AND MITIGATION

There are no significant risks identified to the completion of this investment.

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| G-GP-10 | PHYSICAL SECURITY UPGRADES |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 14.0 | 8.0 | 8.0 | 8.0 | 4.0 | 42.0 |

**Summary:**

The investments under this ISD consist of two distinct physical security upgrade programs that are required in order to ensure the ongoing security of crucial transmission facilities and, in the case of certain facilities, to comply with North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards. Through these investments, Hydro One will replace existing physical security technology systems (including access control, surveillance systems, security lighting, gates, intercoms, power supplies, alarms and other systems and technologies) that have reached or are expect to reach their useable end of life and/or are anticipated to fail and require replacement between 2023 and 2027. In addition, these investments will install perimeter security monitoring systems at seven critical transmission stations in order to mitigate physical security incidents and risks to transmission system reliability and resiliency, customer impact and risks to public safety.

## A. OVERVIEW

Hydro One maintains physical security systems at its transmission stations and control centers to ensure the ongoing security of critical facilities and, as applicable, to meet ongoing compliance with Critical Infrastructure Protection (CIP) standards established by the North American Electric Reliability Corporation (NERC) pertaining to physical security. The investments set out in this ISD are necessary to maintain and upgrade physical security systems in place at transmission stations across Hydro One's network.

Hydro One maintains various forms of physical security technology and infrastructure at all Hydro One facilities across the province, including at 105 stations and control centers that form part of the Bulk Electricity System (BES). As components of the BES, these stations must comply with the CIP standards, which mandate certain physical security technologies be in place, such as physical access control, logging, alarming and detection systems. Further, Hydro One's transmission system includes critical facilities required for the implementation of the *Ontario Power System Restoration Plan* (OPSRP) established by the Independent Electricity System Operator (IESO). As a "restoration participant" under the OPSRP, these facilities are critical to enable restoration of the Basic Minimum Power System and are subject to certain IESO requirements.

As described below, investments at certain facilities are required in order to comply with NERC CIP standards, which apply to facilities that form part of the BES. NERC standards with specific physical security requirements and controls include CIP-006 (*Physical Security of BES Cyber Systems*), CIP-014 (Physical *Security*), and CIP-003 (*Security Management Controls*).

This ISD consists of two physical security upgrade programs required to help ensure the ongoing security of crucial transmission facilities and, as applicable, to maintain compliance with NERC CIP standards. The component programs of this ISD are:

i. End of Life Physical Security Device Upgrades: Replacing existing physical security technology systems that have reached their end of life and repairing or replacing assets that are not covered under warranty.

ii. Perimeter Monitoring Upgrades at Critical Facilities: Upgrades to the physical security at seven critical stations to ensure that critical transmissions assets are safe and secured. These investments include two transmission stations that were recently identified as requiring investments in order to comply with NERC CIP-014.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

Hydro One operates large and complex physical security network that is monitored 24 hours a day in order to protect assets, information and people across 145 facilities. In addition, the operation and monitoring of physical security systems at certain facilities is further mandated by current NERC CIP requirements.

Investments under this ISD are identified through a risk-based approach, and are fundamentally designed to reduce physical security risks to critical transmission facilities and associated assets and personnel located at such facilities. Hydro One performs ongoing Threat Risk Assessments (TRA) of its stations and the control centers on a periodic basis, based on the industry standard RCMP Harmonized Threat Risk Assessment methodology and produces physical security plans that are designed to implement measures that mitigate physical risks to employees, assets, information and facilities.

This ISD will implement supplemental physical security measures at seven facilities, based on recommendations identified through TRAs. Providing adequate physical security at these critical facilities will help ensure operational effectiveness, grid resiliency, reliability to Hydro One customers and increase personnel and public safety. In addition, the replacement of end of life physical security systems and hardware at critical sites will help ensure that physical security risk reduction measures are upheld into the future.

**I. END OF LIFE PHYSICAL SECURITY DEVICE UPGRADES**

A significant portion of Hydro One's security hardware and assets are expected reach their end of useable life during the 2023-2027 period and will require replacement to sustain ongoing site security, access control and compliance. Hydro One has seen escalating break-fix and replacement costs in recent years as a result of the expanding network of devices and increasing average age (and therefore failure rate) of the assets. Approximately 75% of Hydro One's security hardware and assets have exceeded or will reach the end of their useful lives in the 2023-2027 period. Hydro One classifies these assets as posing a "high-consequence" failure risk, since the company depends on the ongoing reliability of these critical systems and assets to ensure the security, access control, and reliability of Hydro One facilities and assets. In addition, Hydro One is required to maintain many of these assets in order to comply with NERC CIP physical security standards.

**II. PERIMETER MONITORING UPGRADES AT CRITICAL FACILITIES**

Hydro One continually performs TRAs to identify potential physical threats at critical facilities. A TRA is a detailed risk assessment process performed by Hydro One security specialists who evaluate, among other things, security gaps and vulnerabilities at Hydro One transmission stations.

Hydro One also identifies and ranks facilities based on a number of factors, including their importance to the implementation of the OPSRP, impacts on critical regional and customer load and security incident history and trends. Based on this, Hydro One has identified five stations that have physical security vulnerabilities and have been deemed high in importance that will require upgrades in order to mitigate identified risks.

In addition, as summarized in the overview section above, Hydro One's transmission system comprises part of Ontario's BES, which requires compliance with reliability standards established by NERC to ensure the integrity of the interconnected North American BES. The NERC CIP-014 standard requires Hydro One to identify and protect transmission stations and transmission substations (and their associated primary control centers) that, if rendered inoperable or damaged, could result in widespread instability, uncontrolled separation or cascading effects to the BES. Hydro One has adopted the Northeast Power Coordinating Council's (NPCC) Criteria A-10, "Classification of Bulk Power System Elements" as the methodology and criteria for identifying the transmission stations that, if rendered inoperable or damaged, could have adverse impact on the NPCC-recognized Bulk Power System. As a result of revisions to the IESO's A-10 assessment, Hydro One, in conjunction with an independent third party review, has identified two additional stations that are subject to the CIP-014 requirements.

## C. INVESTMENT DESCRIPTION

Hydro One's physical security systems are comprised of access control hardware, thermal surveillance systems and cameras, security lighting, automated gates, intercoms, power supplies and invertors, alarm sensors and key control systems and other security technologies, all of which are monitored 24 hours a day. These systems are protecting Hydro One facilities and critical assets across 145 facilities across the Province, including 105 stations and control centers that comprise the BES.

Through TRAs, Hydro One has identified five BES stations that are considered operationally critical to the transmission system in Ontario due to their role in the OPSRP and for regional load, switching and transfer reliability. Furthermore, the company has identified a further two stations that are subject to ongoing NERC CIP-014 compliance requirements. Finally, Hydro One requires funding to replace security systems and hardware deployed across the province that is expected to reach its end of life during the 2023-2027 period. Planned investments in each category are summarized in the sub-sections below.

### I. END OF LIFE PHYSICAL SECURITY DEVICE UPGRADES

Hydro One's physical security systems and associated assets have been progressively expanding since 2008, driven largely by increasing NERC CIP compliance requirements and risk reduction measures. This component of the program represents the replacement of existing physical

security technology systems (access control hardware, thermal surveillance systems and cameras, security lighting, automated gates, intercoms, power supplies and invertors, alarm sensors and key control systems) that have reached the end of their useful lives.
Additionally, a number of assets will have reached operational obsolescence due to technology limitations, end of manufacturer support (including the ability to obtain ongoing security patches and firmware updates) and where such assets no longer integrate effectively with current security monitoring systems. An example of obsolescent technology included in the program is the replacement of analog cameras that provide limited low-light visibility, have poor resolution and do not integrate with the current security monitoring systems.

Finally, Hydro One requires resources to respond to asset failures across its physical security system that require immediate ad-hoc replacement in conditions where such assets are no longer covered under manufacturer warranty.

Replacing end of life security cameras accounts for approximately half of planned physical security devices replacements over the 2023-2027 period. Hydro One utilizes a combination of commercial-grade pan-tilt-zoom, fixed and precision thermal camera systems to secure its facilities and maintain compliance with NERC CIP standards. Hydro One has identified approximately 1,350 cameras that have exceeded or will reach the end of their useful life in the 2023-2027 period. In addition, a large proportion of Hydro One’s cameras are becoming functionally obsolete; approximately 62% of Hydro One’s security cameras utilize legacy analog technology that poses performance risks including reduced monitoring capability in comparison to modern cameras along with system integration limitations.

The current population of security cameras is shown in Figure 1 below. Security cameras have a useful life of between seven and ten years, meaning that all cameras installed before 2012 are already beyond the end of their useful lives. By the end of the 2027, all cameras installed prior to 2018 will have exceeded their useful lives. Under this ISD, Hydro One plans to prioritize replacement of the oldest cameras.

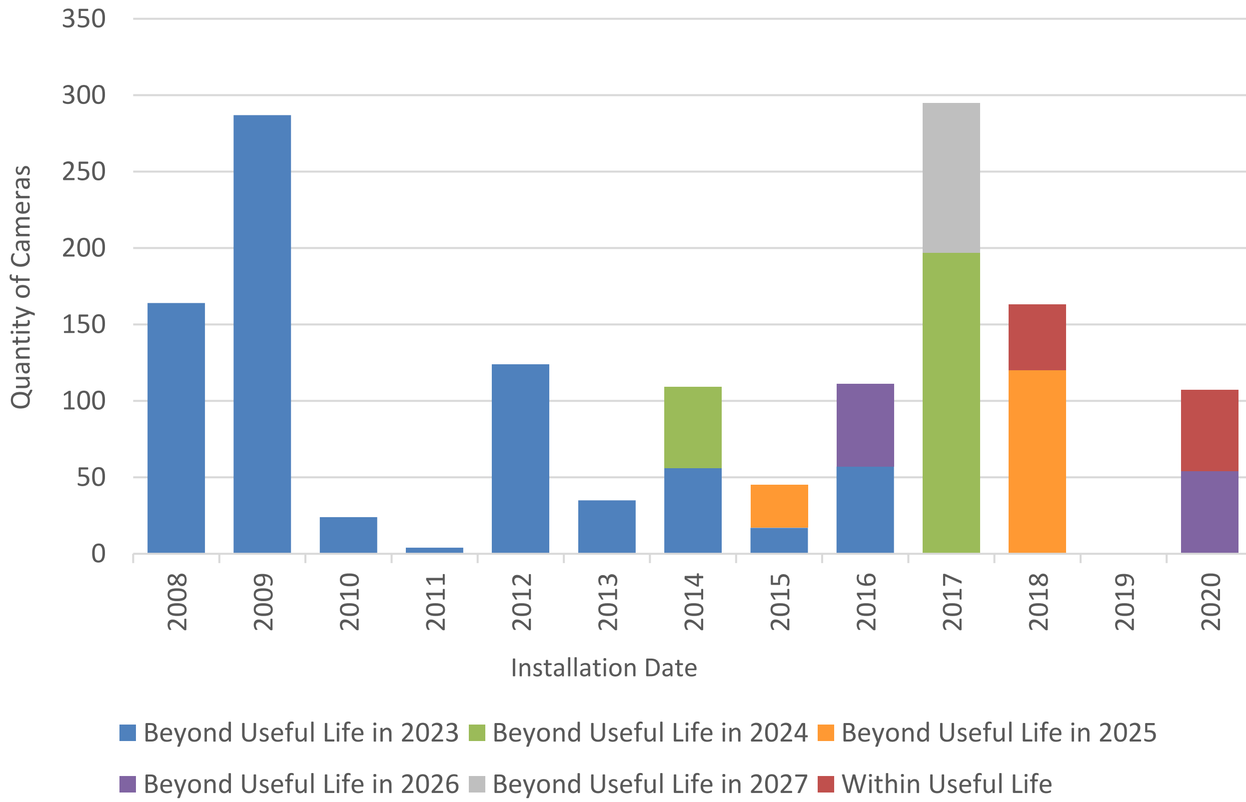


**Figure 1: Projection of Camera Population within their Useful Life by Installation Date**

Over the 2023-2027 period, Hydro One plans to invest $19.6M in this category.

### II. PERIMETER MONITORING UPGRADES AT CRITICAL FACILITIES

This ISD will implement physical security measures based on the recommendations resulting from the TRA process. These investments include improved physical security measures at two critical stations in order to comply with NERC CIP-014, along with five other critical transmission stations identified for upgrade between 2023 and 2027. Providing adequate physical security to Hydro One critical stations will help ensure ongoing operational effectiveness, as well as grid resiliency and reliability to Hydro One customers.

As discussed in section B.1, Hydro One completes TRA's to identify potential physical security vulnerabilities and assess the criticality of transmission stations and substations with respect to the OPSRP and inherent customer impact. Through TRAs, Hydro One has identified five stations that will require physical security upgrades. In addition, as a result of revisions to the IESO's A-10 assessment described above, Hydro One has identified two additional stations that are subject to the CIP-014 requirements.

While the physical security equipment required at the seven stations identified vary in scope and complexity, the enhancements to be executed include:

- Physical barriers such as upgraded fences, walls and vehicle barriers that form the outermost layer of security.
- Automated gates with integrated card readers and intercoms to ensure monitoring, management and logging of all vehicular entries into the facility based on need.
- Surveillance cameras with thermal night vision, analytics and motion detection used to deter, detect, assess and respond to unauthorized entries or surveillance of such facilities.
- Security lighting that provides deterrence, visual-assessment and increased safety during periods of darkness.
- Physical access control systems such as electronic door controls, magnetic card readers and access cards that trigger alerts in response to detected unauthorized access and limit access
- Audio loud-speakers to deter potential unauthorized entry, malicious activity or surveillance of critical facilities.
- Protection of fiber optic cabling that provides the supervisory, teleprotection, power system operational technology and corporate information technology communication to reduce the possibility of tampering or malicious damage.

Over the 2023-2027 period, Hydro One plans to invest $22.4M in this category.

## D. OUTCOMES

The Physical Security Upgrades investments under this ISD will help ensure that Hydro One remains able to safeguard the physical security of its facilities. Other outcomes of these investments include the following:

- Ensuring that Hydro One remains compliant with NERC CIP regulatory requirements, helping sustain critical BES transmissions asset reliability and resiliency.
- Mitigating legal, financial, reputational and compliance risks as the current legacy system becomes obsolete and no is longer adequately protected from security vulnerabilities and device failures.
- Maintaining system reliability and supply to customers by ensuring secure operation of critical facilities.

### D.1 OEB RRF OUTCOMES

The following table presents the anticipated benefits as a result of this ISD in accordance with the Ontario Energy Board's Renewed Regulatory Framework:

**Table 1 – Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Maintain system reliability and supply to customers by ensuring secure operation of critical transmission facilities. |
| **Operational Effectiveness** | • Maintain operational effectiveness, as well grid resiliency and reliability. |
| **Public Policy Responsiveness** | • Compliance with NERC CIP-014 regulatory requirements. |

## E. EXPENDITURE PLAN

Specific physical security improvements will vary by location depending on site-by-site factors, existing risks and controls. The replacement of end of life and obsolete equipment will be scheduled based on associated risk with a view to geographical, resource efficiencies and alignment with CIP-014 and station upgrades. The increased expenditures in 2023 are driven primarily by specific investments at two critical CIP-014 stations that are required to comply with NERC standards. Hydro One has committed to complete this work by the end of 2023. Table 2 below presents forecast costs for this ISD.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 14.0 | 8.0 | 8.0 | 8.0 | 4.0 | 42.0 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **14.0** | **8.0** | **8.0** | **8.0** | **4.0** | **42.0** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **14.0** | **8.0** | **8.0** | **8.0** | **4.0** | **42.0** |

## F. ALTERNATIVES

**NERC CIP INVESTMENTS ARE NON-DISCRETIONARY**

Upgrades related to end of life of physical security systems and assets at CIP-014 sites are non-discretionary and, as such, no other alternatives have been considered for these investments. Such upgrades are required to replace devices that have reached the end of their useful life, physical security enhancements at other critical stations is are based on asset need and the criticality of such facilities to system restoration, critical load, switching and transfer capability.

**I. ALTERNATIVE FOR END OF LIFE ASSETS: RUN-TO-FAILURE APPROACH**

With respect to the end of life component of the ISD, Hydro One has considered a run-to-fail approach in replacement of assets. However, this alternative exposes Hydro One to unacceptable risks due to downtime associated with longer lead times in procuring assets on an emergency basis. In addition, such devices require increasing repair and maintenance costs with age and, as may no longer be supported by manufacturers, require higher costs to source parts, if available. Finally, as noted, many of the devices requiring replacement are obsolete and as such, create vulnerabilities in the security systems of Hydro One as they may not adequately integrate or provide required functionality.

**II. ALTERNATIVE FOR PERIMITER MONITORING UPGRADES: DEFER INVESTMENT**

With respect to upgrades to the five stations that have been identified as critical but are not required for NERC CIP compliance, a potential alternative would be to defer the investment. However, this approach would not be appropriate since it would expose the OPSRP and customers to heightened risks related to the failures at these stations, as identified through the TRA process.

## G. EXECUTION RISK AND MITIGATION

The risk to this ISD includes scheduling of resources to complete all the necessary work. This risk is mitigated through coordinated planning and scheduling of key ISD execution deliverables.

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| **G-GP-11** | **SECURITY MONITORING** |
|---|---|
| **Primary Trigger:** | Business Support Sustainment |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 6.5 | 4.0 | 1.0 | 1.0 | 1.0 | 13.5 |

**Summary:**

The investments in this ISD will replace and update critical security monitoring systems and provide an on premise back-up cyber and physical security monitoring facility. These cybersecurity and physical security systems protect important assets from malicious acts, including destruction, sabotage and theft. Some of the systems addressed by this ISD are subject to requirements established by the North American Electric Reliability Corporation's (NERC) Critical Infrastructure Protection (CIP) standards, which mandate continual operation and monitoring of such systems.

Hydro One's current security monitoring solutions and assets will be at or beyond end of useful life and require replacement during the 2023-2027 period. In addition, Hydro One plans to establish a back-up Security Operations Centre to help ensure redundant security monitoring, disaster recovery and continuity of operations in the event that the primary security monitoring facility is unavailable or damaged.

## A. OVERVIEW

The investments in this ISD are to replace and update the hardware and software systems that Hydro One uses to monitor both cybersecurity and physical security systems across the company. The ISD also includes capital expenditures in 2023 to establish a back-up Security Operations Centre, in order to provide redundancy, continuation of operations, and disaster recovery if the company's primary monitoring facility is unavailable or damaged.

