

## APPENDIX E – EMBEDDED GENERATION FACILITIES CONNECTION REQUIREMENTS OVERVIEW

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### A. Connection Impact Assessment (CIA) and Documentation Requirements

All Embedded Generators shall provide Hydro One with the documentation requested by Hydro One including any information specified in the Technical Interconnection Requirements.

Hydro One performs a Connection Impact Assessment (CIA) for any Embedded Generation Facility with a name-plate rated capacity greater than 10 kW, or for any Embedded Generation Facility 10 kW or less when deemed required by Hydro One, in order to assess the impact of the connection of the proposed Embedded Generation Facility to Hydro One's distribution system and where connection is feasible, to specify the connection requirements. The capacity will be allocated for the Embedded Generation Facility upon the completion of the CIA in accordance with the Distribution System Code. The cost of performing the CIA will be paid by the Generator, at the applicable OEB-approved rates.

If the Embedded Generator changes the Embedded Generation Facility's design, plans or equipment materially from that in the original application for connection, Hydro One is obligated to follow the treatment prescribed in [Section 6.2.15](#) of the Distribution System Code.

### B. Interface Protection and Isolating Devices

The Embedded Generator shall provide an interface protection for their Embedded Generation Facility that detects all applicable faults on the Hydro One distribution system for the purposes of the Embedded Generator disconnecting the Embedded Generation Facility from the Distribution System in the event of such faults. The Embedded Generator shall provide, install and maintain a disconnecting device at the Point of Common Coupling with the Distribution System or some other acceptable location to Hydro One for the purpose of isolating the Embedded Generation Facility in case of an Emergency and for work protection. The disconnecting device shall be installed in accordance with the technical requirements specified in [Appendix F.2](#) of the Distribution System Code, the Technical Interconnection Requirements, including any Hydro One communication of Technical Interconnection Requirements updates in the form of bulletins and/or amendments that may occur periodically, and the Electrical Safety Code.

### C. Metering for Embedded Generation Facilities

#### Meter Installations for Micro-embedded Generation Facilities

The Embedded Generator is responsible for providing a Meter Installation for its Micro-embedded Generation Facility in accordance with the requirements of the Distribution System Code, Hydro One's standard metering requirements and Hydro One's policy directive for Embedded Generation Facility metering. Hydro One shall supply and install the revenue meter. All costs associated with new or modified metering are the responsibility of the Embedded Generator.

#### Metering for Embedded Generation Facilities Larger than 10 kW

##### a) Meter Installations – Installed after July 14, 2000

The Embedded Generator is responsible for providing a Meter Installation in accordance with the requirements of the Distribution System Code, Hydro One's standard metering requirements and Hydro One's policy directive for Embedded Generation Facility metering. Prior to installing the Meter Installation, the Embedded Generator shall provide Hydro One with the technical details of the Meter Installation, for Hydro One's approval. All costs associated with new or modified metering are the responsibility of the Embedded Generator.

The Meter Installation shall be installed at the Point of Common Coupling with the Distribution System or some other acceptable location at the sole discretion of Hydro One. If the Meter

Installation is not installed at the Point of Common Coupling, Hydro One shall apply loss factors to the output of the Embedded Generation Facility in accordance with the OEB-approved loss factors applied for retail settlements and billing.

The Embedded Generator shall supply single line diagrams showing revenue metering connections in the format specified by Hydro One. Such diagrams must be signed and stamped by a professional engineer registered in Ontario. The loss factors, if required, must be supplied by the Embedded Generator in the format specified by Hydro One and signed and stamped by a Professional Engineer registered in the province of Ontario.

In all cases where the Embedded Generator is responsible for any Meter Installation, the Generator is also responsible for the quality of the equipment and installation including all work and materials related to the Meter Installation. Deficiencies in any Meter Installation that require remediation, as determined by Hydro One, including but not limited to replacement costs and labour, will be performed by Hydro One at the cost of the Embedded Generator. The Embedded Generator shall be responsible to Hydro One for Meter Installation deficiencies for a period of two (2) years after Hydro One becomes the owner of the Meter Installation.

