

# Guidance Document: Distributed Energy Resource (DER) Project Connection Cost Information

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## Disclaimer:

This guidance document has been prepared by Hydro One Networks Inc.'s ("Hydro One") to provide Distributed Energy Resource ("DER") applicants with information on Hydro One's performance related to the estimation of DER connection costs (the "**Guidance Document**"), in particular, but not limited to, information on what a DER applicant can or cannot expect in terms of the accuracy of the estimates that Hydro One will or has provided to the DER applicant during the connection process in respect of the cost of the work to be performed by Hydro One on its distribution system and where applicable, its transmission system to connect the DER applicant's facility to Hydro One's distribution system.

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## Context

If sufficient connection capacity is available, Hydro One will provide any person who submits an application to connect a DER facility greater than 10 kW to its distribution system with a Connection Impact Assessment (CIA) study and a high-level cost estimate of the connection work that would need to be performed by Hydro One to connect the facility. This estimate issued by Hydro One is defined as a Class C estimate and has a general degree of accuracy of +/- 50%. While Hydro One strives to provide DER project applicants with an accurate estimate of their project's connection costs, DER applicants are required to pay the actual cost of their connection, which is determined after the facility is connected and energized to the distribution system.

To help guide and level-set expectations regarding the accuracy of its CIA estimates, Hydro One is providing the following information to DER applicants:

- 1) Estimated and actual connection costs for DER projects that have recently connected to Hydro One's distribution system
- 2) The typical cost range for connection work scope items that high variability and can affect estimate accuracy

The tables below provide connection cost information for DER projects that have connected to Hydro One’s distribution system over the last 1-2 years. Projects have been grouped based on size into three categories that reflect the general complexity of the connection. These tables are intended to provide an indication of Hydro One’s past performance of estimating connection costs for DER projects within each size category and should only be used by DER project applicants as an informational reference. The information below should in no way be viewed to guarantee a specific estimate accuracy tolerance range for a proposed DER project of a similar size and with similar connection characteristics.

**Table 1: DER Projects with a Nameplate Rating < 250 kW**

Project Type	Project Size (kW)	Connection Cost Estimate (\$)	Actual Connection Cost (\$)	Variance [Actual Estimate] (\$)	Variance %	Expansion Required (Y/N)	Transfer Trip
Exporting <sup>1</sup>	20	16,700.00	8,100.00	(8,600.00)	-51%	N	N
Exporting	50	19,000.00	12,400.00	(6,600.00)	-35%	N	N
Non-Exporting <sup>2</sup>	60	16,700.00	8,000.00	(8,700.00)	-52%	N	N
Exporting	200	25,300.00	15,100.00	(10,200.00)	-40%	N	N
Exporting	50	11,500.00	15,100.00	3,600.00	31%	N	N
Exporting	130	19,000.00	14,400.00	(4,600.00)	-24%	N	N
Exporting	20	16,700.00	13,100.00	(3,700.00)	-22%	N	N
Exporting	190	40,500.00	41,000.00	500.00	1%	Y	N
Exporting	70	19,000.00	15,900.00	(3,100.00)	-16%	N	N
Exporting	30	16,700.00	13,900.00	(2,800.00)	-17%	N	N
Exporting	20	9,200.00	13,300.00	4,100.00	45%	N	N
Exporting	30	16,700.00	16,000.00	(700.00)	-4%	N	N
Exporting	100	49,600.00	42,900.00	(6,700.00)	-14%	Y	N
Exporting	100	28,200.00	25,100.00	(3,100.00)	-11%	N	N
Non-Exporting <sup>3</sup>	30	4,600.00	9,200.00	4,600.00	100%	N	N
Exporting	20	8,100.00	9,000.00	900.00	11%	N	N
Exporting	40	16,700.00	15,900.00	(800.00)	-5%	N	N
Exporting	20	16,700.00	9,100.00	(7,600.00)	-46%	N	N
Exporting	80	43,000.00	43,100.00	100.00	0%	N	N

**Notes**

1. Overall design was simple; design, labour and meter installation costs were much lower than expected
2. Overall design was simple; design, labour and meter installation costs were much lower than expected
3. Project management and labour costs were much higher than estimated