Hydro One operates large and complex distributed cyber and physical systems on dedicated networks that are centrally monitored 24 hours a day in order to protect the ongoing reliability, availability and integrity of information technology and operational technology networks, systems, assets and information. These systems protect approximately 145 facilities across the province from cyber and physical threats, including destruction, sabotage and theft. The continual operation and monitoring of cyber systems associated with medium and high impact Bulk Electric Systems (BES) facilities is further mandated by current North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection (CIP) standards.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

The investments in this ISD address the following needs:

i. updating the company's Cyber Security Event Monitoring (SEM) solution to account for the increasing volume of cybersecurity event data that over the 2023-2027 period;
ii. refreshing/upgrading aging components of cyber event monitoring solution;
iii. updating physical security monitoring and access control system, including central server infrastructure along with network appliances used to transport and communicate data across its monitored facilities in real-time; and
iv. establishing a backup site for Hydro One's Joint Security Operations Centre (JSOC).

Each investment category is described below.

## I. SECURITY EVENT MONITORING

Hydro One's current cyber security event monitoring solution must be updated in order to keep pace with current and emerging technologies and cybersecurity threats. The primary trigger of the investment is regulatory compliance (continuous monitoring of the NERC BES Cyber Assets) as well as maintaining a robust cyber anomaly detection and response capability to protect networks, systems, assets, employee and customer data.

Hydro One's SEM system is the backbone of Hydro One's cybersecurity operations. The SEM system continually monitors the company's Information Technology (IT) and Operational Technology (OT) networks and digital assets for cybersecurity threats. It collects events and logs from devices across the networks, correlates events from various networks and systems to generate security alerts, feeding threat analysis to the company's JSOC, which continuously monitors alerts and responds to suspicious or malicious cyber activity reported through these alerts.

Hydro One's current SEM system is not equipped to process the increasing volume of cybersecurity event data that will be generated in the coming years. The volume of cyber security events is expected to increase due to a range of factors including the modernization of the technology supporting Hydro One's OT environment being ongoing targets from external threats and the ability to capture more events through the planned implementation of a situational awareness solution to monitor and secure the grid of the future. While these new systems will provide benefits for Hydro One's networks and customers, they will place greater strain on the SEM systems that must receive and process a much larger volume of event data. If the SEM is not kept up to date and scaled appropriately to support this workload, the performance of system will degrade and SEM will not be able to ingest required system security events thereby increasing the risk of non-compliance with NERC-CIP continuous monitoring requirements.

In addition to allowing the JSOC to continue performing its core functions, the updated SEM system is expected to enable Hydro One to enhance the JSOC performance. The incremental performance benefits of the updated SEM are described in the corresponding Investment Description sub-section below.

**II. PHYSICAL MONITORING AND ACCESS CONTROL**

Physical security monitoring and access control systems are an integral aspect of Hydro one's physical security and physical access controls (doors, gates) operations that are centrally managed through a computing architecture spread across two distinct data centre locations. All physical security systems operate on a dedicated data Video Surveillance Telecom Service (VSTS) network, isolated from power system and corporate functions.

Hydro One forecasts that many of the company's physical security system assets (core servers, appliances and networking assets) will be at or beyond end of life during the 2023-2027 period and will no longer be able to provide ongoing and effective security monitoring.[1] These assets have an immediate high consequence of failure, due to the criticality of maintaining physical security monitoring to ensure the ongoing availability and integrity of Hydro One networks, systems, assets and information and compliance with NERC standards.

In addition, Hydro One depends on the ongoing reliability of the physical security monitoring and access control servers, appliances and network assets to ensure the ongoing security and reliability of Hydro One facilities, including sustaining ongoing compliance with NERC CIP physical security standards such as CIP-006, CIP-007, CIP-008, and CIP-014 applicable to 105 separate NERC-facilities.

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[1] Hydro One defines a security asset's end of life as the date in which the asset has reached its expected useful life as recommended by the manufacturer and where the use of such assets have reached operational obsolescence due to technology limitations, end of manufacturer support, including the ability to obtain ongoing security patches and firmware updates and where such assets no longer integrate effectively with present-day security monitoring systems.

### III. SECURITY OPERATIONS CENTRE BACKUP SITE

Hydro One is currently undertaking the process of insourcing its cyber and physical security monitoring operations with the primary location expected be completed in 2022. Following the completion of the primary facility, a back-up location at an alternate Hydro One facility is required to ensure ongoing redundancy and disaster recovery of operations should the primary JSOC location not be available.

Hydro One relies on the continuous function of its cyber monitoring facilities in order to ensure the ongoing detection, assessment and analysis of threats to its IT and OT networks and systems. Likewise, Hydro One is dependent on the continuous function of its physical security and access control systems in order to safeguard assets and facilities from attacks, sabotage and thefts. Physical security systems are operated on a 24/7 and such systems are used to provide remote gate management and door access into Hydro One facilities.

In addition, Hydro One is required to by NERC CIP standards such as CIP-006, CIP-007, CIP-008, and CIP-014 to monitor, log, alert and respond to cyber and physical security incidents that may impact Medium and High Impact Cyber Systems associated with the BES. As a result, these requirements necessitate the creation of a back-up security operations location that provides a physical work area for disaster recovery that includes up-to-date versions of required information systems, hardware and data that can be used immediately in the case that access to its primary monitoring location is disrupted by a disaster event.

## C. INVESTMENT DESCRIPTION

### I. CYBER SECURITY EVENT MONITORING

Over the 2023-2027 period, Hydro One plans to upgrade existing hardware and software components of the SEM as required to scale the existing solution up to meet the increasing volume of cybersecurity event data. The investments will also enable more sophisticated threat detection capabilities by implementing current SEM technologies, such as machine learning.

Hydro One also plans to replace respective hardware components of the solution that will reach end of life during 2023-2027 period.

The planned investments will leverage “best of the breed” technologies and platforms to keep pace with emerging threats and advancement in technology both from offensive and defensive standpoint. This investment will help Hydro One’s Security Operations maintain the level of continuous monitoring of Hydro One’s IT and OT landscape to satisfy corporate and NERC CIP requirements.

Over the 2023-2027 period, Hydro One plans to invest $6.0M in these systems.

## II. PHYSICAL MONITORING AND ACCESS CONTROL

Under this investment, Hydro One plans to replace existing physical security technology virtual server hardware, host appliance and storage, along with distributed networking assets, including firewalls, routers and switches located on Hydro One’s dedicated physical security network.

Hydro One’s physical security monitoring systems across the province are dependent on centralized virtual server infrastructure at two on premise datacenters comprising over 25 core servers and appliances. These systems and reside on the dedicated VSTS network which comprises 715 networking assets (including switches, routers and firewalls) that enable continual connectivity, data transfer and monitoring of 145 Hydro One facilities across the province.

As shown in Table 1, these assets are forecasted to reach their end of life due to the end of manufacturer support (including the ability to obtain ongoing security patches and firmware updates) or operational obsolescence due to technology limitations during the 2023-2027 period. Hydro One plans to replace these assets through a staggered end of life replacement program based between 2024 and 2027, prioritized based on risk.

**Table 1 - Physical Access Control and Monitoring Security Asset Summary**

| Description | Quantity | End of Life (Years) | Average Age in 2021 (Years) |
|---|---|---|---|
| Video Surveillance Telecom System Networking Assets | 715 | 5 | 5.5 |
| Virtual Servers, Hosts and Storage Infrastructure | 25 | 5 | 3.0 |

Over the 2023-2027 period, Hydro One plans to invest $5M in replacing physical monitoring and access control assets.

## III. SECURITY OPERATIONS CENTRE BACKUP SITE

This investment involves the physical construction of a back-up JSOC location at a geographically disparate Hydro One facility in order to ensure ongoing redundancy, business continuity and disaster recovery of operations in the event the primary JSOC location is no longer available. The JSOC houses all real-time cyber and physical security monitoring and response functions, including live alarm and video surveillance of all sites across the province, including associated audio visual systems, telephony, disaster recovery and physical and cyber security emergency response functions and supporting technologies.

The elements of this investment includes design, engineering, new construction and modification of various equipment including electrical and data cabling, switching, lighting, audio visual systems and video wall installations. Likewise, this investment includes the procurement, configuration and installation of monitoring hardware and fixtures, including consoles, desks, chairs, monitors, specialized workstations, and telephony and intercom master systems. Lastly, this investment includes professional services required to design and manage the back-up JSOC implementation.

Over the 2023-2027 period, Hydro One plans to invest $2.5M to establish the back-up JSOC.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 2 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Early detection and response to cyber and physical security events |
| **Operational Effectiveness** | • Greater situational awareness of cyber and physical security events with the potential to affect Hydro One's operations<br>• Earlier detection and response to cyber and physical security threats and incidents, improving the company's ability to minimize impacts and resulting recovery costs<br>• Monitoring of unauthorized cyber or physical access to provide confidence required for internal and external financial reporting |
| **Public Policy Responsiveness** | • Effective cyber and physical security monitoring systems and facilities are required to comply with NERC CIP and OEB Cyber Security Framework (CSF) guidelines. |

## E. EXPENDITURE PLAN

Table 3 below summarizes projected spending on the aggregate investment level.

**Table 3 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 6.5 | 4.0 | 1.0 | 1.0 | 1.0 | 13.5 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **6.5** | **4.0** | **1.0** | **1.0** | **1.0** | **13.5** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **6.5** | **4.0** | **1.0** | **1.0** | **1.0** | **13.5** |

The levels of investment in 2023-2024 are driven by the implementation of SEM upgrades, which are planned to be completed by the end of 2024, and the creation of the back-up JSOC location, which is planned for 2023.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred approach as set out in this ISD.

**NERC CIP PHYSICAL SECURITY INVESTMENTS ARE NON-DISCRETIONARY**

Upgrades related to end of life of physical security monitoring and access control systems are non-discretionary and, as such, no other alternatives have been considered for these investments. Such upgrades are required to replace devices that have reached the end of their useful life in order to maintain ongoing compliance with NERC CIP physical security standards (CIP-006, CIP-014).

In addition, Hydro One is required to by NERC CIP standards such as CIP-006, CIP-007, CIP-008, and CIP-014 to monitor, log, alert and respond to cyber and physical security incidents that may impact Medium and High Impact Cyber Systems associated with the BES. As a result, these requirements necessitate the creation of a back-up JSOC location that provides a physical work area for disaster recovery that includes up-to-date versions of required information systems, hardware and data that can be used immediately in the case that access to its primary monitoring location is disrupted by a disaster event.

**SEM ALTERNATIVE 1: STATUS QUO**

If Hydro One were not proceed with the SEM investments, the current SEM would be beyond its functional capacity to process incoming cybersecurity events and otherwise beyond its useful life, resulting in degraded cybersecurity detection and response ability. Hydro One would also risk non-compliance with NERC requirements if the SEM is not able to meet the CIP continuous monitoring requirements.

**SEM ALTERNATIVE 2: UPGRADE AND REPLACE SEM (RECOMMENDED)**

With the proposed investments in the SEM, Hydro One will maintain the cybersecurity event detection and monitoring capability, allowing the company to effectively monitor risks across the IT and OT environments, and maintain compliance with NERC CIP continuous monitoring requirements.

These investments will also help streamline data collection from all sources within Hydro One, including feeds from the situational awareness solution at operational facilities. These investments will also leverage emerging technologies, such as machine learning and automation, to enhance the company's cybersecurity threat detection and response capabilities.

## G. EXECUTION RISK AND MITIGATION

The risk to this ISD includes scheduling of resources to complete all the necessary work. This risk is mitigated through coordinated planning and scheduling of key ISD execution deliverables.

| G-GP-12 | COMMON OPERATION TECHNOLOGY INFRASTRUCTURE |
|---|---|
| **Primary Trigger:** | Reliability |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 8.0 | 7.0 | 5.0 | 5.5 | 4.0 | 29.5 |

**Summary:**

This investment involves the planned replacement of Hydro One's Common Operation Technology Infrastructure (COTI), which is relied on by critical network operating systems to facilitate the key applications for the monitoring and control of the Bulk Electric System (BES). These replacements are required for the lifecycle management of COTI to ensure continued vendor support and compliance with cyber security requirements. A secure and vendor-supported COTI is crucial to maintaining system reliability, cyber security compliance, and service levels for mission critical applications.

## A. OVERVIEW

This investment involves the planned replacement of Hydro One's Common Operation Technology Infrastructure (COTI), which is relied on by computing hardware and network operating systems – including the Network Management System (NMS), Network Outage Management System (NOMS), Outage Response Management System (ORMS), and Distribution Management System (DMS)[1] – to provide the safe and reliable operations of the transmission and distribution network.

COTI assets include VMware, storage area network (SAN) switches, storage devices, computing management devices, Oracle database and next generation computing hardware. These assets are managed through a lifecycle program to maintain vendor support in alignment with industry practices. In addition, Hydro One is required to comply with NERC reliability standards, including the critical infrastructure protection (CIP) standards that apply to the cyber security aspects of maintaining an efficient and reliable bulk electric system.

The COTI investment is driven by the need to maintain reliability and service levels for Hydro One customers through the 24/7 support of mission critical applications and the need to ensure regulatory compliance. The projected cost of the investment is estimated to be $29.5M over the 2023-2027 planning period.

[1] The NMS is a critical system for the effective monitoring and control of the transmission system. The NOMS is the primary outage management tool that provides for planning, scheduling, assessment, and execution of outages. The ORMS is the operating tool used to manage distribution outages and trouble response. The DMS is used to model the distribution system and for the monitoring, control, analysis and management of the distribution grid.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

This investment is required to sustain the COTI, which is the shared platform for Hydro One's network operating systems that enable the safe and reliable management of the electric grid. Specifically, multiple mission critical systems (such as the NMS, DMS, NOMS and ORMS) rely on COTI as the foundational support platform. Planned lifecycle management of the computer systems that make up COTI is critical to the ongoing reliable and safety operations of the electric grid on a 24/7 basis. Installation of multiple discrete applications that are all supported by COTI as a common platform is more efficient from a technical perspective and also leads to a lower total cost of ownership.

The COTI consists of both hardware and software components, including:

- Data storage archives - devices that retain, retrieve and archive digital data, and storage area network (SAN) switches;
- Computer servers - processors that fetch, decode, execute and write data in response to system processes and inquiries;
- Computer hardware;
- Operations Technology (OT) networks - a series of communication paths interconnecting devices; and
- Various other systems and software applications – including:
    - VMware (i.e., a virtualization of servers/desktops);
    - Citrix (presentation software), Netscaler load balancing hardware and proxy servers;
    - Windows Servers, desktop operating system (MS Windows), and MS-SQL servers;
    - Next Generation Data Centre (NGDC) and Data Centre Infrastructure Management (DCIM);
    - Oracle database software; and
    - Control room computer consoles.

Each of the above categories include numerous individual hardware components and associated software suites. The lifecycle of the individual components vary and require replacement at different intervals. While computing systems are generally capable of providing acceptable services over their lifespan (up to 5 years in some cases), end of life systems are likely to exhibit slower processing capability when handling complex electric grid operations, state estimation and simulation exercises, which are fundamental to reliable and safe grid operations. In addition, the expiry of vendor support means that performance issues or failures that arise may not be readily resolvable. According to original equipment manufacturer (OEM) recommendations, such complex systems and tools need to be replaced on a lifecycle approach in order to ensure the availability of critical spares.

Not carrying out the planned lifecycle replacement of the COTI components will increase the risk of high consequence component failures. Such failures have the potential to cause cascading system impacts, including the failure of critical applications (e.g., NMS, NOMS, ORMS, DMS) and the business functions they support, loss of system redundancy, and unavailability of operating systems at the Integrated System Operations Centre (ISOC) and/or the Backup Ontario Grid Control Centre (BU-OGCC). In turn, potential adverse impacts on customer service quality and work execution include:

- Cancellation or delay of planned outages, which will cause planned field work to be rescheduled;
- Inefficient outage management, interrupted communication with customers and staff, and inability to respond to emergency events which could result in safety risks to field crews and the public; and
- Required activation of BU-OGCC, which involves a series of work steps that – while crucial to ensuring operational continuity in the absence of a functional ISOC – can nonetheless hinder service quality and the expediency of critical response.

In addition to the need to maintain vendor support, lifecycles for different COTI components are also driven by the need to maintain compliance with cyber security standards – in particular, NERC CIP-007-5 (Security Patch Management), which outlines certain technical, operational, and procedural requirements in support of secure BES operations. Loss of vendor support means that potential cyber security vulnerabilities cannot be effectively addressed as cyber security patches are no longer provided for end of life software. This will render the operating systems, which are integrated with the end of life software, vulnerable against cyber attacks, resulting in compromised reliability and efficiency as well as potential non-compliance with the aforementioned NERC requirements regarding security patch management.

In addition, maintaining existing systems beyond their expected service life is more costly as spare components (e.g., spare servers, network cards and switches, interface modules, etc.) become scarce and difficult to source. While extended support agreements may be available for certain systems at the end of their vendor support window, these extended support costs are significant while the risk of random equipment failure would remain unmitigated under extended support. The upgrade of end of life COTI components will avoid the significant extended support costs and minimize the risk of random equipment failure.

## C. INVESTMENT DESCRIPTION

The COTI investment is comprised of multiple asset groupings, and is required to maintain a functional and secure common platform for Hydro One’s network operating systems that are leveraged by both Transmission and Distribution control functions at both the ISOC and the BU-OGCC.

The proposed investment for 2023-2027 includes the replacement of COTI components such as SAN units, Servers for the Next Generation Data Centre (NGDC), and data center infrastructure management (DCIM) software. The investment also includes the procurement of spare data centre infrastructure components. Also included in the investment are the required upgrades and replacements of hardware to enable the next upgrade projects of NMS, ORMS, and DMS (refer to GSP Section 4.11, G-GP-16, G-GP-17 and G-GP-18, respectively).

In carrying out procurements, Hydro One leverages opportunities for volume quantity discount or discounts associated with the seasonal timing of purchases (i.e., at vendor fiscal year-end to maximize potential discount and value for ratepayers).

Table 1 below summarizes the COTI upgrade plan for the years (2023-2027).