**b) Meter Installations – Installed Prior to July 14, 2000**

Where the existing Meter Installation for an Embedded Generation Facility was installed prior to July 14, 2000, the Embedded Generator shall upgrade the Meter Installation to be in accordance with Hydro One’s standard metering requirements and Hydro One’s policy directive for Embedded Generation Facility metering by no later than the meter seal expiry date. All costs associated with metering are the responsibility of the Embedded Generator.

**C.1 Metering Standards - Embedded Generation Facilities including Net Metering**

Hydro One will apply the metering standards in **Table 1** below for Embedded Generation Facilities including Net Metering:

**Table 1:**

Generator Capacity	Metering Requirements
≤ 10 kW	Smart Bi-directional or 4-Quadrant MIST (if net-metering load is >50kW)
>10 kW to ≤ 250 kW	4-Quadrant MIST
>250 kW	4-Quadrant PQ

- Smart bi-directional: A dual register meter measuring kWh delivered and kWh received, which may be manually or remotely read.
- 4-Quadrant MIST: Bidirectional meter with a minimum of four recording channels kWh & kVArh delivered and received with telephone or other communication (interval meter and remotely read)
- MIST: Metering Inside the Settlements Timeframe (interval meter)
- 4-Quadrant PQ Meter: A meter with multiple recording channels that includes power quality information.

Any Customer with an Embedded Generation Facility that sells energy and settles through Hydro One's retail settlement system will be responsible for all costs for Hydro One to provide and install metering as per Table 1 and for the costs to have a Communication Line installed if required, unless the Embedded Generator makes other arrangements for the Meter Installation that are acceptable to Hydro One and provides Hydro One with the technical details of their Meter Installation. The Embedded Generator metering will conform to current Hydro One retail revenue metering standards at the time of construction and Hydro One will subsequently own and maintain the metering and the communication line. For an existing Meter Installation on the meter's seal expiry date, unless an earlier transfer date is established by Hydro One, the Embedded Generator will shall be responsible for all costs for Hydro One to provide and install metering as per Table 1 for Embedded retail Generators to replace the existing metering per Hydro One's current retail revenue metering standards.

The Embedded metering will conform to Measurement Canada requirements and be installed at the Point of Common Coupling and Ownership Demarcation Point. If it is not practical to install the meter at the Point of Common Coupling, Hydro One will apply loss factors to the generation output in accordance with the applicable loss factors for retail settlements and billing. Depending on meter location, the loss factors may be calculated to include transformer losses, line losses, or both.

Where an existing Embedded Generator's Meter Legal does not conform to Measurement Canada requirements or the accuracy class of instrument transformers cannot be confirmed, the Embedded Generator must have the Meter Installation tested and apply a Measurement Canada correction factor to meter readings until such time as conformity to the standards is achieved. If pursuing an IESO contract, the Generator will upgrade metering to current Hydro One retail standards within a time period acceptable to Hydro One.

Where an existing Embedded Generator has non-standard voltage on the secondary side of the transformer and is metered at the secondary voltage, or the existing Meter Installation does not comply with Hydro One's retail revenue metering standards, the Embedded Generator will own and maintain the metering, including the Communication Line, per Measurement Canada requirements. If pursuing an IESO contract, the Generator will upgrade metering to current Hydro One retail standards within a time period acceptable to Hydro One.