**Table 2: DER Projects with a Nameplate Rating  $\geq$  250 kW and  $\leq$  1 MW**

Project Type	Project Size (kW)	Connection Cost Estimate (\$)	Actual Connection Cost (\$)	Variance [Actual Estimate] (\$)	Variance %	Expansion Required (Y/N)	Transfer Trip
Exporting	500	45,400.00	28,100.00	(17,300.00)	-38%	N	N
Non-Exporting <sup>4</sup>	500	19,000.00	6,800.00	(12,200.00)	-64%	N	N
Non-Exporting	750	17,900.00	25,500.00	7,600.00	42%	N	N
Non-Exporting	750	122,000.00	98,000.00	(24,000.00)	-20%	Y	N
Non-Exporting	1,000	69,000.00	60,000.00	(9,000.00)	-13%	N	N
Non-Exporting <sup>5</sup>	320	17,900.00	30,700.00	12,800.00	72%	N	N
Non-Exporting <sup>6</sup>	320	17,900.00	33,900.00	16,000.00	89%	N	N
Exporting	250	19,000.00	9,600.00	(9,400.00)	-49%	N	N
Exporting	250	16,700.00	8,700.00	(8,000.00)	-48%	N	N
Exporting	500	43,100.00	27,600.00	(15,500.00)	-36%	N	N
Exporting	500	45,400.00	48,000.00	2,600.00	6%	N	N
Non-Exporting	980	40,000.00	47,700.00	7,700.00	19%	N	N
Exporting	500	63,900.00	76,300.00	12,400.00	19%	N	N

**Notes**

4. SCADA and telecom work costs were lower than estimated
5. Project management and telecommunication work costs were higher than estimated
6. Project management and telecommunication work costs were higher than estimated

**Table 3: DER Projects with a Nameplate Rating  $>$  1 MW**

Project Type	Project Size (kW)	Connection Cost Estimate (\$)	Actual Connection Cost (\$)	Variance [Actual Estimate] (\$)	Variance %	Expansion Required (Y/N)	Transfer Trip
Non-Exporting <sup>7</sup>	4,000	784,000.00	357,500.00	(426,500.00)	-54%	N	Y
Non-Exporting	2,250	350,000.00	213,800.00	(136,200.00)	-39%	N	Y
Non-Exporting	10,000	375,000.00	278,100.00	(96,900.00)	-26%	N	Y
Non-Exporting	2,500	338,000.00	294,600.00	(43,400.00)	-13%	N	Y
Non-Exporting	8,290	72,000.00	87,400.00	15,400.00	21%	N	Y
Non-Exporting	3,000	92,000.00	66,900.00	(25,100.00)	-27%	N	Y
Exporting <sup>8</sup>	10,000	1,008,000.00	399,000.00	(609,000.00)	-60%	N	Y
Non-Exporting	1,270	142,000.00	119,200.00	(22,800.00)	-16%	N	Y

**Notes**

7. Project activity costs were lower than estimated resulting from various process efficiencies and timely customer touchpoints
8. Procurement and construction costs for the tele-protection scope of work was lower than estimated

Table 4 provides a list of the connection work scope items identified in the CIA that typically have high cost variability and the approximate cost of this work.

**Table 4: High Cost DER Connection Work Scope Items**

Project Type	Applicability	Approximate Cost (\$)
Station anti-islanding protection	Required for DERs $\geq$ 1 MW if the generation to minimum load ratio at the transformer station bus is $>$ 50%	50,000
Transfer Trip from feeder line recloser	Required for: (i) DERs $<$ 1MW if the generation to feeder minimum load ratio is $>$ 50% (ii) DERs $\geq$ 1MW	200,000
Transfer Trip from feeder protection at the station	Required for: (i) DERs $<$ 1MW if the generation to feeder minimum load ratio $>$ 50% (ii) DERs $\geq$ 1MW	300,000
HV Transfer Trip between upstream Transmission circuit breaker and the TS	Required for all DERs $\geq$ 1 MW if the upstream transformer station is supplied by a radial transmission circuit and the generation to minimum load ratio at the transformer station bus is $>$ 50%	300,000
Line backup protection	Required if HV transfer trip is required	500,000