**Table 1 - COTI Components Upgrade Plan (2023-2027)**

| COTI Components | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|
| Next Generation Data Centre | | | | ✓ | ✓ |
| Microsoft SQL | ✓ | | | | ✓ |
| Microsoft O/S | | ✓ | | | |
| Netscalers | | | ✓ | | |
| Storage Archive & SAN Switches | | ✓ | ✓ | | |
| Proxy Servers | | | | ✓ | |
| ORACLE Upgrade | | | ✓ | | |
| Control Room Refresh | | | | | ✓ |
| DCIM | | ✓ | | | |
| VMware | | ✓ | | | |
| NMS Hardware Upgrade<br>(Application updates are covered under G-GP-16) | ✓ | | | ✓ | |
| ORMS Hardware Upgrade<br>(Application updates are covered under G-GP-17) | ✓ | ✓ | | | |
| DMS Hardware Upgrade<br>(Application updates are covered under G-GP-18) | ✓ | ✓ | | | |

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table lists anticipated benefits of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 2 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Ensures 24/7 support to mission critical applications (including NOMS, NMS, ORMS and DMS) that support emergency storm response, field and customer communications, and outage coordination and that must reliably function to minimize the impact of system outages on customers. |
| **Operational Effectiveness** | • Provides the required OT infrastructure to holistically support the functionality of mission critical grid operations applications and systems.<br>• Mitigate the risk of reduced system performance (i.e., unable to effectively handle complex system operations functions) and potential adverse impact to service levels due to a COTI failure. |
| **Public Policy Responsiveness** | • Ensures mission critical grid operations are supported with functional and vendor-supported COTI in compliance with regulatory requirements (NERC CIP-007-5 – Security Patch Management). |

## E. EXPENDITURE PLAN

The level of investment for the 2023-2027 period is estimated based on historical costs and latest available market intelligence. The timing and cost estimates of investments are optimized through the continuous monitoring of current performance levels of computing systems (i.e. to identify performance degradation) and with consideration of equipment manufacturer recommendations. Alternative technologies are evaluated based on cost analysis, maintenance requirements, the potential option to bulk purchase multiple components, and potential opportunities to leverage end of fiscal year discounts.

**Table 3 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 8.0 | 7.0 | 5.0 | 5.5 | 4.0 | 29.5 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **8.0** | **7.0** | **5.0** | **5.5** | **4.0** | **29.5** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **8.0** | **7.0** | **5.0** | **5.5** | **4.0** | **29.5** |

The factors that impact the costs for these investments include:

- Refinement of planning estimates as projects near execution.
- Potential changes to regulatory policies or security requirements that may impact implementation.
- System or architecture landscape changes that may impact technical complexity associated with implementation.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred investment approach.

**ALTERNATIVE 1: CONTINUING TO OPERATE EXISTING COTI**

This alternative is to continue to operate the existing COTI. If COTI is kept in-service beyond vendor support, an eventuality is that existing infrastructure can fail randomly and lead to the loss of one or more critical computing hardware and systems, thus placing Hydro One's critical operating capabilities at risk. Second, the loss of vendor support means the unavailability of contracted expert assistance to resolve unexpected events (e.g., equipment failure). Thirdly, systems that have not been renewed with the necessary updates/patches are subject to a higher likelihood of cyber security breach. Other risks include non-compliance with regulatory standards and higher cost of remedial efforts in the event of a failure. Therefore, this alternative is not recommended.

**ALTERNATIVE 2: MAINTAIN VENDOR-SUPPORTED COMMON OT INFRASTRUCTURE (RECOMMENDED)**

Asset lifecycle management is recommended to ensure the continued functionality and reliability of COTI assets. There are a number of factors that drive COTI lifecycle management – with a primary driver being the vendor support window. In alignment with industry standard practices for managing OT assets, Hydro One's planned lifecycle management and replacements of existing COTI assets will ensure vendor support and decrease the likelihood and consequence of asset failures. More specifically, by enabling the following outcomes, this recommended alternative will sustain critical business functions and ensure that tools and systems used to support grid operations are functioning as designed:

- Continued availability of vendor-supported computing systems and tools and compliance with reliability standards;
- Availability of replacement/spare components;
- Vendor updates and software patches to protect against cyber security risks; and
- Ensuring Hydro One's ability to effectively recover from random failures without jeopardizing real time system operations.

## G. EXECUTION RISK AND MITIGATION

Potential risks related to procurement and logistical challenges can extend the timeline for project delivery and result in cost increases. For example, changes in market trends and dynamics beyond Hydro One's control can lead to reduced availability of services/products from vendors. In addition, there could be unexpected shipping or delivery issues to affect investment timeline. To mitigate these risks, Hydro One will implement a purchasing schedule that is coordinated well in advance with relevant vendors and pursue timely intervention to prevent or mitigate any unexpected delays.

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| G-GP-13 | OPERATING TECHNOLOGY FACILITIES SUSTAINMENT |
|---|---|
| **Primary Trigger:** | Reliability |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 2.0 |

**Summary:**

This investment involves the lifecycle refresh of common operating facilities at the Integrated Systems Operations Centre (ISOC) and Back-up Ontario Grid Control Centre (BU-OGCC), including Uninterrupted Power Supply (UPS) units, batteries and standby generators. The UPS units (with a lifecycle of 10 years) and batteries (lifecycle of 5 years) will reach end of life during the JRAP period and require replacement. The standby generators at the BU-OGCC were installed in 2003 when that facility was built and replacement is planned to be completed by 2025. This investment will mitigate the risk of UPS units or standby generators becoming unavailable and adversely impacting Hydro One real-time system control functions, by providing the required operating technology facilities.

## A. OVERVIEW

This investment involves the lifecycle management of common operating facilities at the ISOC and the BU-OGCC. These facilities include the UPS units and batteries as well as standby generators to provide back-up power supply. In managing these assets, Hydro One adheres to the industry standard practice of following a lifecycle program in order to maintain the reliability and continuity of critical control functions. In the event the main power supply to the control room computer systems becomes unavailable, continued operation of the control function depends on the back-up power systems.

The optimal timing for the replacement of operating facilities is determined by equipment lifecycle, industry standards and engineering practices. The investment is needed for the continued support of critical grid operations infrastructure while maintaining compliance with NERC CIP-007-5 (Security Patch Management), which outlines certain technical, operational, and procedural requirements in support of secure BES operations. The projected cost of the investment is $2.0M over the 2023-2027 planning period.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

Common operating facilities that will reach end of life by 2025 and 2026 need to be replaced in accordance with a prudent asset lifecycle management approach. Factors that influence a component’s lifecycle are asset age, the assessment of replacement of certain facilities, and the availability of necessary replacement parts. The asset age is determined by the expected service life. The condition of the asset influences its optimal replacement, and the unavailability of replacement parts determines the necessity for upgrade. These three factors are carefully assessed before deciding to replace operating facilities. This investment will fund the lifecycle replacements of the UPS units and batteries as well as the standby generators at the BU-OGCC, which are critical to ensuring continuous power when primary power sources become unavailable.

The UPS units at the BU-OGCC were last replaced in 2015 and it will be due for upgrade in 2025. UPS units at critical facilities like the ISOC and BU-OGCC, are scheduled to be replaced after 10 years in-service. That strategy allows for maximizing the useful performance while change outs are planned before random and unexpected in-service equipment failure.

UPS batteries have a lifecycle of 5 years. The batteries at the BU-OGCC (last replaced in 2020) will need to be replaced in 2025, and the batteries at the ISOC (installed in 2021) will require replacement in 2026. The existing standby generators at the BU-OGCC which were installed in 2003, will be replaced with newer generators with control-links to microgrid technologies, for reliable, efficient, low-cost, clean energy alternatives.

Delaying or not proceeding with lifecycle replacement can compromise the reliability and availability of control room functions at the ISOC and/or BU-OGCC, and elevate the risk of non-compliance with NERC CIP-007-5 on technical, operational, and procedural requirements for BES operations. In the event such critical functions are rendered unavailable due to inadequate backup power supply, Hydro One’s ability to ensure continuous operation and monitoring of the electric grid will be seriously impacted.

## C. INVESTMENT DESCRIPTION

This investment sustains the lifecycle management of common operating facilities at the ISOC and BU-OGCC such as the UPS units and batteries as well as standby generators. Batteries will be replaced and the UPS units will be upgraded pursuant to their asset lifecycle, and the standby generators will be assessed and replaced with newer generators with control-links to a microgrid system.

## D. OUTCOMES

This investment will mitigate the risk of failure associated with common operating facilities that are essential to Hydro One's ability to control and monitor the electric grid via the ISOC or BU-OGCC on a 24/7 basis.

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the OEB's RRF:

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Ensure reliable operations of the ISOC and BU-OGCC which enable system control functions and contact with customers. |
| **Operational Effectiveness** | • Provides the required facilities for the continuity of the Hydro One's real-time control function.<br>• Mitigates the risk of UPS units or standby generators becoming unavailable and adversely impacting system control functions due to potential component failures. |
| **Public Policy Responsiveness** | • Ensures that control function is supported to maintain grid reliability and to mitigate the risk of non-compliance with regulator requirement (NERC CIP-007-5 on technical, operational, and procedural requirements for BES operations) |

## E. EXPENDITURE PLAN

Table 2 below summarizes projected spending on the aggregate investment level.

**Table 2 – Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 0.0 | 0.0 | 2.0 | 0.0 | 0.0 | 2.0 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **0.0** | **0.0** | **2.0** | **0.0** | **0.0** | **2.0** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **0.0** | **0.0** | **2.0** | **0.0** | **0.0** | **2.0** |

The costs shown in the above table are based on estimates derived from previous replacements of common operating facilities and the anticipated technical specifications of new or upgraded common operating facilities.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred option.

**ALTERNATIVE 1: REACTIVE REPLACEMENT (NOT RECOMMENDED)**

This alternative is to continue to use the existing common operating facilities beyond the end of their expected lifecycle and to reactively address any component failures. This approach is not recommended because it will not mitigate the likelihood and consequence of potential asset failures, which can seriously impact Hydro One's real-time control functions. As an example, a random failure on one UPS occurred in 2015 and caused a fire at the BU-OGCC. This fire resulted in the activation of the Richview control centre which, at that time, was the backup centre. It also caused an evacuation at the BU-OGCC, which was then the primary control centre. The BU-OGCC was unavailable for almost 8 hours due to the fire.

**ALTERNATIVE 2: LIFECYCLE REPLACEMENT OF COMMON OPERATING FACILITIES (RECOMMENDED)**

Under this alternative, Hydro One would follow an industry standard lifecycle management approach to ensure the continued ability to monitor and control the electric grid from the ISOC and BU-OGCC. The important considerations for determining component lifecycle are asset age, the assessment of replacement of certain facilities (standby generators), and the availability of necessary replacement parts.

This alternative is recommended to sustain the continuity of control room functions and minimize the risk and impact of abnormal or unanticipated equipment or component failures.
This option provides for the following:

- Confidence in availability of critical systems such as the standby generators, UPS units and associated equipment.
- Availability of appropriate spares in the event of unanticipated failures in any of the critical backup system.
- An improved ability to recover from random failures.

## G. EXECUTION RISK AND MITIGATION

Unanticipated procurement, logistical and technical issues, when changing out the UPS units, batteries or standby generators are risk factors. To mitigate these risks, Hydro One will implement a purchasing schedule, coordinate in advance, with relevant vendors and pursue timely intervention to prevent any unexpected delays. The mitigation strategy will also ensure the proper skilled personnel are retained before commencing the project to resolve any unexpected technical issues.

| G-GP-14 | INTEGRATED VOICE COMMUNICATIONS TECHNOLOGY (IVCT) REFRESH |
|---|---|
| **Primary Trigger:** | Compliance |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness, |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | 2.3 |

**Summary:**

The investment involves the continuation of the upgrade of the Integrated Voice Communications Technology (IVCT) system software and associated phone system hardware at the Integrated System Operations Centre (ISOC) and the Backup Ontario Grid Control Centre (BU-OGCC). The existing technology requires upgrade before 2024 when it will no longer serve the the control rooms' voice communcation need. The primary trigger for this investment is regulatory compliance. Other factors that influences this investment are reliability, and customer communication. This upgrade will ensure consistent availability and reliability of voice communication between the ISOC and BU-OGCC, IESO, interconnected utilities, emergency services and field staff.

## A. OVERVIEW

The IVCT enables voice communications management between the ISOC, BU-OGCC, IESO, interconnected utilities, emergency services, field staff and transmission and distribution customers. This investment involves upgrading the IVCT application software and associated phone system hardware at Hydro One's two control centres. Ugrades are required before 2024 when the current system will no longer serve the control rooms' voice communication needs due to the obsolesnce.

A reliable and adequate IVCT system is required to meet compliance requirements such as the North American Electric Reliability Corporation (NERC) communication standards (COM-001-3) and IESO Market Rules which require redundant voice and emergency communications capabilities. Failure to upgrade the IVCT as planned can result in unanticipated equipment failure and components unavailability and end of vendor support. The risks associated with interrupted voice communications include delays in response times to emergencies and other trouble calls where customers may be affected, as well as longer restoration times.

The projected costs of the investment for the upgrade are $2.3M in 2023.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

The IVCT system provides integrated access and intelligent call routing via multiple communication platforms that manage daily control room calls on a 24/7 basis. It is a core communications tool used by operators at the ISOC and BU-OGCC as the primary means of communications with Hydro One field staff, customers, and organizations such as the IESO. It enables call recording of all voice communications traffic, including telephone and radio communications. The IVCT system consists of users' interface consoles, call recording system, interactive voice response (IVR) and autodialer.

On average, 2,600 calls are processed through the IVCT each day. A reliable and adequate IVCT system is required to meet compliance requirements such as the North American Electric Reliability Corporation (NERC) communication standards (COM-001-3) and IESO Market Rules which require redundant voice and emergency communications capabilities.

The existing system has been in service since 2015. As new technologies emerge, support for older systems and the ability to purchase spare or replacement hardware becomes more difficult and costly. Software and devices operating beyond their designed lifecycle can result in the unavailability of component spares and inefficient and unreliable performance of the IVCT, contributing to an increased risk to operations. Not upgrading the IVCT when necessary can result in situations where random components failures cause interruptions to critical communications capabilities with customers, field staff and other organizations, and reduced performance effectiveness (such as work execution delays and planned outage cancellations) by Hydro One.

## C. INVESTMENT DESCRIPTION

The critical nature of the IVCT and the impact it can have on daily operations makes planned upgrades based on forecasted lifecycle schedules extremely important. These lifecycle schedules range from approximately five to seven years for the different components and are designed to ensure the continuity of valid vendor support and spares. Furthermore, this ongoing upgrade of the IVCT is important for purposes of maintaining effective customer service, as without it customer service and operational effectiveness will be adversely affected.

This investment provides for the upgrade of the IVCT application software, and associated phone system hardware at the ISOC and BU-OGCC. The current features of the IVCT system include a user-friendly touchscreen interface, quick dial functionalities, and a customized rolodex contact database, which will be preserved. Newer features are available with this upgrade, including automated voice-to-text capability which adds another preferred means of communication for Hydro One customers. This investment is scheduled in consideration of the forecasted software and server hardware lifecycles.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the OEB's RRF:

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Ensure a functional voice communications system essential to timely and efficient response to failures and unplanned outages and thus minimize impact to customers. |
| **Operational Effectiveness** | • Supports system reliability by maintaining a communication medium between the control room and field staff.<br>• Maintain efficient maintenance work coordination, and system events with LDCs, generators and customers on the transmission and distribution systems. |
| **Public Policy Responsiveness** | • Allows Hydro One to meet Market Rules and the NERC communication standards. |

## E. EXPENDITURE PLAN

Table 2 below summarizes historical and projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | 2.3 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **2.3** | **0.0** | **0.0** | **0.0** | **0.0** | **2.3** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **2.3** | **0.0** | **0.0** | **0.0** | **0.0** | **2.3** |

The costs shown in the above tables are derived from cost estimates derived from the discovery phase of this project, GAP analysis conducted based on data derived from early investigation, and a final scope development for the project.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred option.

**ALTERNATIVE 1: CONTINUE WITH THE ONGOING IVCT UPGRADE (RECOMMENDED)**

It is recommended to proceed with the ongoing project to upgrade the IVCT, as it will be substantially complete in 2023 with minimal spend, hence the only feasible and realistic option is to see it through. This upgrade will ensure continued IVCT reliability, and maintain the communication capabilities at the ISOC and BU-OGCC. This upgraded IVCT will mitigate the risk of control room activities being affected, work execution delays, planned outage cancellations and the resulting negative impacts on Hydro One customers.

## G. EXECUTION RISK AND MITIGATION

Unanticipated challenges (e.g. procurement and logistical issues) when upgrading the IVCT can extend the timeline for project delivery. Provisions for mitigating procurement and logistical issues on this upgrade project will hinge on a well-coordinated project management schedule and on timely intervention to prevent unwanted situations and unexpected delays.

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| G-GP-15 | BU-OGCC OFFICE REMEDIATION |
|---|---|
| **Primary Trigger:** | Safety |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 2.0 |

**Summary:**

Investments to maintain the office environment at the Backup Ontario Grid Control Centre (BU-OGCC) have been minimal and limited to break-fix remediation since 2003. This investment is required to complete the necessary remediation to office facilities and fixtures. The primary trigger for this investment is the mitigation of health and safety risks at this critical facility. This investment is expected to remediate the deteriorated working space infrastructure in a timely manner, hence minimize disruption to operations resulting from the unavailability of the office equipment or facility.

## A. OVERVIEW

This investment is required to fund renovations at the control room and office facilities of the Back-up Ontario Grid Control Centre (BU-OGCC). These renovations are required to ensure adequate health and safety performance in alignment with Ontario Building Code requirements. The projected cost of the investment is estimated to be $2.0M over the 2023-2027 planning period.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

The BU-OGCC is Hydro One’s backup control facility for the monitoring and control of the entire transmission and distribution electricity grids. This facility was the headquarters for System Operations and the primary Control Room at Hydro One before 2022. After that, the primary control centre shifted to the Integrated System Operations Centre (ISOC), which was built in 2021 and will be occupied in 2022. The BU-OGCC building has been operational, 24 hours a day, seven days a week, and 365 days a year since inception in 2003. Since that time, there has been minimal investments to maintain the office environment beyond break-fix remediation.

The BU-OGCC building now accommodates more people and technology than was originally forecasted. The interior office space requires renovation to replace end of life fixtures, furnishings, floor coverings, walls, and other items that can potentially become health and safety risks to employees and ensure compliance with Ontario building codes. The office furnishings include cubicles, cabinets and tables that were in “used condition” when installed at this facility in 2003. The issues identified in this paragraph are manageable at this time (when the ISD is written), but can escalate into an unmanageable situation if not addressed.

## C. INVESTMENT DESCRIPTION

This investment will remediate the BU-OGCC, which has not been renewed since 2003. The existing fixtures, furnishings, floor coverings, walls, and other items at the BU-OGCC have diminished below acceptable standards since it was established in 2003 and will be refreshed. Control Room consoles will be replaced and or retrofitted to include sit/stand functionality to improve ergonomics for staff and to reduce the risk for potential musculoskeletal injuries which will reduce lost time. A remediation of the facility is the least costly option and least operationally disruptive at the BU-OGCC and the business functions it supports. This option also allows scheduling flexibility to align with the construction of the new ISOC facility. The remediation work at the BU-OGCC is being timed to start after the commissioning of the ISOC project to minimize disruption and cost impacts for staff relocation to a third party site, or labour premiums and enhanced work efforts to isolate areas during construction.