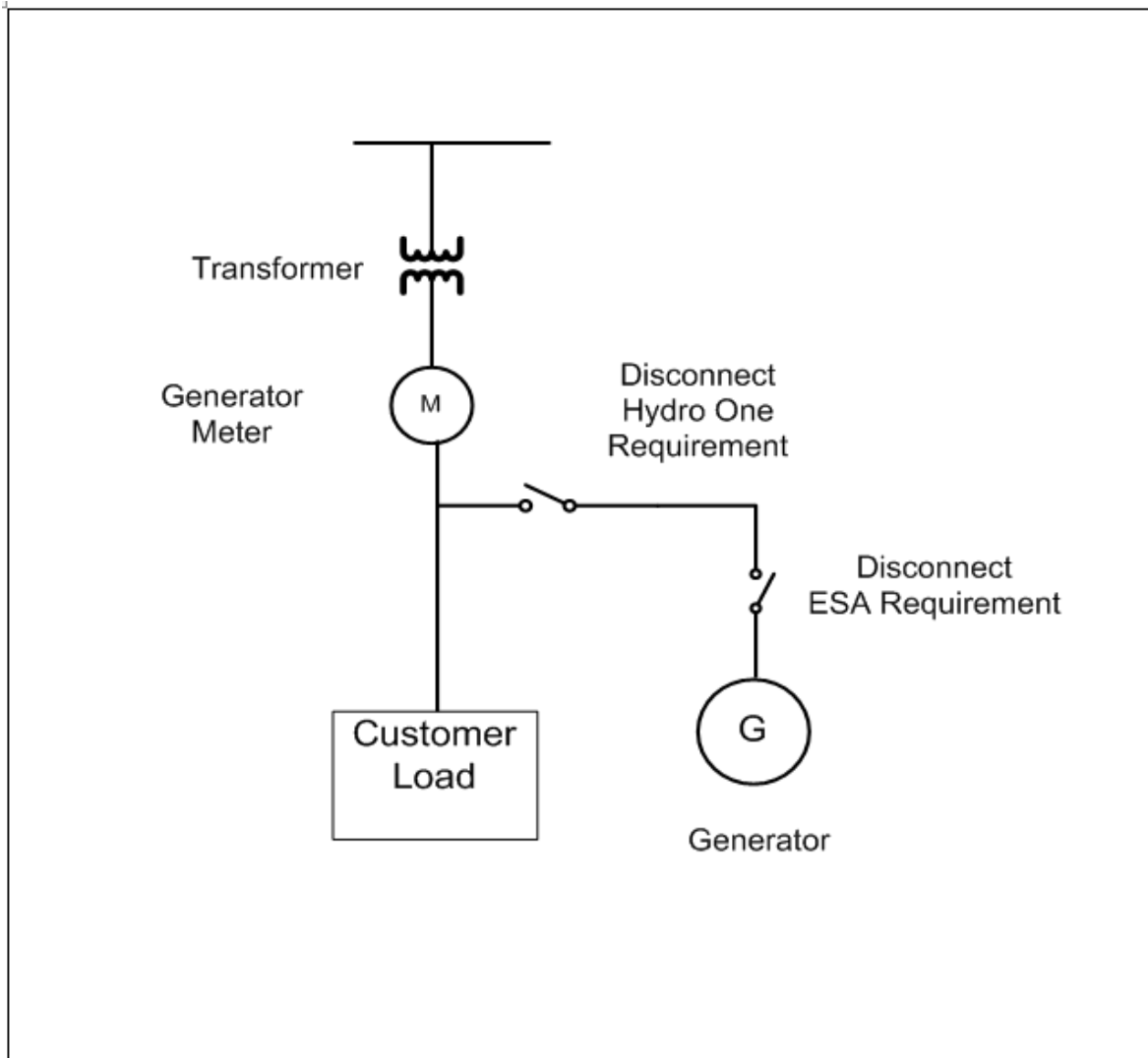
When Hydro One has agreed to allow separate metering for station service, the metering must meet all Hydro One metering requirements, including Hydro One's retail revenue metering standards, communication requirements and location requirements.

An Embedded Generator that receives energy (including for station use or back-up supply) will be placed in the appropriate Rate classification and billed for the energy consumed.

## C.2 Typical Embedded Generation Facility Meter Installations

The following figures demonstrate a typical Embedded Generation Facilities Meter Installation and are intended to show the location of the metering relative to the Customer Load and the generator. These are not a complete list of all possible Meter Installations but represent a typical Meter Installation.