The remediation work will ensure that backup functions and departments, such as Outage Planning (OP) and other engineering teams, that support system control function will operate in a safe working environment. This will also ensure that employees in these roles will not experience challenges that can negatively impact the support they provide to control room activities. The remediation will include painting and carpet replacement. Completion of the necessary improvements to office and control room space will mitigate the health and safety hazards associated with a deteriorating workplace infrastructure.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the OEB's RRF:

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Indirectly benefits Hydro One customers by minimizing the risk of interruptions to operations at the BU-OGCC, which helps oversee the reliable operation of the transmission and distribution power systems. |
| **Operational Effectiveness** | • Ensure that deteriorated working space infrastructure is replaced in a timely manner to minimize disruption to operations resulting from the unavailability of the office equipment or facility. |
| **Public Policy Responsiveness** | • Align with objectives set out in the Ontario Building Code that aim to minimize preventable safety risks inside and outside of Ontario buildings.<br>• Address Occupational Health and Safety considerations to ensure staff are provided with the appropriate tools to prevent injury (i.e., Musculoskeletal risk requiring ergonomic requirements for 24/7 shift environment). |

## E. EXPENDITURE PLAN

The summary in table 2 shows projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 0.0 | 2.0 | 0.0 | 0.0 | 0.0 | 2.0 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **0.0** | **2.0** | **0.0** | **0.0** | **0.0** | **2.0** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **0.0** | **2.0** | **0.0** | **0.0** | **0.0** | **2.0** |

The remediation work at the BU-OGCC is being timed to start in 2024 after the commissioning of the ISOC project to minimize disruption and cost impacts for staff relocation to a third party site, or labour premiums and enhanced work efforts to isolate areas during construction.

The factors that impact the costs for these investments include:

- Refinement of planning estimates as projects near execution.
- Changes to regulatory policies or security requirements at the time of implementation.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred option.

**ALTERNATIVE 1: STATUS QUO (NOT RECOMMENDED)**

Under this alternative, Hydro One would maintain the offices at the BU-OGCC in the current condition. This alternative poses risks to employees working out of the BU-OGCC as office facilities have been maintained, since 2003, in a break-fix manner which did not allow for deteriorating facilities conditions to be effectively remediated. The BU-OGCC is a high capacity facility which houses up to 100 employees who on a daily basis perform backroom support for control room operation at the BU-OGCC.

The ability to effectively carry out critical support operations for the control function is significant to maintain Hydro One control room function. Without this investment in the office facilities at the BU-OGCC, there is a significant possibility of untimely disruption of office facilities which can negatively affect backroom support for control activities. Therefore, this alternative is not recommended.

**ALTERNATIVE 2: REMEDIATE BU-OGCC OFFICES (RECOMMENDED)**

This investment will remediate the existing fixtures, furnishings, floor coverings, walls, and other items at the BU-OGCC. Completion of necessary improvements to office spaces will mitigate the health and safety hazards associated with a deteriorating workplace infrastructure. The 2024 timing of the investment at the BU-OGCC (i.e. after the ISOC is fully occupied and is operating as the primary control centre) will provide a cost effective solution, when considered against the full occupancy of this facility before the ISOC was constructed. With the ISOC in place, an effective work strategy will be developed to allow for major maintenance at the BU-OGCC to commence in 2024. Therefore, this alternative is recommended.

## G. EXECUTION RISK AND MITIGATION

The remediating exercise at the BU-OGCC can result in a cost over run because of unanticipated conditions and work specifications for repairs to conform to current standards. To mitigate the risk of cost escalation, the detailed execution plan will be designed to quickly resolve unexpected difficulties that may hinder or adversely impact the remediation work. To mitigate the risk of health and safety issues in the workplace during remediation exercises at the BU-OGCC a temporary relocation of staff to the ISOC will occur during renovations. This will also eliminate the cost of a leased/rented third party office. This investment timing offers the most strategic and cost effective approach to remediation to the BU-OGCC and will minimize the cost burden to rate payers.

| G-GP-16 | NETWORK MANAGEMENT SYSTEM INVESTMENTS |
|---|---|
| **Primary Trigger:** | Reliability |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 7.6 | 0.0 | 1.2 | 2.5 | 2.5 | 13.8 |

**Summary:**

The investment is the continuation of ongoing upgrades to the NMS platform (with vendor support ending by year end 2023) and planned upgrades to other NMS-related components (with vendor support ending in later years of the JRAP period). This upgrade is necessary to maintain the NMS's performance and availability, which is critical to reliable and safe grid operations and regulatory compliance. Note that the forecast spend for 2023 represents the final phase of the upgrade that was approved in the previous rate application.

## A. OVERVIEW

The Network Management System (NMS) is Hydro One’s real-time power system monitoring and control platform that is critical to the effective control of the transmission system – including the Ontario Bulk Electric System (BES) – and to ensure Hydro One’s compliance with regulatory requirements (including NERC reliability standards). The NMS is used for switching operations and alarm monitoring at Hydro One's control centres - the Integrated System Operations Centre (ISOC) and the Backup Ontario Grid Control Centre (BU-OGCC). It is vital not only for grid reliability but also for the safety of field staff and the protection and sustainment of Hydro One’s power system assets.

The NMS platform links 380,000 communication points on equipment located throughout the province to control operations through the ISOC and the BU-OGCC and is vital for the monitoring and control of the electrical power system. The NMS is also connected to external organizations including the IESO, Ontario Power Generation, and Local Distribution Companies (LDCs).

The NMS enables advanced power system network applications, such as state estimation, contingency analysis, and work protection. These applications are critical for the safe, efficient and reliable operation of the transmission grid in Ontario and five interconnections (Manitoba, Quebec, and three to the United States), which form part of the wider Northeast Power Coordinating Council (NPCC) grid. Given the importance of Ontario’s BES to the NPCC system, the NMS’s availability and functionality also impact the reliable operations of the broader regional grid.

These components require updates every 5-7 years as newer and more up-to-date applications for management of electrical power systems become available, so as to ensure the continuity of vendor support and stay ahead of evolving cyber security threats. Delaying or not proceeding with this upgrade will make the earlier spend of $32M stranded as there will be no usable results from the investment made in the preceding period. Furthermore, this will lead to elevated risks to the reliable and safe operation of the electric grid, including as a result of the inability to receive vendor security patches/updates in response to emerging cyber security threats.

This investment is wholly allocated to the Transmission business. The projected costs of the investment for the ongoing version upgrade are $7.6M in 2023 (in addition to $32M in the 2020-2022 period). The projected costs for e-terra/Historian Module upgrade are $1.2M in 2025, and for front-end processors (FEP) and network model manager (NMM) upgrade are $5M in the 2026-2027 period.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

This investment is required to upgrade and ensure vendor support of Hydro One's NMS platform, a critical operating tool used for the effective monitoring and control of the Hydro One transmission system. Maintaining the consistent high availability and reliable performance of the NMS is crucial to the 24/7 reliable operation of the BES.

The NMS platform is used at the ISOC and the BU-OGCC to monitor the status (e.g. open, closed, loading) and condition (e.g. alarm annunciation) of the transmission system and assets. It allows Hydro One to control and operate these assets, change system configuration, or restore supply to customers after a contingency condition. NMS-supported work operations include the management of outage requests by field staff, customers, and the IESO. To facilitate situational awareness of changing system conditions, the NMS tracks roughly 600,000 alarm conditions annually on the electric grid. These alarms prompt System Control personnel to initiate corrective action prior to the occurrence of malfunctions which could interrupt customer service.

The NMS platform is a modular build of different applications that are integrated to form the overall system. It includes:

- a core Energy Management System (EMS) which enables the Hydro One to perform scenario testing of real time grid conditions to confirm that they are within designed limits;
- the e-terra application which enables inter-control centre communications (e.g., with the IESO, OPG, LDCs, generators, etc.);
- the NMS historian database which provides data recording and historical logging/reporting functions;
- FEP for supervisory control and data acquisition (SCADA);
- NMM application, which is used to model the electrical network and validate model integrity;
- NMS browser, which is the user interface (UI) that displays the status and measurement data required for control room operations; and
- open access gateway (OAG) to enable communications with other SCADA systems.

Hydro One's ongoing NMS upgrade is necessary to sustain the system's performance, reliability and availability and ensure that Hydro One remains compliant with applicable regulatory requirements. Without the fundamental capabilities to remotely operate/control assets and minimize the impact of emergency situations, Hydro One would not be able to manage or respond to changing system conditions or contingencies (whether forced interruptions or planned outages). In turn, this would mean that the continued high availability, performance, and security of the NMS cannot be assured. In addition to the risk to the Ontario transmission system, interconnections to other NPCC entities could also be impacted. Alarms may not annunciate if the NMS is impeded operationally or rendered unavailable, thus hindering Hydro One's ability to properly respond. Depending on the severity, failure to clear a fault or isolate a faulted element from the system in a timely manner could result in a wide spread interruption in the BES due to the cascading effect of protection systems (an example was the 2003 Northeast Blackout).

The current NMS platform is being upgraded as it will reach the end of its normal vendor support in 2023. Hence, the ongoing upgrade is planned to be completed in 2023. In addition, the e-terra, the NMS historian applications and the Open Access Gateway (OAG) were last upgraded prior to 2020 and will reach end of vendor support in 2025 (when the next upgrades are required). Subsequently, NMS FEP, Browser, and NMM application components will see their vendor support expire in the period of 2026-2027 and therefore require upgrades in that timeframe.

In addition to the need to maintain a reliable and vendor-supported platform, without the planned NMS upgrade Hydro One will not be able to comply with the following regulatory standards:

- NERC Reliability Standards -- NERC TOP-001-4 R10 and R13 govern the standards for monitoring and frequency of real-time assessments of the transmission system.
- IESO/Hydro One Operating Agreement – The operational requirements under Part 2 of the IESO/Hydro One Operating Agreement (including Section 4.2) govern: the availability and capability of equipment; the connection and disconnection of equipment to the IESO-controlled grid; and actions regarding control voltage, loading, and configuration of facilities.
- OEB Transmission System Code – OEB Transmission System Code Section 5.4 sets out a transmitter's performance requirements under emergency operations conditions.

## C. INVESTMENT DESCRIPTION

The investment involves upgrading the NMS server operating system, database and software, as well as monitoring and control computers, network and storage hardware. This investment has significant customer impacts as it is critical to the ability of Hydro One control room staff to monitor customer connection status, coordinate customer outage requests, restore power to customers and investigate events impacting customers. This investment will ensure the continued reliable performance and vendor support of (i) the operating system, database, software, and (ii) NMS specific infrastructure and other components. It will also ensure sufficient capacity for emerging transmission system requirements and create opportunities for leveraging new baseline functionality for system operation.

This investment includes the following three projects in the sequence noted below:

**CONTINUATION OF CURRENT VERSION UPGRADE**

In 2023, Hydro One plans to complete the multi-year investment in the ongoing NMS version upgrade (see EB-2019-0082 application, ISD GP-03). The remaining investment for 2023 ($7.6M) will involve the NMS commissioning, stage and sequential cutover as well as employee orientation and training.

**2025 E-TERRA/HISTORIAN MODULE UPGRADE**

The forecast investment for 2025 funds the lifecycle upgrade of the NMS OAG) and web application components (including the e-terra browser and NMS historian) that were in-serviced prior to 2020 and will be at end of vendor support in 2025. The projected costs for these upgrades is $1.2M.

**2026-2027 FRONT END PROCESSOR AND NETWORK MODEL MANAGER UPGRADE**

The forecast investment for 2026-2027 funds the lifecycle upgrade of the NMS FEP, Browser, and NMM application components that will be at end of vendor support in 2027. The projected costs are estimated to be $5.0M.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table lists anticipated benefits of the Investment in accordance with the OEB's RRF:

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Ensure Hydro One's ability to effectively monitor and coordinate customer outage requests, and perform timely investigations and/or power restoration following contingency events in order to minimize customer service impact. |
| **Operational Effectiveness** | • Ensure the continued 24/7 reliable operations of a vendor-supported and secure NMS, which is critical in enabling Hydro One to monitor and manage real time system operations at the two control centres. |
| **Public Policy Responsiveness** | Allow Hydro One to maintain compliance with:<br>• OEB Transmission System Code (Section 5);<br>• Operational Responsibilities as outlined under Part 2 of the IESO Hydro One Operating Agreement, including responsibilities under Section 4; and<br>• NERC standards TOP-001-4 R10 and R13. |

## E. EXPENDITURE PLAN

Table 2 below summarizes projected spending on the aggregate investment level. As explained above, the $7.6M forecast for 2023 is to complete the ongoing, multi-year NMS upgrade, and the next round of upgrades will be carried out in 2025 (for the e-terra and historian modules) and in 2026-2027 (for the FEP and NMM).

**Table 2 - Total Investment Cost (2023-2027)**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 7.6 | 0.0 | 1.2 | 2.5 | 2.5 | 13.8 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **7.6** | **0.0** | **1.2** | **2.5** | **2.5** | **13.8** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **7.6** | **0.0** | **1.2** | **2.5** | **2.5** | **13.8** |

The costs shown in the above tables are based on cost estimates derived from past NMS upgrades and current estimates and pricing provided by the vendor. The factors that impact the costs for these investments include:

- Refinement of planning estimates as projects near execution.
- Potential changes to regulatory policies or security requirements that may impact implementation.
- System or architecture landscape changes that may impact technical complexity associated with implementation.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking.

### ALTERNATIVE 1: CONTINUING TO OPERATE NMS WITHOUT UPGRADES

This alternative would maintain the existing NMS platform beyond the period of extended vendor support. Under this scenario, the current NMS will no longer be supported by the vendor beyond 2023, which would negatively impact the company's ability to recover from a failure of NMS components. Furthermore, the required cybersecurity updates and patches – which are required to ensure this critical system remains secure against possible breach – would no longer be available. Maintenance costs for extended repairs would be higher and replacement components more difficult to procure as the technology becomes obsolete. NMS failure would hinder control room monitoring and control capabilities, which will significantly compromise Hydro One's ability to effectively operate the transmission system (including the Ontario BES) and maintain compliance with mandatory requirements (e.g., NERC TOP-001-4 R10 and R13). Therefore, this alternative is not recommended.

### ALTERNATIVE 2: UPGRADE NMS PLATFORM AND ASSOCIATED COMPONENTS (RECOMMENDED)

The ongoing upgrade of the NMS platform is a multiyear exercise where modular discrete applications are upgraded independent of other applications on the platform. This makes it possible to upgrade the entire platform in a way that allows for systems to be available and in-service when the upgrade of a particular component is completed. The vendor has agreed to provide extended support in this particular case at no additional cost until the end of the current upgrade.

Under the recommended alternative, Hydro One will complete this multi-year upgrade by the end of 2023. The new version that NMS is being upgraded to is expected to provide a range of benefits. These include the ability to operate a reliable system that is vendor supported in case of failures or outages and a secure system that is protected through regular updates/patches to guard against cyber threats. This alternative maintains operational effectiveness and the continued reliability of the daily operating, monitoring and control functions of the transmission business at Hydro One. Unlike the other alternatives, the proposed investment mitigates the risk of control room downtime, interruption of work execution and planned outages that can negatively impact Hydro One customers and work programs.

## G. EXECUTION RISK AND MITIGATION

To reduce the risk of potential delays or unforeseen complexities during implementation, NMS test environments will be designed, built and tested prior to full deployment. This approach provides for non-conformances to be identified and corrected prior to deployment. In addition, unanticipated challenges beyond Hydro One’s control (e.g. procurement and logistical issues) can extend the timeline for project delivery. The strategy of mitigating procurement and logistical issues on this project will leverage a well-coordinated project management schedule and timely intervention to prevent unexpected delays.

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| G-GP-17 | OUTAGE RESPONSE MANAGEMENT SYSTEM (ORMS) UPGRADE |
|---|---|
| **Primary Trigger:** | Reliability |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 5.5 | 5.5 | 0.0 | 0.0 | 0.0 | 11.0 |

**Summary:**

This investment involves the upgrade of Hydro One's Outage Response Management System (ORMS) that went into service in 2016 and has been in operation on a 24/7 basis. This upgrade is necessary for ORMS to remain compatible with newer technologies and systems that support Hydro One's distribution modernization and AMI 2.0 investments. The primary trigger for this investment is reliability. Other factors that influence this investment are safety, and regulatory compliance. The upgrade will improve ORMS' functionality, outage analytics and reporting, together with trouble call management for enhanced customer experience. This investment aligns with other distribution modernization investments at Hydro One.

## A. OVERVIEW

This is a distribution investment in for the upgrade of Hydro One's Outage Response Management System (ORMS), which is the operating tool used to manage distribution outages and trouble response. Specifically, ORMS allows System Operations personnel to (i) analyze trouble calls and predict abnormal customer connectivity issues, and (ii) identify and align work crew dispatch in response to customer issues by supporting work flow monitoring and tracking and performance reporting. ORMS is a key interface system that drives the outage notifications, restoration times, and related outage information that customers receive from Hydro One. The projected costs of the investment are $11.0M between 2023 and 2027.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

This investment is required for the outage management and workforce management functions of ORMS to continue to function as designed and to allow efficient outage response at Hydro One.

The current version of ORMS needs to be upgraded if Hydro One is to maintain flexibility and response management to problems with customer experience outages. The next ORMS will have an ability to integrate with the Distribution Management System (DMS) and AMI 2.0, so that customer information will be more correctly linked to events occurring on the distribution system. If ORMS is not upgraded there can be situations where Hydro One will not be able to restore to normal operation after system events on a timely basis. When the next ORMS upgrade occurs, the new system will enable Hydro One to dispatch crews, identify problems and notify the closest crew to shorten restoration times, to ensure customer satisfaction. This investment is also driven by the need to maintain compliance with service quality requirements under DSC *Section 7.9 Emergency Response* and to provide the associated data for performance reporting.

Furthermore, to support a grid of the future, the next version of ORMS must integrate newer technologies (such as those presented by the Distribution Management System (DMS) in G-GP-18 and AMI 2.0 in D-SR-12), enhance data integrity, and maintain cyber security while providing for outage management workflow. The integration, lacking in the current version of ORMS, with the other distribution based systems will allow a real-time flow of outage related data into ORMS, which will be used to improve and expedite restoration routines. This will allow for outage data analysis, real-time analytics and simulations of outage data and quality service indices. Furthermore, the analytics quality of outage data in the upgraded version of ORMS will improve restoration planning procedures, positively enhancing customer experience.