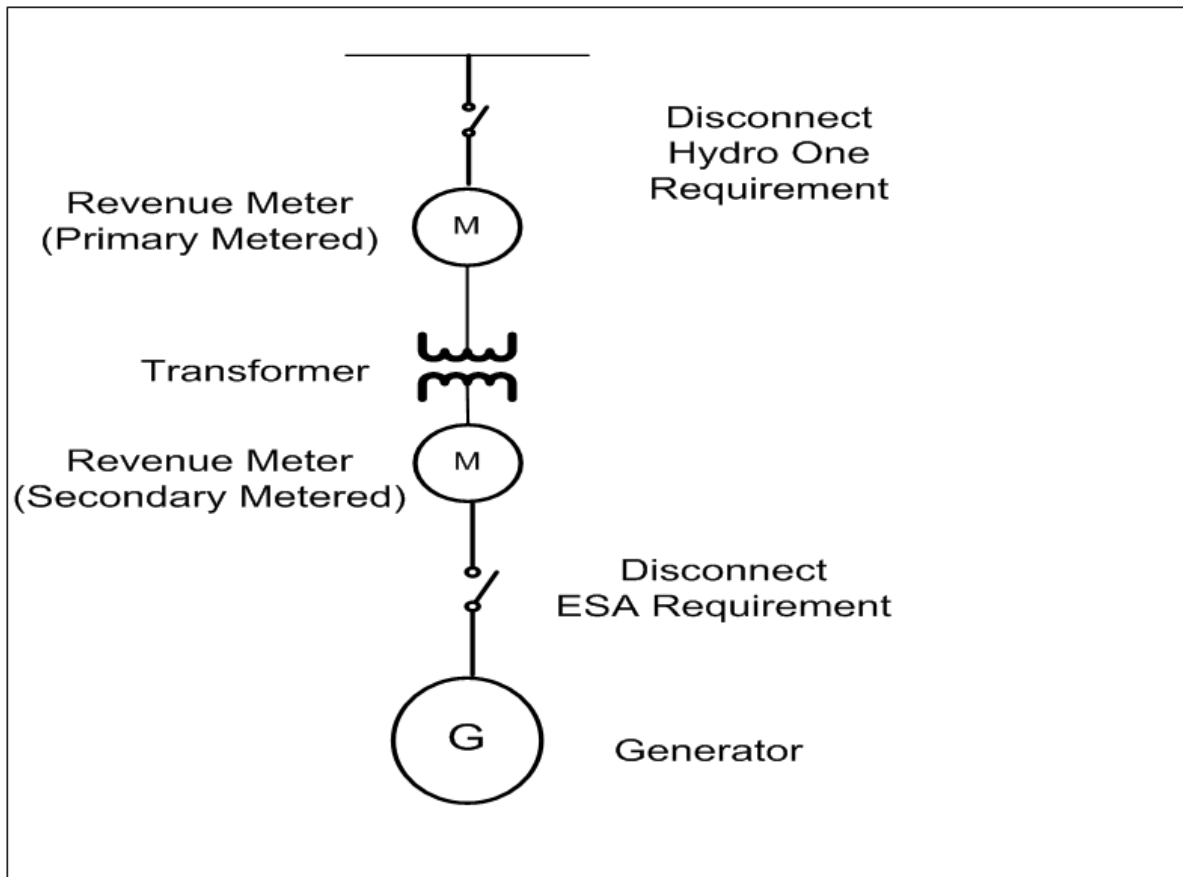
**Figure 1: Metering Arrangement for an Embedded Generator – Net Metering Connection**



This drawing is intended to show the location of the metering relative to the Customer Load and the generator. The generation facility must follow the technical requirements contained in either the Technical Interconnection Requirements for Distributed Generation, Micro Generation & Small Generation, 3-phase, less than 30 kW DT-10-20 or the Distributed Generation Technical Interconnection Requirements, Interconnection at Voltages 50 kV and Below DT-10-015 as applicable.

Net metering must be implemented using meters approved by Measurement Canada. See [Table 1](#) above for Retail Generators.

**Figure 2: Metering Arrangement for Directly Connected Embedded Retail Generators**



This drawing is intended to show the location of the metering relative to the Customer Load and the generator. Metering may be installed as primary metered or secondary metered. The Embedded Generation Facility must follow the technical requirements contained in either the Technical Interconnection Requirements for Distributed Generation, Micro Generation & Small Generation, Three phase, less than 30 kW DT-10-20 or the Distributed Generation Technical Interconnection Requirements, Interconnection at Voltages 50 kV and Below DT-10-015 as applicable.

Embedded Generator metering must be implemented using Hydro One meters approved by Measurement Canada. The Embedded retail Generator will be responsible for all costs to supply and install metering. See Table 1 above for Retail Generators.

When the meter is not installed at the point of supply, loss factors will be applied to the generation output for retail settlements and billing.

**Figure 3: Metering Arrangement for Indirectly (Parallel) Connected Embedded Retail Generators**

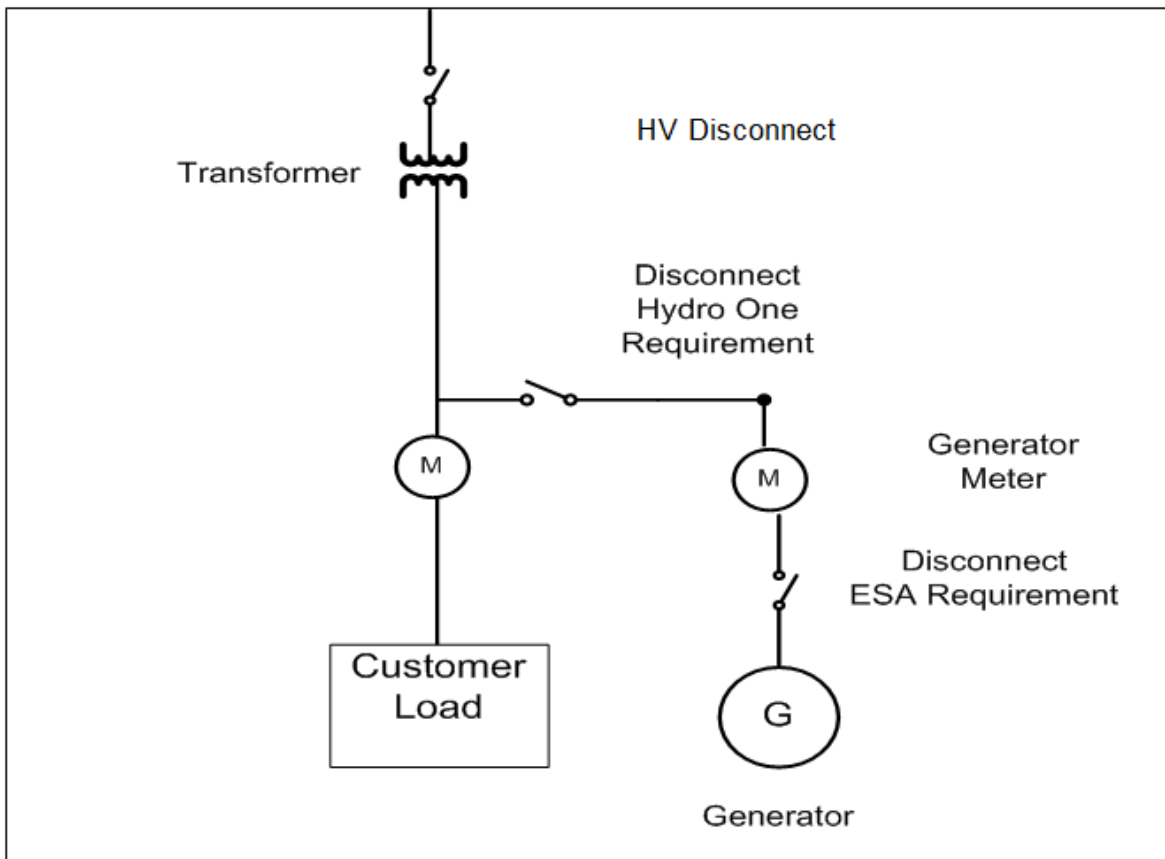


Figure 3 is intended to show the location of the metering relative to the Customer Load and the generator. The Embedded Generation Facility must follow the technical requirements contained in either the Technical Interconnection Requirements for Distributed Generation, Micro Generation & Small Generation, Three phase, less than 30 kW DT-10-20 or the Distributed Generation Technical Interconnection Requirements, Interconnection at Voltages 50 kV and Below DT-10-015 as applicable.

Embedded Generator metering must be implemented using Hydro One meters approved by Measurement Canada. The Embedded retail Generator will be responsible for all costs to supply and install metering as per Table 1 for Retail Generators.

When the meter is not installed at the point of supply, loss factors will be applied to the generation output for retail settlements and billing.