## C. INVESTMENT DESCRIPTION

This investment includes a review of available features as part of the next upgrade and compatibility with existing systems in the Hydro One environment. It will also involve an operating system upgrade and maintain the efficiency and effectiveness of system control operation while ensuring safe and reliable management of the distribution system. This will enable Hydro One's ability to respond to outages in a timely manner.

This investment will involve the following:

- ORMS software upgrade;
- upgrades of related hardware as required; and
- integration with enterprise systems including SAP, and new technologies such as DMS and AMI 2.0.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the QOEB's RRF:

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Positive customer experience through better management and coordination of outages.<br>• Improved customer service, timely response to outages, and better customer updates by the employment of multiple communication modes. |
| **Operational Effectiveness** | • To maintain and improve efficiency and reliability of the distribution system operations, ensure effective communications with customers.<br>• To support efficient distribution outage planning and work coordination between control-room function and field crews in real-time operations. |
| **Public Policy Responsiveness** | • Ensure compliance with DSC Section 7.9 Emergency Response service quality requirements to provide the data for performance reporting (e.g. emergency response SLA as per Distribution System Code) |

## E. EXPENDITURE PLAN

Table 2 below summarizes the projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 5.5 | 5.5 | 0.0 | 0.0 | 0.0 | 11.0 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **5.5** | **5.5** | **0.0** | **0.0** | **0.0** | **11.0** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **5.5** | **5.5** | **0.0** | **0.0** | **0.0** | **11.0** |

The costs shown in the above tables are based on cost estimates derived from Hydro One's previous ORMS upgrades and market intelligence from other organizations in the electric industry.

The factors that impact the costs for these investments include:

- Refinement of planning estimates as projects near execution.
- Changes to regulatory policies or security requirements at the time of implementation.
- System or architecture landscape changes that proceed in parallel that may add or reduce technical complexity at the time of implementation.

## F. ALTERNATIVES

Hydro One considered the following alternative before selecting the preferred option.

**ALTERNATIVE 1: STATUS QUO (NOT RECOMMENDED)**

The current ORMS beyond 2024 poses a significant risk of the system not being compatible with newer technologies being introduced for optimizing customer experience. Continuing to operate the existing ORMS version will present unacceptable challenges, including the possibility of an hardware failure (see GSP Section 4.11, G-GP-12) occurring creating inefficiencies in the management of ORMS. Projects, including AMI 2.0 and distribution modernization, each involve the influx of state of the art technology and operating features which can impact on ORMS; and an under utilization of full capabilities of these new technologies. Therefore, this alternative is not recommended.

**ALTERNATIVE 2 : UPGRADE ORMS TO THE LATEST VERSION (RECOMMENDED)**

Upgrading ORMS in the 2023-2024 period will enable and enhance several work processes and abilities at Hydro One. These include planned outage scheduling and management, organized and efficient correlation of crews to trouble tickets, and an automated outage prediction ability across the entire distribution system owned and managed by Hydro One. This ability makes for better customer experience and is the recommended alternative.

## G. EXECUTION RISK AND MITIGATION

Potential risks related to procurement and logistical challenges can extend the timeline for project delivery and result in cost increases. For example, changes in market trends and dynamics beyond Hydro One's control can lead to reduced availability of services/products from vendors. To mitigate these risks, Hydro One will implement a purchasing schedule that is coordinated well in advance with relevant vendors and pursue timely intervention to prevent any unexpected delays.

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| G-GP-18 | DISTRIBUTION MANAGEMENT SYSTEM (DMS) UPGRADE |
|---|---|
| **Primary Trigger:** | Reliability |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 4.0 | 4.0 | 0.0 | 0.0 | 0.0 | 8.0 |

**Summary:**

This investment involves upgrading the Distribution Management System (DMS) that was in-serviced in 2018. The project will commence in 2023 and end in 2024. This investment will enable the integration of DMS with other critical data systems necessary for effective DMS operation (which is currently subject to limitations under the existing DMS version) and improve the management and control of system operations. The primary trigger for this investment is reliability. This DMS upgrade will provide the opportunity for better management of the electric grid at the Integrated Systems Operations Centre (ISOC) and Back-up Ontario Grid Control Centre (BU-OGCC).

## A. OVERVIEW

The Distribution Management System (DMS) is a software management package used to model the distribution system and for the monitoring, control, analysis and management of the distribution grid by system operators at the Integrated Systems Operations Centre (ISOC) and Back-up Ontario Grid Control Centre (BU-OGCC). Hydro One currently uses a DMS version that went into service in 2018 (version 3.7). The planned upgrade is needed to enable the necessary integration and customization for Hydro One to fully benefit from the capabilities of an up-to-date DMS. The projected costs of the investment are $8.0M between 2023 and 2027.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

Hydro One's DMS provides a platform for distribution supervisory, control and data acquisition (SCADA) to remotely monitor and operate critical electrical infrastructure and assets. This provides Hydro One with real-time information on the status of the distribution system including information on fault conditions and locations. A reliable and functional DMS allows Hydro One to optimize electric load and supply on a local basis and effectively leverage variable load resources (e.g. electric vehicle, energy storage, residential/commercial demand response) and available generation resources (e.g. renewables, energy storage).

The current version, DMS 3.7, has been in service since 2018 and presents technical challenges that make it both difficult and time consuming to manage the real time status of the electrical grid. To ensure that accurate data is available in this system, System Operations is required to frequently update the DMS with changes to network connectivity and geospatial electrical diagrams. This processes requires significant time and effort, and creates challenges for System Operations. This is exacerbated by the significant level of customization included in the DMS to cover the unique characteristics of the Hydro One distribution system, which spans a vast area of the provinces, with varying customer densities and expected load growths.

The next upgrade of DMS will address these challenges by improving the integration with existing data from other Hydro One databases, including AMI 2.0, protection and control management information system (PCMIS), geographic information system (GIS), power systems data base (PSDB), and outage response management system (ORMS). This work is expected to begin in 2023 and be completed in 2024, so that the next version of DMS will be compatible with newer technologies being introduced, such as AMI 2.0.

DMS is a critical component of Hydro One's distribution grid modernization efforts to improve customer experience. It enables Hydro One to manage distributed energy resource and integrates a broad set of distribution modernization functions such as mobility solutions to provide field crews with ready access to system data. DMS also allows for the optimization of electric loads, including energy storage, and generation sources.

## C. INVESTMENT DESCRIPTION

The DMS upgrade project includes hardware refresh, server operating system upgrade, DMS software upgrade, as well as the ability to integrate existing data from other Hydro One databases. These include AMI 2.0, protection and control management information system (PCMIS), geographic information system (GIS), power systems data base (PSDB), and outage response management system (ORMS). These are critical systems that funnel important data necessary for the modeling of the electric grid. This modeling is vital for modernizing the distribution grid and for safe system control function from the ISOC and BU-OGCC.

Change management of electric grid status using the current DMS 3.7 is technically difficult and time consuming. This DMS upgrade project will focus on mitigating these change management challenges. This upgrade will also integrate with the existing Network Management System (NMS) so that efficient cross referencing of field installed devices and equipment can be done to further enhance safe control operations.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the OEB's RRF:

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Enable better planning for customer electricity demands, as DMS will extract demand history data from AMI to allow for the creation of usage patterns, which will be used to forecast future load demand cycles for customers.<br>• Notify customers of system related issues on a more timely and efficient basis. |
| **Operational Effectiveness** | • Enhance distribution system reliability resulting from optimization of switching activities, voltage optimization, fault location service restoration.<br>• Improve situational awareness, for field crews, with the real-time state of the distribution system and location of faults.<br>• Improve the accuracy of distribution system analysis and studies for operational efficiencies and load forecasting. |

## E. EXPENDITURE PLAN

Table 2 below summarizes historical and projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 4.0 | 4.0 | 0.0 | 0.0 | 0.0 | 8.0 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **4.0** | **4.0** | **0.0** | **0.0** | **0.0** | **8.0** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **4.0** | **4.0** | **0.0** | **0.0** | **0.0** | **8.0** |

The factors that impact the costs for these investments include:

- Refinement of planning estimates as projects near execution;
- Changes to regulatory policies or security requirements at the time of implementation;
- System or architecture landscape changes that proceed in parallel that may add or reduce technical complexity at the time of implementation.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred option.

**ALTERNATIVE 1: STATUS QUO (NOT RECOMMENDED)**

Not proceeding with the DMS upgrade project will result in keeping the current version beyond its usefulness, as change management of electric grid status using the current version is technically difficult and time consuming This complicates Hydro One’s ability to effectively model the newer technologies and equipment that are being installed as part of the distribution modernization exercise. This would increase the likelihood of application failure, elevated cyber security threats, and operating complications due to newer systems such as the AMI 2.0. Newer technologies, equipment, and devices will be difficult to model, and field crews and ISOC may not have an accurate understanding of the real-time status and circumstances of the distribution system resulting in significant safety risks when controlling or monitoring the distribution system. Therefore, this alternative is not recommended.

**ALTERNATIVE 2: UPGRADE DMS (RECOMMENDED)**

Proceeding with the DMS upgrade project will allow Hydro One to continue to effectively model the newer technologies and equipment installed as part of the distribution modernization exercise. The upgrade will allow for superior prediction simulation on system behavior and events using real-time and archived data. It will also allow for state estimation and switching order and sequence management, which are necessary for safe and efficient operations of the distribution grid. These abilities will augment greater cyber security protection and reduce the complications that exists with the current DMS 3.7. This will support better monitoring and tracking of maintenance and other work activities by Hydro One personnel resulting in safer operation of the distribution system. Therefore, this alternative is recommended.

## G. EXECUTION RISK AND MITIGATION

Potential risks related to procurement and logistical challenges can extend the timeline for project delivery and result in cost increases. For example, changes in market trends and dynamics beyond Hydro One's control can lead to reduced availability of services/products from vendors. To mitigate these risks, Hydro One will implement a purchasing schedule that is coordinated well in advance with relevant vendors and pursue timely intervention to prevent any unexpected delays.

| **G-GP-19** | **GRID CONTROL NETWORK SUSTAINMENT** |
|---|---|
| **Primary Trigger:** | Reliability |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness, Financial Performance |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 6.5 | 6.6 | 6.8 | 7.0 | 7.1 | 34.0 |

**Summary:**

This investment involves (i) the migration of the Grid Control Network to a new and simplified network topology, and (ii) the replacement of Grid Control Network critical components that are approaching or have reached their end of vendor support. The new network topology will eliminate the use of hub sites, thereby meeting the IESO Market Rules requirements for high-performance assets and optimizing network performance. Grid Control Network components targeted for replacement due to end of vendor support are the Gateway and the Remote Terminal Unit (RTU). The Gateway is a critical piece of equipment that performs station protocol conversion and acts as a station data concentrator. The RTU interfaces with the primary yard equipment to execute control operations. Also targeted for replacement are the Local Control Computers (LCCs) and Local Maintenance Computers (LMCs). The LCCs and LMCs are end-of-life station computers that will be functionally replaced with newer technology. This optimization of the network will (i) ensure compliance with the IESO Market Rules, (ii) improve network reliability, and (iii) improve operational visibility.

## A. OVERVIEW

The Grid Control Network is a computer network that allows Hydro One controllers located at the Ontario Grid Control Center (OGCC) to continuously monitor and control the Hydro One transmission grid. Information from the Grid Control Network, known as Supervisory Control and Data Acquisition (SCADA) information, is also used by external parties, such as other utility control centers, customers, and the Independent Electricity System Operator (IESO). The SCADA information is retrieved from Hydro One transmission stations.

This investment involves the following two components: (i) the migration of the Grid Control Network from the existing hub site topology to a new and simplified "Direct SCADA" topology, and (ii) the replacement of Grid Control Network critical components that are approaching or have reached their end of vendor support.

### I. Migration to New Direct SCADA Topology

The migration of the Grid Control Network topology to the new, simplified Direct SCADA topology is required to comply with the IESO Market Rules for high-performance assets. The existing hub site topology consolidates SCADA information from transmission stations at hub sites before passing that information to the OGCC. This hub site network topology has inherent processing delays and fails to meet the IESO Market Rules requirements for associated performance. With the Direct SCADA topology, transmission stations will send SCADA data directly to the OGCC, eliminating hub sites and the associated processing delays, thereby improving the network speed and ensuring compliance to the IESO Market Rules.

Hub sites were necessary in the past to act as a regional consolidation point for SCADA information from Hydro One transmission stations. Over the last 20 years, the need for hub sites has diminished for two reasons:

1. When hub sites were first deployed, they performed protocol conversion between Hydro One stations and the OGCC, because the equipment at the Hydro One stations was unable to perform this protocol conversion. The majority of Hydro One transmission stations now have local protocol conversion, such that this intermediary step provided by the hub sites is no longer required.
2. Telecom circuits have migrated from older point-to-point connections to modern IP-based routable circuits. These newer circuits do not have the same geographic limitations.

With the implementation of Direct SCADA, Hydro One will maintain only one hub site, at Manby TS, in order to accommodate transmission-connected customers and Hydro One transmission assets that cannot be migrated to Direct SCADA.

**II. Replacement of Obsolete Grid Control Network Components**

In addition to the migration of the Grid Control Network topology, this investment also addresses the following components which are approaching or have reached their end of vendor support: Gateways, Remote Terminal Units (RTUs), Local Control Computers (LCCs), and Local Maintenance Computers (LMCs).

Gateways are a critical component within the Grid Control Network because they perform the necessary local protocol conversion for the transmission station and act as a concentration point for SCADA information. Half of Hydro One's gateways will lose vendor support in 2023. Without vendor support, spare parts and firmware will no longer be available from the manufacturer, thereby impeding the necessary engineering support. In addition, as failures occur in the field, the on-hand supply of spares will diminish and cannot be replenished.

Legacy RTUs are long past vendor support, and parts can no longer be replaced. RTUs are important in the Grid Control Network because they interface with the primary yard equipment at a station to execute control operations initiated by the OGCC. If a legacy RTU fails, there may be a significant outage duration, because like-for-like replacement may no longer be feasible due to part obsolescence, and a new device using new technology takes time to be redesigned and commissioned.

LCCs and LMCs are separate Windows-based computers used in Hydro One stations, which are no longer vendor supported. The LCC provides local control of the primary power equipment within the station. The LMC interfaces with protection and control equipment within the station in order to assist field staff with commissioning and troubleshooting activities. The new network topology migrates the function of the LCC into the station gateway. The function of the LMC has been replaced by the Transient Cyber Asset (TCA), a secure USB-based operating system issued to field staff, used in conjunction with their corporate laptops. The removal of the LCC and LMC from Hydro One stations is preferred because:

- It removes the need to maintain the LCCs and LMCs at Hydro One stations. Microsoft no longer supports the operating systems on these station computers, which means Microsoft does not provide software updates or patches.
- It reduces the amount of equipment that needs to be commissioned and maintained at Hydro One stations.

This investment will impact approximately 40 hub sites and a total of approximately 400 stations that are communicating to the control center through these hub sites. This investment includes network migration to Direct SCADA and component replacement work at approximately 300 of these stations, and migration to the Manby TS hub site at approximately 100 stations. To date, 4 hubsites and 100 stations have been converted to the Direct SCADA. Approximately 36 hubsites and 200 stations remain to be migrated to Direct SCADA, and 100 stations remain to be migrated over to the Manby TS hubsite. The investment has worked in conjunction with station capital investments to strategically migrate stations to the new topology, and it will continue to do so for the work at the remaining stations.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

The Grid Control Network provides monitoring capabilities and remote control of the assets at Hydro One transmission stations to the OGCC and Backup Control Center (BUCC). It is critical to Hydro One's real-time operation of its transmission grid and is necessary to ensure safe, reliable, and efficient power delivery. This investment is required to: (i) migrate the Grid Control Network to a new network topology, and (ii) replace elements of the Grid Control Network that are at or approaching end of vendor support, including Gateways, RTUs, LCCs, and LMCs.

#### I. Migration to New Direct SCADA Topology

This investment will implement a new and simplified Direct SCADA topology for the Grid Control Network that will eliminate hub sites. The Direct SCADA topology is required to meet the IESO Market Rules requirements for high-performance assets. Appendix 4.21 of the IESO Market Rules requires that high-performance assets have data measurements and equipment status changes available at the IESO communications interface in less than two seconds. The hub site network configuration fails to meet these requirements. Figure 1 below provides a diagram of Hydro One's current hub site network topology. In this configuration, stations are consolidated at intermediary hub sites. Each level of hardware inherently introduces a processing delay. Therefore, by removing the hub sites and connecting transmission stations directly to the OGCC, as shown in Figure 2, the processing time of the relevant equipment is reduced, increasing the speed of the network on the whole. This new configuration will allow Hydro One to satisfy the requirements in Appendix 4.21 of the IESO Market Rules.

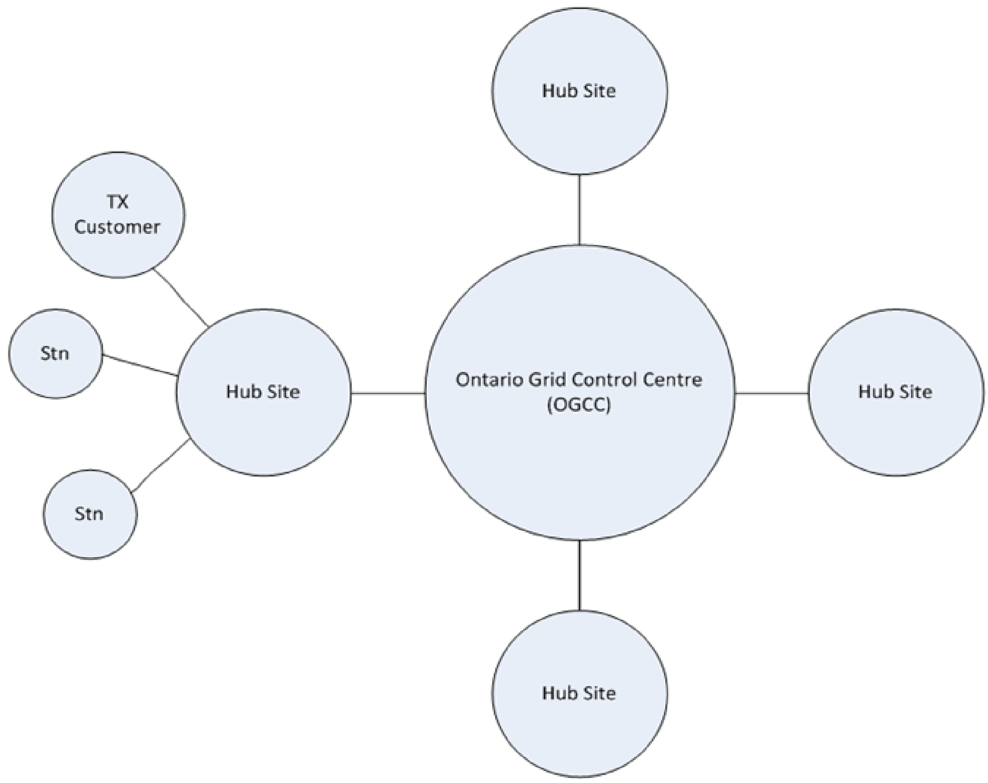


**Figure 1: Existing Network Topology (Hub Site)**

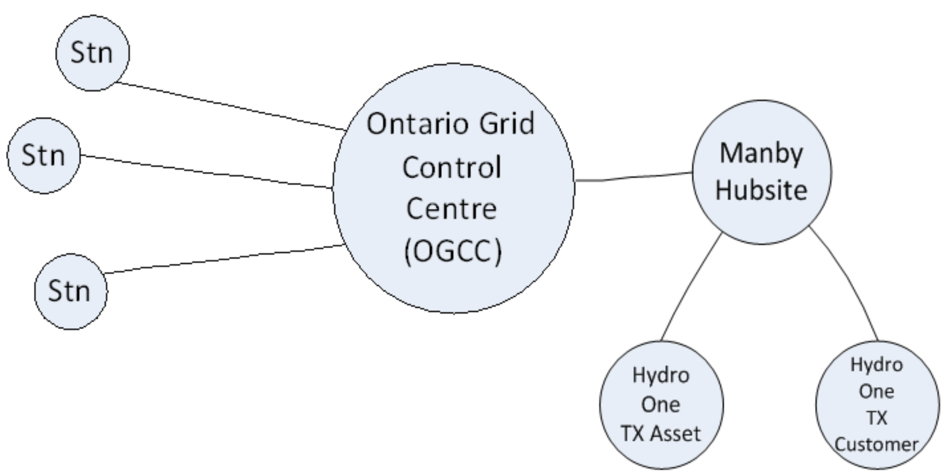


**Figure 2: New Simplified Network Topology (Direct SCADA)**

The hub sites were put in place when the OGCC was originally built almost two decades ago. Their function is to perform protocol conversion and provide a consolidation point when connecting telecom (Bell S4T4) circuits to Hydro One stations. Over time, Hydro One stations have been equipped with their own protocol conversion and the telecom circuits at stations have transitioned to IP-based circuits, thus eliminating the need for information to be relayed through a hub site before reaching the OGCC.

In the new Direct SCADA topology, one hub site will remain at Manby TS to accommodate transmission-connected customers and Hydro One transmission assets that cannot be migrated to the new topology. This is the case for Hydro One transmission assets that have telecom limitations or do not warrant their own protocol conversion. Connections to the Manby TS hub site will be classified by the IESO Market Rules as medium-performance assets and will be required to meet the less stringent IESO Market Rules for medium asset performance.

Other drivers for the Direct SCADA migration include increased network reliability and operational visibility. Direct SCADA increases network reliability by removing the intermediary communication hop to hub sites, which are potential nodes of failure. The removal of hub sites will also benefit operational visibility, as they present a large blind spot for Operations when one is taken offline. For example, routine work at a hub site results in a loss of availability of all remote stations connected to that hub site. In contrast, with the new Direct SCADA topology, work on a station will only affect the visibility to Operations of that station alone.

**II. Replacement of Obsolete Grid Control Network Components**

Gateways are a critical component, as they perform local protocol conversion (which is necessary under the new Direct SCADA topology) and act as data concentrators. Gateway hardware within the Grid Control Network will lose vendor support in 2023. It is impossible to predict when the existing gateways will fail. If the gateways are left to run until failure, a large portion of the gateways at existing Hydro One hub sites may fail at the same time, raising the cost to replace multiple gateways concurrently. Proactive phased replacement of these units will ensure that the gateway devices can be maintained and supported.

Hydro One also has an installed base of legacy RTUs that are well beyond end of vendor support and in need of replacement. As is the case with the gateway hardware, there is no way to predict time of failure with certainty, as most of the systems and their components do not show signs of wear and fatigue. They usually operate until they fail abruptly. RTUs interface with the primary yard equipment at a station to execute control operations initiated by the OGCC. The RTU is based on the concept of physical wiring and the digital conversion of electrical signals delivered by wires. Failures of RTUs are very high risk: they can result in complete loss of station Power System Monitoring and Control (PSMC) functionalities. Replacement of this hardware is necessary to ensure that RTUs reflect current design standards and can therefore be properly maintained and supported.

At the station level, the Grid Control Network allows field staff to centralize local control of primary yard equipment (such as a circuit breaker or disconnect switch) from an LCC. The LCC is a Microsoft Windows-based station computer that runs on either Windows XP or Windows 7. Both of these operating systems are no longer supported by Microsoft, with Windows 7 support having ended in early 2020. This investment targets the replacement of the LCC with a Human Machine Interface (HMI), software feature enhancements that can replace the functionality previously provided by the LCC, thus eliminating the need for the LCC. The proposed HMI within the station gateways are superior to the LCC, as they do not have the same end-of-support issues associated with Windows-based computers and will instead have the same lifespan as the station gateway hardware.

The LMC is a station computer that facilitates commissioning and maintenance activities by field staff. Like the LCC, the LMC is a Microsoft Windows-based station computer that runs on either Windows XP or Windows 7. As mentioned, both of these operating systems are no longer supported by Microsoft. This investment targets the removal of the LMC, since the LMC function has been replaced by the TCA, a secure USB-based operating system used by field staff with their corporate laptops. The LMC is therefore redundant, and this investment will decommission LMCs in Hydro One's stations.

## C. INVESTMENT DESCRIPTION

As discussed above, this investment entails (i) the migration of the Grid Control Network to a new architecture, and (ii) the replacement of equipment in Hydro One's Grid Control Network that is approaching or has reached its end of vendor support. At each station there are four major components of work to be carried out as part of this investment:

1. Implementation of Direct SCADA network topology;
2. Upgrading the station gateway with HMI;
3. Replacement of legacy RTUs (if applicable); and
4. Removal of LCCs and LMCs.

All of these components are related, and Hydro One will utilize a "bundling" approach (i.e. perform all components of the work concurrently at a station) in order to reduce costs and shorten timelines. An additional aspect of this investment work will be to reroute transmission connected customers and some Hydro One transmission assets to the Manby TS hub site. These transmission assets, which are currently connected to existing Hydro One hub sites, are unable to perform their own protocol conversion. This is necessary to ensure that hub sites in our existing network topology can be removed from service, thus realizing the new Direct SCADA network topology.

This investment, in conjunction with station capital investments, will complete this work at approximately 40 hub sites and 400 stations in the entirety of the migration. This is ongoing work, and the network migration is required to be completed at each of these 440 sites and the component replacement work required at the majority of these stations. Furthermore, hub sites themselves can only be migrated over to Direct SCADA once all of the remote stations connected to them have been migrated. To date, Hydro One has migrated 4 hub sites and 100 stations to the new network topology along with component replacements. Approximately 36 hub sites and 200 stations remain to be migrated to Direct SCADA and another 100 stations remain to be migrated to the Manby TS hubsite throughout the JRAP rate period.

Every year, a list of stations will be developed based on their criticality to the Grid Control Network. The cost of doing this work at each station will vary depending on the size and complexity of the local network. In general, larger stations that are subject to the Critical Infrastructure Protection (CIP) requirements of the North American Electric Reliability Corporation's (NERC) are given higher priority. The investment will work in conjunction with station capital investments to ensure that the Grid Control Network equipment is replaced and fully migrated to the new Direct SCADA network topology by the end of the rate period. This work cannot be deferred for three main reasons:

1. The new Direct SCADA network topology is required to ensure compliance with the IESO Market Rules requirements for high-performance assets.
2. If the network continues to operate with end-of-support hardware and an issue arises, there will be no support available. As a result, the overall reliability of the Grid Control Network would be impacted. This is of critical concern since it is relied upon by the OGCC to operate the transmission system.
3. Hydro One has a large installed base of legacy RTUs in the Grid Control Network that are no longer supported by vendors. Due to their age, these RTUs have a high risk of failure. If repair is not possible with available spare parts, an RTU replacement will have to be engineered as a reactive project, resulting in a lengthy equipment restoration time.

## D. OUTCOMES

This investment will migrate the Grid Control Network topology to the new and simplified Direct SCADA network topology. With the exception of Manby TS, hub sites will be eliminated. This optimization of the network will (i) ensure compliance with the IESO Market Rules, (ii) improve network reliability, and (iii) improve operational visibility:

i. Removing hub sites will eliminate the unnecessary processing delays associated with the hub sites, allowing stations to communicate directly with the OGCC and in turn satisfying the IESO Market Rules.
ii. The removal of hub sites will also increase network reliability by removing the intermediary communication hop to a hub site, which are potential nodes of failure.

iii. In the Direct SCADA topology, a station outage will only affect that station alone, as there will be no remote stations connected to it, as is the case with hub sites.

This investment will also address the Grid Control Network components that are approaching or have reached their end of vendor support: (i) Gateways, (ii) RTUs, (iii) LCCs, and (iv) LMCs.

**I. Addressing Near End-of-Vendor-Support Gateways**

Gateway replacement will ensure reliability of the Grid Control Network by having continued vendor support for these devices. It will also facilitate the removal of the LCCs at Hydro One stations.

**II. Addressing End-of-Vendor-Support RTUs**

RTUs are a critical part of the Hydro One Grid Control network because they interface with the primary yard equipment. Hydro One has a large installed base of legacy RTUs that are well beyond vendor support. This investment will systematically replace these RTUs with units that are aligned with Hydro One's current design standard. Retired RTUs will be kept as spares until the entire installed base is upgraded.

**III. Addressing End-of-Life LCCs**

LCCs are Microsoft Windows-based station computers that provide the important function of local monitoring and control of primary yard equipment. They will be replaced by station gateway HMIs. The HMIs will allow for the continued local monitoring and control of station primary yard equipment, eliminating reliance on obsolete Windows-based software.

**IV. Addressing End-of-Life LMCs**

LMCs are Microsoft Windows-based station computers that support field staff in commissioning and maintenance activities. Their function has been replaced by the TCA, which are used by field staff with their corporate laptops. The elimination of LMCs will eliminate reliance on obsolete Windows-based software.

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Migrating to the new topology will reduce the total amount of equipment in the network, thereby reducing the possible points of failure and improving network reliability. This, in turn, will improve Hydro One's ability to safely and effectively operate its transmission system, with the result that customers will experience fewer and shorter service interruptions. |
| **Operational Effectiveness** | • Migration to the new Direct SCADA network topology optimizes the Grid Control Network by reducing processing delays associated with hub sites. It also ensures compliance to IESO Market Rules for high-performance assets.<br>• Removal of hub sites increases network reliability by removing an intermediary communications step and potential node of failure. It also improves operational visibility by eliminating nodes in the network that consolidate stations.<br>• Replacing end-of-vendor-support gateways and obsolete legacy RTUs will improve system reliability by ensuring continued vendor support for these critical components and by ensuring that these units are aligned with current design standards.<br>• Removal of LCCs and LMCs will eliminate reliance on obsolete stations computers. |
| **Public Policy Responsiveness** | • Comply with the IESO Market Rules for high-performance assets. |
| **Financial Performance** | • Systematically replacing gateways and legacy RTUs will avoid the need for reactive replacement of failed units, which can result in costly, lengthy, and unplanned restoration time due to part obsolescence.<br>• Realize cost savings by addressing multiple degrading components within the station as part of the same investment. |

## E. EXPENDITURE PLAN

Through this investment, a number of stations will be addressed each year in a phased manner, so as to complete the required migration and component replacement work at approximately 200 stations and 36 hub sites and, migration to the Manby TS hubsite of approximately 100 stations by the end of the rate period. To date, 100 stations and 4 hub sites have been migrated to the Direct SCADA network topology. The estimated costs shown below have been determined on a per-unit basis, with reference to the volume of equipment at each station. The per-unit cost was estimated based on historical costs of the same work performed at previous stations. Larger stations that are more critical to the Bulk Electrical System will be prioritized.

Table 2 below summarizes historical and projected spending on the aggregate investment level.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 6.7 | 6.8 | 7.0 | 7.2 | 7.4 | 35.1 |
| Less Removals | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 1.1 |
| **Capital and Minor Fixed Assets** | **6.5** | **6.6** | **6.8** | **7.0** | **7.1** | **34.0** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **6.5** | **6.6** | **6.8** | **7.0** | **7.1** | **34.0** |

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking.

### ALTERNATIVE 1: STATUS QUO

Alternative 1 is to continue operating with the existing hub site network topology and to maintain existing Grid Control Network equipment until the work described by this investment can be bundled as part of other integrated station work.

With respect to network topology, this alternative is not recommended, as the current hub site topology prevents Hydro One from meeting the IESO Market Rules for high-performance assets. Additionally, Hydro One will not benefit from the increased reliability or improved operational visibility that could be achieved by the optimized Direct SCADA network topology.

With respect to component replacement, the current integrated station investment practice at Hydro One is to evaluate the need to perform work at each station on a seven-year cycle. Under this alternative, end-of-vendor-support equipment would not be replaced in a timely manner. Operating equipment without vendor support reduces the reliability of the Grid Control Network, which is critical to the daily operation of the transmission grid. Additionally, replacement parts for failed end-of-vendor-support components will become harder to obtain over time. For these reasons, the status quo alternative is not recommended.

**ALTERNATIVE 2: REPLACEMENT OF GRID CONTROL NETWORK ELEMENTS WITHOUT VENDOR SUPPORT**

Alternative 2 is to only replace the elements of the Grid Control Network that are no longer supported by vendors, without addressing the migration of the Grid Control Network to its new network topology. This alternative is not recommended, as it will impede Hydro One’s ability to meet the IESO Market Rules for high-performance assets. Additionally, Hydro One will not benefit from the increased reliability that could be achieved by the reconfiguration of the Grid Control Network, and will not realize the cost efficiencies associated with executing both components of this investment at the same time.

**ALTERNATIVE 3: MIGRATION OF THE GRID CONTROL NETWORK TO THE NEW DIRECT SCADA NETWORK TOPOLOGY AND REPLACEMENT OF GRID CONTROL NETWORK COMPONENTS WITHOUT VENDOR SUPPORT (RECOMMENDED)**

The recommended alternative is to migrate the Grid Control Network to the new Direct SCADA network topology, and to replace the elements of the Grid Control Network that are approaching or have reached their end of vendor support. By the end of the rate period, all eligible Hydro One stations will be migrated to the new Direct SCADA network topology.

Through a bundled work approach, gateways and RTUs will be replaced with units that align with current design standards and are vendor supported, and LCCs and LMCs will be decommissioned.

This alternative will optimize the Grid Control Network and ensure that Hydro One can meet the IESO Market Rules for high-performance assets. Hydro One will also benefit from the increased system reliability and improved operational visibility affected by the removal of hub sites. This alternative will also minimize Hydro One's operational risk by systematically replacing equipment in the Grid Control Network that is approaching or has reached its end of vendor support. It is cost- and time-effective to perform both aspects of the investment at the same time because the equipment, engineering, and commissioning work are closely related.

## G. EXECUTION RISK AND MITIGATION

The major risk associated with the execution of this investment is the ability to obtain the project outages necessary for field commissioning. Cancellations may arise due to higher priority projects or unforeseen system contingencies. The strategy for risk mitigation will be to apply for project outages as soon as stations have been identified for execution under this investment and the necessary details for work have been finalized.

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| G-GP-20 | TRANSMISSION NON-OPERATIONAL DATA MANAGEMENT SYSTEM |
|---|---|
| **Primary Trigger:** | Business Enhancements |
| **OEB RRF Outcomes:** | Financial Performance, Customer Focus, Operational Effectiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 5.5 | 1.1 | 0.0 | 0.0 | 0.0 | 6.7 |

**Summary:**

This investment involves the purchase and installation of a Non-Operational Data Management System to manage and analyze data in real-time from transmission assets at transformer stations. The primary trigger of the investment is improved planning for aging assets, increased performance and reliability of the electric grid, and reduced costs. The investment is expected to reduce maintenance costs and optimize capital asset expenditues, increase reliability of the grid, and improve safety by having data available remotely for all transformer stations connected to transmission system.

## A. OVERVIEW

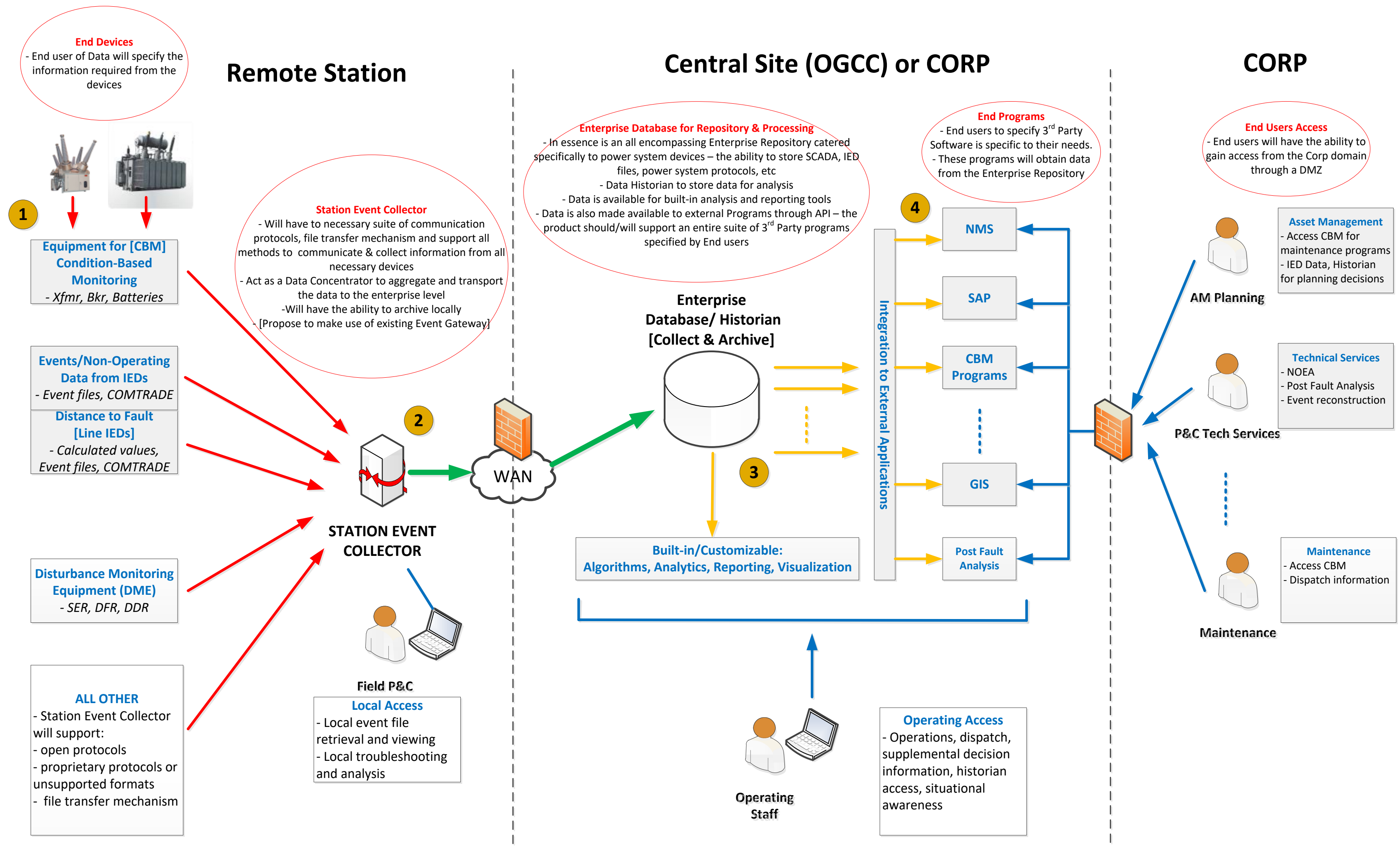
This project provides the necessary framework to enable automation and use of enhanced technology in relation to maintenance activities and personnel dispatch, and provide access to detailed and accurate information to be used in analysis and modeling. The system also provides an essential foundation to pursue future initiatives and provide system controllers with additional operational awareness, allowing for timely control actions to avoid equipment failure and minimize customer impacts. The Non-Operational Data Management System will build on and enhance asset analytics accuracy and dependability by including previously unavailable data in the asset risk modeling to be used in investment planning.