**D. Transformer Requirements**

**a) Micro-embedded Generation Facilities**

Embedded Generators connecting a Micro-embedded Generation Facility in parallel to a new or existing load service, may use the existing transformer to interface with the distribution system if it is of sufficient size as specified in the appropriate Technical Interconnection Requirements, including any Hydro One communication of Technical Interconnection Requirements updates in the form of bulletins and/or amendments that may occur periodically. Embedded Generators connecting Micro-embedded Generation Facilities in a standalone fashion shall pay the Actual Costs for Hydro One to supply, install and maintain the step up transformation. In the situation where the connection of the Embedded Generation Facility requires a transformer upgrade to a

size over and above the requirements of the load, Hydro One will provide, install, own and maintain the transformer at standard Hydro One voltages. The transformation supplied by Hydro One is dependent on the load of the new or existing load service, is subject to the limitations noted in section 2.1 of Hydro One's Conditions of Service, and is sized solely upon the new or existing load. All costs associated with the transformer upgrade (including procurement and installation of the new transformer and the decommissioning and removal of the existing transformer) will be at the Embedded Generator's expense.

**b) Embedded Generation Facilities With a Name-plate Rated Capacity of Greater than 10 kW**

Any Embedded Generator connecting an Embedded Generation Facility with a name-plate rated capacity greater than 10 kW in parallel to a new or existing load service, may use the existing transformer to interface with the distribution system if it is of sufficient size and provided that the net reverse power flow through the transformer is within the reverse flow limit established by Hydro One. In the case where a connection of the Embedded Generation Facility requires a transformer upgrade to a size over and above the requirements of the load, Hydro One will provide, install, own and maintain the transformer for standard Hydro One voltages to a maximum size of 500 KVA. The transformation supplied by Hydro One is dependent on the load of the new or existing load service, is subject to the limitations noted in section 2.1 of Hydro One's Conditions of Service, and is sized solely upon the new or existing load. All costs associated with the transformer upgrade (including procurement and installation of the new transformer and the decommissioning and removal of the existing transformer) will be at the Embedded Generator's expense.

Excluding the above, any step-up transformation equipment that is required to step-up the Embedded Generation Facility's output voltage to the primary voltage of Hydro One's distribution line shall be supplied, installed, owned and maintained by the Embedded Generator at their own expense.

**E. Embedded Generation Facilities Sharing Transfer trip/DGEO Path, Devices and Equipment**

Where Hydro One in its sole discretion agrees to permit an Embedded Generator to use another Embedded Generation Facility's transfer trip/DGEO path devices and equipment ("**Project with TT/DGEO**") to cascade transfer trip/DGEO signals on the Embedded Generation Facility's behalf instead of installing its own transfer trip/DGEO path devices and equipment ("**Project(s) without TT/DGEO**") in a manner that the Project with TT/DGEO is not able to send and receive independent transfer trip/DGEO signals to and from the Project(s) without TT/DGEO e.g. Hydro One cannot discern the individual TT/DGEO signals being sent and received from the Project with TT/DGEO and the Project(s) without TT/DGEO, the following terms and conditions which will be included in the CCA and the Connection Agreement of the Project(s) without TT/DGEO, shall apply:

(a) acceptance of the following operational restrictions:

- Hydro One will treat all of the Project(s) without TT/DGEO's and the Project with TT/DGEO's generation facilities (collectively the "**Facilities Using Single TT/DGEO**") as one single Embedded Generation Facility for teleprotection purposes;
- a single transfer trip signal will be sent to the Project with TT/DGEO and a single DGEO signal will be received from the Project with TT/DGEO;
- all of the Facilities Using Single TT/DGEO must be disconnected in the event of an emergency or unavailability of the teleprotection;
- upon Hydro One's request, all of the Facilities Using Single TT/DGEO must disconnect in the event that the protection of one of the Facilities Using Single TT/DGEO is not available or fails;

- upon Hydro One's request, all of the Facilities Using Single TT/DGEO must cease generation if any one or more of the Facilities Using Single TT/DGEO's telemetry or alarms are not fully functional; and
- all of the Facilities Using Single TT/DGEO must cease generation if the transfer trip/DGEO path devices and equipment are not fully functional.

(b) the Embedded Generators and their common owner(s) must accept all risks associated with this arrangement including any impact on any agreement they have with the IESO in respect of the sale of the output of the Project(s) without TT/DGEO's Embedded Generation Facility(ies).