The Transmission Non-Operational Data Management System project will leverage the capabilities of existing technology by connecting existing monitoring devices to a centralized and integrated data management system. Data will be collected centrally and used for monitoring, reporting and analysis. The project consists of hardware and engineering development at the substation level to ensure interfacing of all substation devices and components and the collection and processing of non-operational data. Software and hardware integration at the Central/Enterprise level will also be required to ensure processing and archiving of all substation non-operational data, and to connect, interface and exchange data with external programs, which will facilitate data analytics, reporting and visualization. A conceptual pilot project has been completed in late 2020 to test the system, to analyze and identify the best solution to meet the needs of the investment, and to ensure the most effective implementation. Hydro One has analyzed various alternatives associated with the investment and has determined that a full implementation of Non-Operational Data Management System is the preferred solution.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

In an effort to reduce OM&A costs, Hydro One is embarking on an initiative to implement a Transmission Non-Operational Data Management System. Non-operational data is defined as data, in a variety of formats, generated during the operation of the transmission and distribution grid that is not continually utilized by Ontario Grid Control Centre (OGCC) controllers for real-time operating processes. While this data is not required for the real-time operations of the Hydro One transmission system, the collection of this data will provide the platform to empower various lines of business to pursue efficiencies and streamline business processes. This data can also be utilized to support or supplement real-time operating processes and decisions. Figure 1 below depicts a conceptual diagram of the envisioned Transmission Non-Operational Data Management System.




1 **Figure 1: Transmission Non-Operational Data Management System**

Witness: JABLONSKY Donna

There are essentially four (4) sub-components which collectively make up the entire system:

1. **Remote Station Collection:** The expected end devices that act as data sources for the Station Event Collector.
2. **Station Event Collector:** The Station Event Collector is a data concentrator for non-operational data coming from various end devices. It will be required to support the necessary suite of communication protocols, file transfer mechanisms and support all methods to communicate and collect information. As a data concentrator, it will be required to aggregate and transport the data to the Database/Historian at the Enterprise level.
3. **Enterprise Component:** Database/Historian: The Enterprise Database/Historian will collect and archive all non-operational data from the various "enabled" substations. It will have the ability to create customized dashboards; perform analytics, and generate reports, annunciations, and trending.
4. **Interfaces:** This component deals with the ability to interface data from the Database/Historian to external applications and ensures users across the corporation can effectively access and utilize the data.

This investment provides the necessary framework to enable automation and use of enhanced technology to optimize planning of maintenance activities and realize cost reduction related to personnel dispatch. The system also provides an essential foundation to pursue future initiatives.

The assets to be monitored will include, but will not be limited to, transformers, breakers, capacitors, reactors, batteries, intelligent electronic devices (IEDs), buildings, cables and lines. Examples of data that will be collected and aggregated in the system include:

- For breakers: $I^2T$ (a measure of energy dissipation), duty cycles, number of operations, and other measures of mechanical health;
- For transformers: Gas measurements, bushing conditions, partial-discharge measurements, temperatures and tap-changer movements;
- For lines: Distance to fault calculations; and

- For disturbance monitoring: Sequence of events, digital fault and waveforms and dynamic response measurements.

Many internal stakeholders will benefit from the availability of the additional information to make their processes more efficient and effective. For example, the Operations team will benefit from the supplemental information that will aid in real-time operating decisions, Transmission Asset Management will use the additional information to facilitate condition-based maintenance programs and to make planning decisions for life-cycle management power system assets, and P&C Technical Services will integrate the added information in post-fault analysis and event reconstruction efforts.

The deployment of the Transmission Non-Operational Data Management System will allow Hydro One to realize the following benefits:

- **Condition-Based Maintenance (CBM):** Currently, maintenance activities are completed at pre-determined time intervals or are performed a reactive basis. In contrast, a non-operational data management system enables a CBM approach, which uses measurement technology installed at certain points on the relevant assets to continually monitor the current condition of the assets, in order to gauge when maintenance activities are necessary. Information collected through the monitoring process, such as indications of deteriorating performance, are used to determine the frequency and specific type of maintenance activities that are required. This strategy optimizes station maintenance resources and activities. Cost savings are expected to be realized in the form of reduced maintenance activities, less frequent dispatch of staff for manual data sampling and retrieval, and fewer break-fix activities.

  The predictive approach, incorporating non-operational data and analysis, will allow assets to be operated beyond their estimated service life if the data being collected supports continued use. This will result in an increased useful life of assets and optimized performance outputs.

- **Automated Non-Operational Data Collection from Substation Devices:** The transmission system has a significant base of protection IEDs with the capability to provide additional non-operational data. The protection IEDs currently serve two purposes: power system protection and reporting of real-time operating information. However, these devices also have the capability to provide additional non-operational data through sensing and calculating functions. In order to take advantage of these additional capabilities, engineering efforts are required to program the IEDs to collect this information and to program the Station Event Collector to obtain this data. The capabilities of the existing systems assets will be leveraged to form the non-operational data system.

  Data collected by these devices, such as distance-to-fault data, which is information calculated internally within the protection IEDs that can be made available for extraction, is particularly useful to support the decision-making and activities of Hydro One Transmission’s operating divisions. Distance-to-fault data is used to dispatch line crews to the approximate fault location with a higher degree of accuracy. This will provide savings by reducing resource intensive inspections and patrols, performed via helicopter fly-by inspection or ground-based visual line inspection.

  The IEDs also produce a suite of logs and files for post-fault analysis. When a contingency occurs, these files need to be collected for proper fault analysis, a process which currently requires the dispatch of field personnel for manual data collection. By automating this collection method, the Non-Operational Data Management System will enable savings by eliminating the need to dispatch personnel, which will in turn improve employee safety by reducing travel to stations some of which are quite remote.

  For post-fault analysis, large terminal stations contain Disturbance Monitoring Equipment (DME) that records power system events. DME consists of Sequence of Events Recorders (SER), Digital Fault Recorders (DFR) and Dynamic Disturbance Recorders (DDR).

Staff currently obtains the information from the DME via two methods: dispatching field personnel for manual collection of files, or dialling-in to download the required files remotely. Automating this file collection method would provide savings by eliminating manual processes and the need to dispatch personnel. It would also improve employee safety by reducing road time.

- **Averting Catastrophic Failure:** Consultation with vendors and other utilities – including PowerStream (now Alectra Utilities), PG&E, and AEP – has indicated that the proposed implementation of a non-operational data management system will potentially reduce catastrophic failure of equipment. These utilities have identified situations in which a non-operational data management system effectively averted serious power system contingencies, which would have resulted in environmental impacts and extended customer outages.

  PowerStream (now Alectra Utilities) provided an example where the non-operational data report for a particular 10 MVA, 44 kV-13.8 kV transformer indicated alarms for high winding temperatures and hydrogen gas. This provided a warning that the transformer was about to fail. The utility was able to preemptively remove the transformer from service prior to failure and replace it with a spare, thereby averting a significant amount in damages and customer outages that may have resulted from a catastrophic failure.

  In another example, the oil of a 75/125 MVA 230 kV-27.6 kV transformer was monitored for gassing vs. load and oil temperature. The monitoring provided an indication of increased transformer gassing, which is a signal of potential impending failure. The utility was able to preemptively react and repair a manufacturing defect in the transformer, thereby avoiding catastrophic failure and/or serious internal damage to the windings or core.

AEP also provided examples in which several transformer failures were averted due to operating action taken after analyzing non-operational data. In each case, measurements indicated issues with the transformer, and the transformer was taken out of service while manual testing was performed to confirm the indications. When the results were confirmed, further testing was conducted to assess whether the unit could be repaired or replaced. In each case, the online measurement indications provided sufficient warning to take the transformer out of service prior to failure, avoiding significant costs and damage in each event.

A significant portion of the cost for this investment could be offset by the avoidance of a single major disaster such as a transformer explosion. The cost of the replacement transformer itself may be up to $1M, while the costs of environmental clean-up, reputational damage, labour required to remove the destroyed transformer and install the new transformer, associated extended outages, and possible damage to the station surroundings would also be significant. The total expected cost associated with a single transformer explosion could conservatively amount to several million dollars.

- **Regulatory Compliance:** The Non-Operational Data Management System will support compliance with NERC PRC-005-6 (Protection System, Automatic Reclosing, and Sudden Pressure Relay Maintenance) in relation to station battery maintenance.

  Hydro One uses two types of station batteries: vented lead-acid (VLA) and valve-regulated lead-acid (VLRA). All batteries associated with components of a protection system station DC supply using VLA batteries or VLRA batteries require time-based maintenance programs within certain maximum maintenance intervals specified by NERC Standard PRC-005-6.

However, the specified time-based maintenance activities for NERC compliance can be completely eliminated if adequate remote monitoring of this data (non-operational in nature) is in place. Certain monitoring functions may be used in lieu of periodic maintenance, as specified in NERC Standard PRC-005-6. Monitoring functions that may eliminate the need for periodic maintenance include monitoring and alarming of the battery charger voltage to detect charger overvoltage and failure, electrolyte level monitoring and alarming, unintentional DC ground monitoring and alarming, and monitoring and alarming of battery string continuity, among others. By requiring a specified set of non-operational data to be monitored and alerts to be provided based on specific criteria, this standard allows for the elimination of station battery maintenance. Effective implementation of the Non-Operational Data Management System to provide monitoring and alerts based on these criteria will eliminate the need for field personnel to provide regular on-site inspections, will result in a more comprehensive understanding of battery condition, and will provide a more efficient means of NERC compliance.

- **Foundation for Future Initiatives:** The Non-Operational Data Management System will also provide an essential foundation for future initiatives. Once developed, this infrastructure will allow for additional metrics and models to be implemented to assist in better decision-making by using a predictive approach for maintenance planning, resulting in improved levels of asset performance. For example, when the system is first implemented, distance to fault data will be assessed based on calculated IED values applicable only to permanent faults for radial lines. In the future, additional models could be implemented in order to calculate multi-ended lines, transient faults, correlations with weather/lightning data, and other scenarios. Another example is the opportunity to augment and enhance the capability of the assessment of asset condition. The use of non-operational data can be used to model asset condition with increased accuracy.

**C. INVESTMENT DESCRIPTION**

The investment's scope includes the development and implementation of several components, which are expected to be executed in parallel. Hardware and engineering development will be required at the substation level to ensure interfacing of all substation devices and components and the collection and processing of non-operational data.

The Database/Historian component will reside at the Central/Enterprise level where all data is aggregated, rather than at the Operations level where typical power system work occurs. This will permit the data to be accessed across the corporation, but will also require certain steps to be taken at the Central/Enterprise level:

- Software and hardware integration at the Central/Enterprise level will be required to ensure processing and archiving of all substation non-operational data. Installation of additional software/hardware is anticipated.
- Software and hardware integration at the Central/Enterprise level to connect, interface and exchange data with external programs, which will facilitate analytics, reporting and visualization. This will enable several lines of business (LOB) to make practical use of the collected data to realize efficiencies and make better decisions for the maintenance and management of transmission system assets. Installation of additional software/ hardware is anticipated.

The implementation plan involves multiple LOB in a staged approach. Each LOB will develop their respective systems after which pilot sites will be targeted for proof-of concept validation. Criteria will be established to prioritize those sites which would benefit most from the automatic collection and analysis of non-operational data. In prioritizing and pacing the implementation of this system, the following factors will be considered:

- Stations in which station battery maintenance is performed for NERC Standard PRC-005-6 compliance will be prioritized, as implementation of this project will eliminate the need for maintenance on these systems.
- Sites will also be prioritized where:
  - DME equipment is already in place;
  - many equipment sensors are already installed; and/or
  - there is high spending on power system equipment maintenance.
- The overall plan will be to implement the system at as many sites as possible.

The decision for recommending the proposed alternative is based on the delivery of cost savings as a result of process efficiencies, including allowing Hydro One to support a transition to a CBM approach to maintain and manage power system assets. Currently, approximately $900,000 is spent yearly on dispatching field personnel to retrieve non-operational data. The goal is to reduce this expense as much as possible. The ultimate savings due to implementation of the Transmission Non-Operational Data Management System will depend on what issues will arise, at what frequency, and at which stations.

This investment aims to make more efficient use of existing technologies deployed at substations. For example, IEDs are currently installed for protection purposes but also have a suite of non-operational data available. Utilizing this data though the proposed system will help the asset planner make more informed decisions related to maintenance and lifecycle management. The system will provide the framework to enable integration with several data systems so that advanced analytics and modeling can be performed. This system will position Hydro One for the future by leveraging industry best practices.

## D. OUTCOMES

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 1 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Improvements to reliability are expected, as the Non-Operational Data Management System can prevent catastrophic failure of power system equipment such as transformers, thereby avoiding potential lengthy outages. |
| **Operational Effectiveness** | • Operational effectiveness is expected to improve, as the access to non-operational data will offer additional insight into power system assets condition, which will facilitate a more proactive approach to CBM. This will result in improved reliability and a reduction in more costly, reactive capital replacements due to asset failures. |
| **Financial Performance** | • Cost savings are expected to be realized through the efficiencies of minimizing or eliminating manual and time-intensivetasks<br>• Implementation costs of the Non-Operational Data Management System will be minimized where possible through an evaluation of the ability to retool or modify existing systems to support the new functional requirements. |

## E. EXPENDITURE PLAN

Table 2 below summarizes the projected spending on the aggregate investment level during the planning period. In addition to these costs, $10.8M is forecasted to be spent prior to 2023.

**Table 2 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 5.5 | 1.1 | 0.0 | 0.0 | 0.0 | 6.7 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **5.5** | **1.1** | **0.0** | **0.0** | **0.0** | **6.7** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **5.5** | **1.1** | **0.0** | **0.0** | **0.0** | **6.7** |

The ultimate cost of the investment will depend on the following several factors:

- An evaluation of whether existing corporate systems meet the functional requirements or whether a new system is required to be implemented. Accordingly, there may be additional upfront costs to facilitate new hardware, software, and licensing.

- Each substation currently has different levels and vintages of devices available for integration into the Non-Operational Data Management System. For example, certain stations may already have the required sensors installed but may not yet be programmed for non-operational capabilities, while other stations may have no sensors installed and will require installation of various sensors to provide useful non-operational data. As such, it is not possible to assess a consistent unit cost per substation in order to enable the system. The total project costs will be affected by the extent of data integration required at each station and the requirement of installation of any additional remote sensing devices.
- Additional software packages may need to be purchased if evaluation deems it more cost-effective than developing in-house algorithms. Potential costs associated with the purchase of software packages or the labour efforts required to develop in-house algorithms will be assessed if and when a need for new software is assessed.

Since the Non-Operational Data Management System will provide the foundation for future initiatives, there may be additional feature enhancements, modifications, or rectification required as future initiatives are implemented. The primary focus of this project is to build the foundation for the system and integrate as many substations as possible into the system. Future initiatives will be funded at a later time or through additional funding.

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking.

### ALTERNATIVE 1: STATUS QUO

Alternative 1 is to continue with time-based maintenance schedules and manual collection of substation non-operational data. This alternative has been ruled out, as this solution is less efficient and more expensive in the long run than the alternatives.

**ALTERNATIVE 2: IMPROVE EXISTING SYSTEM**

Alternative 2 is to make improvements to existing non-operational systems that are segregated in nature. The current system was developed without anticipating the potential to incorporate aspects of CBM or system integration. Automation of some of the non-operational systems is possible, but the remainder will still require either manual intervention or personnel dispatch to retrieve data due to limitations of the existing technology. This alternative has been ruled out, since the existing systems do not have the archival, analytic, or integration capabilities for systems that would properly facilitate the CBM approach.

**ALTERNATIVE 3: FULL IMPLEMENTATION OF NON-OPERATIONAL DATA MANAGEMENT SYSTEM (RECOMMENDED)**

This alternative includes the full implementation and development of several components across the corporation to realize a fully featured Non-Operational Data Management System. The implementation and development program will include Remote Station Collection, Station Event Collector, Enterprise Database/Historian, and a component of integrating the system. This alternative is recommended as it will deliver cost savings stemming from process and labour efficiency gains. It also aligns with RRF outcomes as shown in the Outcome Summary above, as the system framework will allow for the integration of more substations.

## G. EXECUTION RISK AND MITIGATION

A possible risk affecting the delivery and completion time of this investment is the difficulty in integrating several different data systems into one common data management system, which poses interoperability challenges. Hydro One will mitigate the integration risks by limiting the initial rollout to proof-of-concept pilot sites and by applying the lessons learned through that process to the broader rollout that follows.