The above terms will cease to apply to any of the Project(s) without TT/DGEO where:

1. the Project(s) without TT/DGEO installs its own transfer trip/DGEO path devices and equipment and pay Hydro One's costs of installing transfer trip/DGEO path devices and equipment; or
2. should the Project with TT/DGEO be able to send and receive independent transfer trip/DGEO signals to and from the Project(s) without TT/DGEO.

For greater certainty, the above terms do not apply where the Project(s) without TT/DGEO are able to send and receive TT/DGEO signals to and from Hydro One such that Hydro One is able to discern that the signals Hydro One is receiving are coming solely from an identifiable Project without TT/DGEO. However, the Connection Agreement may include information pertaining to the dependency of the Project without TT/DGEO on the other Embedded Generation Facility's path, devices and/or equipment as appropriate.

## **F. Connection Costs**

### **F.1 All Embedded Generation Facilities Other than Micro-embedded Generation Facilities**

For all proposed Embedded Generation Facility connections other than Micro-embedded Generation Facilities, an estimate of the cost to connect the Embedded Generation Facility is provided at the time the CIA is completed. The estimate is a Class C estimate, which is in the range of plus or minus 50%. The Embedded Generator has the option of requesting that Hydro One perform a detailed cost estimate at the Embedded Generator's expense. The CIA and cost estimate are valid for six months from the date of the CIA release.

All Embedded Generators who wish to connect an Embedded Generation Facility to the Distribution System are required to enter into a Connection Cost Agreement (CCA) with Hydro One within 6 months of the Embedded Generator receiving a capacity allocation as referenced in [section A](#) above for the Embedded Generation Facility. Where two or more Embedded Generation Facilities are being connected to Hydro One's distribution system at the same Point of Common Coupling, Hydro One will execute only one CCA with the Embedded Generators, and the Embedded Generators will be liable to Hydro One on a joint and several basis.

A Generator is responsible for all cost of connection of an Embedded Generation Facility, and, if applicable, any required changes to the Distribution System, unless the changes needed are an Expansion investment that does not exceed the Renewable Energy Cost Cap, or a Renewable Enabling Improvement required for the connection of a Renewable Energy Generation Facility, which is the subject of an application for connection to the Distribution System after October 21, 2009. When an Expansion is required to connect an Embedded Generation Facility, Hydro One will perform an economic evaluation in compliance with sections 3.2.5, 3.2.5A and 3.2.5B of the Distribution System Code.

The Embedded Generator is also required to pay all required deposits at the time the CCA is executed which will also include, where applicable, any amounts that Hydro One needs to collect from the Embedded Generator to reimburse to third parties as Upstream Transmission Rebates or



other rebates upon the connection of the Embedded Generation Facility. Failure to pay the connection cost deposit or other required deposits or to have a signed CCA in relation to the connection of the Embedded Generation Facility within the above-referenced timeline will result in Hydro One being required to remove the Embedded Generator's capacity allocation in accordance with [Section 6.2.4.1e](#) of the Distribution System Code.

The Key provisions of the CCA are described in Appendix A of Hydro One's Conditions of Service.

## **F.2 Micro-embedded Generation Facilities**

An Embedded Generator whose proposed Micro-embedded Generation Facility passes Hydro One's assessment will receive an Offer to Connect which includes a cost estimate for the work required to be performed by Hydro One in order for the Micro-embedded Generation Facility to be connected to the distribution system, the appropriate meter, and/or other material and equipment, as required, and any other applicable charges attributable to the proposed facility. As of the date of these Conditions of Service, Hydro One's costs are charged on an Actual Cost basis. The offer to connect and cost estimate will be valid for six months from the date of their issue by Hydro One.

## **F.3 Capital Contributions in Respect of Expansions**

**F.3.1** Where an Expansion is required for the connection of an Embedded Generation Facility, Hydro One will perform an economic evaluation using a discounted cash flow model in compliance with [Appendix B](#) of the Distribution System Code to determine the capital contribution payable by a Generator in respect of the Expansion which shall not exceed the Generator's share of the projected capital costs (equipment, labour, material) and ongoing maintenance costs of the facilities (the "Expansion Costs"). Projected revenue shall be assumed to be zero, unless otherwise determined by rates approved by the Board.

Hydro One shall deliver an offer to connect the Generation Facility that meets the requirements of [Section 3.2.8](#) of the Distribution System Code and where applicable, [Section 3.2.9](#) of the Distribution System Code. Hydro One's offer to connect in respect of any Expansion required to connect the Embedded Generation Facility will be attached to and form part of the CCA.

### **F.3.2 Expansion Capital Contributions - Renewable Energy Generation Facility**

Where an Expansion is required for the connection of a Renewable Energy Generation Facility, the Embedded Generator shall pay Hydro One a capital contribution where the Expansion Costs exceeds their Renewable Energy Expansion Cost Cap. When an Expansion is undertaken in response to requests for the connection of more than one Renewable Energy Generation Facility, Hydro One will apportion the amount of the capital contribution among the requesting Embedded Generators on a pro-rata basis based on the total name-plate rated capacity of the Renewable Energy Generation Facility of each Generator.

Hydro One will not charge an Embedded Generator to construct an Expansion to connect a Renewable Energy Generation Facility:

- (a) if the Expansion is in a Board-approved plan filed with the Board by Hydro One as per [Section 3.2.5 A](#) of the Distribution System Code; or
- (b) if the Expansion Costs are at or below the Renewable Energy Generation Facility's Renewable Energy Expansion Cost Cap as per [Section 3.25 B](#) of the Distribution System Code.

Subsection (a) above also applies to a request for the connection of more than one Renewable Energy Generation Facility. Subsection (b) above applies to any of the requesting Embedded Generators to construct the Expansion, when the costs of constructing the Expansion are at or below the amount that results from adding the total name-plate rated capacity of each Renewable Energy Generation Facility (in MW) and then multiplying that number by \$90,000.

### **F.3.3 Unforecasted Customers and Rebates**

As per [Section 3.2.27](#) of the Distribution System Code, unforecasted customers that connect to the distribution system during the Customer Connection Horizon will benefit from the earlier Expansion and should contribute their share. In such an event, the initial contributors shall be entitled to a rebate from Hydro One.

When the unforecasted customer is a Renewable Energy Generation Facility to which either [section F.3.2 \(a\) or \(b\)](#) above applies and the Customer entitled to a rebate is a Customer to which neither [section F.3.2 \(a\) or \(b\)](#) above applies, the initial contributors shall be entitled to a rebate. The amount of rebate is determined in accordance with [Section 3.2.27](#) of the Distribution System Code. Hydro One reduces the connecting Renewable Energy Generation Facility's Renewable Energy Expansion Cost Cap by an amount equal to the rebate. If the amount of the rebate exceeds the connecting Renewable Energy Generation Facility's Renewable Energy Expansion Cost Cap, Hydro One collects the difference from the connecting Renewable Energy Generation Facility in accordance with [Section 3.2.27 A](#) of the Distribution System Code.

In accordance with [Section 3.2.27 B](#) of the Distribution System Code, when an unforecasted Renewable Energy Generation Facility to which either [sections F.3.2 \(a\) or \(b\)](#) above applies (the "Unforecasted Renewable Generator") connects to the distribution system during the Customer Connection Horizon and benefits from an earlier Expansion made on or after October 21, 2009 to connect another Renewable Energy Generation Facility to which either [section F.3.2 \(a\) or \(b\)](#) above applies (the "Initial Renewable Generator"), the Initial Renewable Generator shall be entitled to a rebate. If the Expansion Costs of the earlier Expansion exceeded the Initial Renewable Generator's Renewable Energy Expansion Cost Cap, Hydro One will pay to the Initial Renewable Generator a rebate and collect a share from the Unforecasted Renewable Generator. The calculation of rebate and share will be on a pro-rata basis based on the total name-plate capacity of each Generator's Renewable Energy Generation Facility in accordance with [Section 3.2.27 C](#) of the Distribution System Code.

### **G. Commissioning**

All Embedded Generation Facilities with generation units with a name-plate rated capacity greater than 10 kW are required to successfully go through a series of commissioning tests before final Connection to the Distribution System will be permitted. Hydro One will provide the Embedded Generator with a list of testing requirements applicable to the Embedded Generation Facility. The requirements will be based on a number of factors, including size and type of generator units and type of connection. The Embedded Generator shall complete and confirm the completion of the commissioning testing through the Confirmation of Verification Evidence Report (COVER) process, as established by Hydro One. All costs associated with commissioning are the responsibility of the Embedded Generator.