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| G-GP-21 | RTU REPLACEMENT PROGRAM |
|---|---|
| **Primary Trigger:** | Obsolescence |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Financial Performance |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 7.7 | 7.9 | 8.0 | 8.2 | 8.3 | 40.1 |

**Summary:**

This investment involves the replacement of obsolete Remote Terminal Units (RTU) that have reached end of life and whose condition[1] warrants replacement. RTU are critical to controlling transmission stations both from Hydro One's Grid Control Center and locally at the station. To perform reliably, they must be in good condition. RTU failures are considered very high risk as they can result in a complete loss of station monitoring and control functionality impacting the reliability of the Power System. The investment discussed here targets the replacement of RTU systems in bulk transmission stations and load supply transmission stations that are not covered under other upcoming station centric capital investments. The investment is expected to reduce reliability risks and improve the automation system performance of Hydro One's transmission network.

[1] Condition is tracked by performance through device failure rate and defect reports. Condition cannot be directly measured for RTU due to the nature of electronic devices.

## A. OVERVIEW

The RTU Replacement Investment (the "Investment") is a program that replaces obsolete Remote Terminal Units (RTU) that have reached end of life and whose condition warrants replacement. The Investment prioritizes replacement of RTU vintages that are end of life, and have high risk of failure caused by deteriorating condition. Because of the nature of electronic devices, condition cannot be directly measured. Factors related to condition that are used as triggers for replacement decisions include: increased failure rates and defect reports related to specific models, limited or non-existent manufacturer support for spare parts needed for repairs, and the inability of the RTU to perform their intended functions. The Investment replaces RTU based on these criteria at both bulk transmission stations and load supply transmission stations.

An RTU is a control device that provides control and monitoring functions for the transmission station and communicates to the Control Center. The RTU is based on the concept of physical wiring and the digital conversion of electrical signals delivered by wires. Failures of RTU are considered very high risk. They can result in complete loss of station Power System Monitoring and Control (PSMC) functionalities. Furthermore, failure of an obsolete RTU typically causes an outage of significant duration, because like-for-like replacement is generally not possible and designing and commissioning a new device using new technology takes time.

The Investment's pacing has been influenced by the assessment of factors related to equipment condition. The expected service life (ESL)[2] is being used as flag for assessment while other factors, such as safety, reliability and technology obsolescence have been used to identify the high risk assets that will be addressed by the Investment.

[2] Hydro One defines ESL as the average age in years that an asset can be expected to operate under normal system conditions.

The average ESL for an RTU is 20 years.[3] Hydro One has three main categories of RTU – legacy, centralized RTU and distributed RTU. The oldest legacy RTU have been in service for over thirty years. Some of the centralized RTU have been installed for over twenty years. Others have been installed for less than twenty years. As RTU go beyond their ESL, their internal components degrade as a function of time, which affects performance and impacts system reliability. Where the spare components for certain types are no longer available from the manufacturer, it can cause significant system impact if they cannot be replaced in a timely manner.

Hydro One's current standard are based on centralized RTU with enhanced operational capabilities such as self-monitoring capability and operational redundancy, and thereby improve the overall operational flexibility of the transmission system.

The Investment first prioritizes the replacement of obsolete RTU primarily of two types – Motorola Datrac and Quindar. These obsolete RTU have no spare parts available from the manufacturer. Their performance worsens as they further exceed their ESL, and they pose high risk to the reliability of the system. Centralized RTU GE D200/D20 RTU are considered second priority and they are replaced based on the overall evaluation of their age, condition (i.e. performance) and part obsolescence. Lastly, distributed GE D25 RTU that are approaching ESL with repeated failures of critical components are replaced on a case by case basis.

The Investment will complement RTU replacements that occur as part of station capital investments over the rate period by strategically replacing RTU that pose a high risk of failure beyond repair. In developing the Investment, Hydro One has concluded that replacement priorities identified above results in the most cost effective and efficient approach.

[3] Based on generally accepted industry practices and Hydro One's experience.

## B. NEED AND OUTCOME

### B.1 INVESTMENT NEED

Hydro One currently employs three types of RTU installations at transmission stations categorized as legacy, centralized RTU and distributed RTU. Legacy RTUs are obsolete technology with no spare parts or vendor support; the communication is slow using a dial-up modem connection. Centralized RTU are mainly GE D200 and D20 RTU. They are installed one per station (per voltage level). Distributed RTU, mainly GE D25, are a series of units that perform the SCADA monitoring and control functions together. Both centralized and distributed RTU are connected to the station LAN infrastructure and communicate to the Control Center via IP over WAN.

Hydro One currently has a total of 1005 RTUs installed in the province. Table 1 depicts the number and types of RTU installations currently in service.

**Table 1 - RTU Count**

| RTU | Count |
|---|---|
| Legacy Motorola Datrac RTU | 58 |
| Legacy Quindar RTU | 19 |
| Centralized GE D200 | 35 |
| Centralized GE D20 | 77 |
| Distributed GE D25 | 816 |

- There are a total of 77 obsolete legacy RTUs (58 Motorola Datrac and 19 Quindar) installed. They have been in service for over thirty years and are well beyond ESL. They account for approximately 8% of the total RTU population.
- There are 35 GE D200 RTU (approximately 3% of total population) in service. Installations of the centralized RTU GE D200 date back to the 1990s, they have passed their ESL. In 2006, GE had issued end of life notice for D200 RTU due to discontinuance of main CPU board.

- There are 77 GE D20 RTU (approximately 8% of total population) in service. GE D20 RTU installations started in the early 2000s. In 2015, GE had issued end of life notice for D20ME[4] due to part obsolescence and discontinued vendor support. Although some D20ME RTU are still within their ESL, there is risk associated with D20ME's end of manufacturer support, particularly with the large number of components and subcomponents deployed.
- There are 816 GE D25 distributed RTU (approximately 81% of total population) in the province. Typically several D25 units are installed for one station. D25 have been used in Hydro One for the past 10 to 15 years. They have not reached their ESL, however individual D25s have experienced repeated defect reports related to power unit failure.

As discussed in TSP Section 2.2, Hydro One has a thorough and ongoing asset management process that involves monitoring and reviewing transmission assets and assessing their condition. Hydro One tracks the condition of its automations asset on the basis of relevant defect reports. In the past twelve years, RTU have seen an increase in defect occurrences due to the aging population.

Failures of RTU are considered very high risk. They can result in complete loss of station Power System Monitoring and Control (PSMC) functionalities. The lack of vendor support equipment operating beyond ESL is significant factor for the Investment. When a device operates without vendor support, the consequence of failure is elevated. The impacts of failure are exacerbated by the diminishing supply of spare parts and reduced engineering support. Due to lack of replacement parts from the manufacturer, when the RTU fails, it results in long duration outages when for a new RTU to be installed.

[4] D20ME is one of the two types of D20 RTU; the other type is D20MX, which is currently Hydro One's standard station level RTU.

## C. INVESTMENT DESCRIPTION

The Investment involves a series of individual investments. Over the rate term, Hydro One is planning to replace approximately 80 RTU at various bulk transmission and load supply transmission stations. The RTU identified for replacement have reached their ESL, have shown increasing failure rates, have limited or no manufacturer support and can no longer reliably perform their intended function.

The Investment plans to replace the identified RTU population at a consistent pace. Starting in 2023, approximately 16 RTU will be replaced per year. The Investment will complement RTU replacements that occur as part of station capital investments by strategically replacing RTU that pose a high risk of failure beyond repair.

## D. OUTCOMES

As a result of the Investment, Hydro One will reduce operational risks associated with the operation of obsolete, end of life and deteriorated equipment; reduce outage duration for outages caused by legacy equipment failure; and maintain reliability performance and prevent loss of control and monitoring of the transmission stations.

### D.1 OEB RRF OUTCOMES

The following table presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board’s (OEB) Renewed Regulatory Framework (RRF):

**Table 2 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Maintain effective and reliable control and monitoring of bulk stations and load supply stations through strategic replacement of end of life RTU and systems.<br>• Reduce equipment failure rate and thereby avoid potential lengthy outages. |
| **Operational Effectiveness** | • Improve operational flexibility of the transmission system through the implementation of new standardized RTU systems enabling enhanced operational capabilities.<br>• Maintain system performance by reducing risks of outages caused by failure of the equipment. |
| **Financial Performance** | • Realize cost savings by addressing degrading components and equipment with planned strategic replacement. |

## E. EXPENDITURE PLAN

As discussed above, the Investment is needed to replace RTU at bulk power stations and load supply stations, which may compromise the reliability of the transmission grid control and monitoring due to the obsolete, high risk assets that have reached their ESL. Hydro One planned the Investment in a way that strives to complete it as effectively and efficiently as possible so to minimize the cost of replacing the identified RTU.

The costs have been determined on a per unit basis. The per-unit cost was estimated based on historical costs of RTU replacements previously performed. Since the cost varies depending on the type of the station and the specific scope required, previous projects of the same scope for the same type of station were used to estimate costs in this Investment.

Table 3 below summarizes projected spending on the aggregate investment level.

**Table 3 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 8.1 | 8.3 | 8.4 | 8.6 | 8.8 | 42.2 |
| Less Removals | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 2.1 |
| **Capital and Minor Fixed Assets** | **7.7** | **7.9** | **8.0** | **8.2** | **8.3** | **40.1** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **7.7** | **7.9** | **8.0** | **8.2** | **8.3** | **40.1** |

## F. ALTERNATIVES

Hydro One considered the following alternatives before selecting the preferred undertaking.

### ALTERNATIVE 1: REACTIVE COMPONENT REPLACEMENT (STATUS QUO)

Alternative 1 involves waiting for deteriorated and end of life devices and systems to fail and replacing components on a reactive basis, which is more costly. Hydro One has rejected this alternative for the following reasons:

- Under this alternative, assets in deteriorated condition continue to deteriorate and decline, increasing the likelihood of unexpected failures. This reduces the reliability of the grid control network, which is critical to the ability to operate the transmission grid.
- Replacement parts that have limited or no vendor support will become harder to obtain over time, making it increasingly difficult to replace the equipment on a like-for-like basis. An RTU failure could result in prolonged equipment and customer outages, which lower system performance.
- Since these replacements would likely be executed on an emergency basis, this alternative would result in the reprioritization of planned work and inefficient redeployment of resources.
- This alternative limits the ability to account for future requirements and has a high risk of re-work and future costs.

- This strategy is likely to increase operating and maintenance costs, decrease equipment performance and could impact the safety of personnel on site.

**ALTERNATIVE 2: PLANNED COMPONENT REPLACEMENT**

Alternative 2 is the preferred alternative. It involves proactive replacement of obsolete, end of life RTU and systems that are in a high risk condition, before failures occur. This alternative minimizes Hydro One's operational risk by proactively replacing equipment. Because it is not possible to directly monitor the condition of automation systems, ESL and equipment vintage is used as a trigger along with other factors summarized below, which are used to identify high risk assets. The assets identified will then undergo further condition assessment to identify replacement candidates.

- Reliability – RTU system failure will result in loss of control and monitoring of the transmission station. A larger zone or circuits may need to be isolated in order to isolate station with no control and monitoring capability. RTU allows Operators to perform immediate Operator action in order to maintain system stability.
- Safety – RTU system failure will require field personnel to be present at the station to manually control the station, which can potentially expose workers to the risk of electrocution and can result in injuries. Proactive replacements are required to mitigate this risk. RTU at stations that most highly impact the reliability of the bulk transmission system are considered most critical and are prioritized for replacement.
- Technology Obsolescence – Many RTU components are no longer available, limiting the availability of spare parts and support; which can adversely impact outage planning and overall system reliability. This is a significant factor for legacy RTU and systems as they are no longer supported by manufacturers. Therefore, obsolete legacy RTU that have no vendor support or spare parts are considered high risk assets and are prioritized for replacement.

- Innovation – Presently new microprocessor based relays (IEDs) are providing substation data via a SCADA protocol. Modernization of the substation through the installation of LAN infrastructure enables a new way of collecting data intelligently from IEDs, thus reducing the amount of hard-wiring from the switchyard. Stations with IEDs and LAN infrastructure require significantly less hard-wiring from the RTU. Therefore, new RTU installations at these stations facilitate substation modernization and align with Hydro One's overall protection and automation modernization strategies.

This alternative is recommended as it addresses the identified need to replace RTU at ESL in order to maintain the reliability of Hydro One's bulk transmission system in the most cost effective manner.

## G. EXECUTION RISK AND MITIGATION

Risks that can impact the completion of the Investment are: outage constraints, resource constraints, construction execution challenges, customer coordination and procurement challenges. Outage constraints and resource constraints are the major risks associated with the execution of the Investment. In some cases, it may be difficult to obtain the project outages necessary for field commissioning. Cancellations may arise due to higher priority projects or unforeseen system contingencies. Resource constraints may impact the project deliverables and schedules. The strategy for risk mitigations will be to schedule resources and apply for project outages as soon as possible.

| G-GP-22 | DISTRIBUTION CAPITAL CONTRIBUTION TO HYDRO ONE TRANSMISSION |
|---|---|
| **Primary Trigger:** | System Capital Investment Support |
| **OEB RRF Outcomes:** | Customer Focus, Operational Effectiveness, Public Policy Responsiveness |

**Capital Expenditures:**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| **Net Cost** | 2.0 | 2.2 | 1.1 | 1.0 | 0.0 | 6.3 |

**Summary:**

This investment involves non-discretionary capital contributions to Hydro One Transmission for transmission system network upgrades to increase capacity at Lambton TS, Lauzon TS, South Middle Road TS #2, and Leamington Area DESN #5. The primary trigger of the investment is system capital investment support. This investment is expected to increase capacity to accommodate forecasted distribution load growth.

## A. NEED AND OUTCOME

### A.1 INVESTMENT NEED

The investments in this ISD are capital contributions to Hydro One transmission for station upgrades to accommodate forecast distribution customer load growth. The capital contributions are required to proceed with the associated transmission investments. Accordingly, if the related transmission projects proceed, these capital contributions are non-discretionary.

Like all Ontario Local Distribution Companies, the TSC requires Hydro One Distribution to enter into cost recovery agreements with Hydro One Transmission for the expansion of Transformer Station facilities. The costs set out in this ISD reflect the forecast capital contributions that Hydro One Distribution will be required to pay to Hydro One Transmission under cost recovery agreements for four transmission system investments, as identified below in Section B. References to the relevant sections of the TSP, and the investments in the DSP tied to capital contribution to Hydro One Transmission covered in this ISD are outlined in Section B.

## B. INVESTMENT DESCRIPTION

The capital contribution investments within this ISD and the related TSP and DSP investments are outlined in Table 1:

**Table 1 – Capital Contribution Investments**

| Investment Name | Investment Description | Investment References | Need & Outcomes | Capital Contribution ($M) |
|---|---|---|---|---|
| Lambton TS New Feeders Capital Contribution | Replace Lambton TS T5 & T6 transformers with like-for-like units, replace switchyard, and add two new distribution feeder positions. | TSP Section 2.11, T-SR-03; DSP Section 3.11, D-SS-01 | To supply increased forecast load demand in the Lambton area, Hydro One Distribution is paying a capital contribution to add two new feeder positions at the station. | 2.0 |
| Lauzon TS Distribution to Transmission Capital Contribution | Replace Lauzon TS T5 & T6 transformers with larger 125MVA units due to increase in load demand, replace switchyard, and add two new distribution feeder positions. | TSP Section 2.11, T-SR-03; DSP Section 3.11, D-SS-01 | To supply increased forecast load demand in the Sandwich South and Town of Lakeshore areas, Hydro One Distribution is paying a capital contribution to add two new feeder positions. | 2.2 |
| South Middle Road TS DESN #2 Capital Contribution | Build an additional 75/125MVA Dual Element Spot Network (DESN) Station in the Kingsville-Leamington area to increase load supply capability. | TSP Section 2.11, T-SA-10; DSP Section 3.11, D-SS-01 | To meet substantial increase in request for load connections in the area driven by expansion in the indoor-agricultural and greenhouse sector, Hydro One Distribution is paying a capital contribution to build a new transformation station. The unprecedented growth in demand in this area is noted in the Windsor – Essex Integrated Regional Resource Planning (IRRP) studies and bulk system planning studies by the IESO found in SPF Section 1.2 Attachment 10. | 1.1 |
| Leamington Area DESN5 Capital Contribution | Build an additional 75/125MVA DESN Station in the Kingsville-Leamington area to increase load supply capability. | TSP Section 2.11, T-SA-10; DSP Section 3.11, D-SS-01 | To meet substantial increase in request for load connections in the area driven by expansion in the indoor-agricultural and greenhouse sector, Hydro One Distribution is paying a capital contribution to build a new transformation station. The unprecedented growth in demand in this area is noted in the Windsor – Essex IRRP studies and bulk system planning studies by the IESO found in SPF Section 1.2 Attachment 10. | 1.0 |

## C. OUTCOMES

### C.1 OEB RRF OUTCOMES

Table 2 presents anticipated benefits as a result of the Investment in accordance with the Ontario Energy Board's (OEB) Renewed Regulatory Framework (RRF):

**Table 2 - Outcome Summary**

| | |
|---|---|
| **Customer Focus** | • Increase capacity to allow connection of new distribution customers and promote economic development.<br>• Improve reliability for existing distribution customers who will be supplied from new Transformer Stations enabled by the Capital Contributions Hydro One Distribution is making to Hydro One transmission per this ISD. |
| **Operational Effectiveness** | • New Transmission supplies will provide additional Transformation capacity in the area and improve reliability. |
| **Public Policy Responsiveness** | • Comply with the TSC Section 6.3 Cost Responsibility for New and Modified Connections and Section 6.5 Economic Evaluation of New and Modified Connections |

## D. EXPENDITURE PLAN

The aggregated contribution costs associated with the underlying projects in Appendix A are presented in Table 3. The capital contributions are determined as per Hydro One's Transmission Customer Contribution Policy in accordance with the TSC.

**Table 3 - Total Investment Cost**

| ($M) | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|
| Gross Investment Cost | 2.0 | 2.2 | 1.1 | 1.0 | 0.0 | 6.3 |
| Less Removals | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Capital and Minor Fixed Assets** | **2.0** | **2.2** | **1.1** | **1.0** | **0.0** | **6.3** |
| Less Capital Contributions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Net Investment Cost** | **2.0** | **2.2** | **1.1** | **1.0** | **0.0** | **6.3** |

The amount of investment per year is dependent on the Transmission investment cost, revenue credits associated with forecasted load growth, and planned in-service dates of the underlying assets.

## E. ALTERNATIVES

The capital contributions associated with this ISD are required to proceed with the transmission investments to which the capital contributions are linked. Accordingly, if the related transmission projects proceed, these capital contributions are non-discretionary. Details on the projects to which the forecast capital contributions relate are provided in Table 1. Please refer to Table 1 above to determine the Transmission Investment Reference for each underlying investment in this ISD.

## F. EXECUTION RISK AND MITIGATION

The capital contribution amounts, which are based off estimated project costs and load forecast, are subject to change as they will be finalized only when the project is placed in-service subject to the terms of the cost recovery agreements.

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