

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

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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 with high variability that 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	30	27,900	15,600	(12,300)	-44%	N	N
Exporting	90	16,700	14,700	(2,100)	-12%	Y	N
Exporting	40	16,700	9,000	(7,700)	-46%	N	N
Exporting	120	26,500	25,800	(700)	-3%	N	N
Exporting	40	25,300	27,700	2,400	9%	N	N
Exporting ¹	30	9,200	14,100	4,900	53%	N	N
Exporting ²	30	16,700	7,900	(8,800)	-53%	N	N
Exporting	30	20,700	27,300	6,600	32%	N	N
Exporting	90	16,700	12,200	(4,500)	-27%	N	N
Exporting	60	25,300	24,300	(1,000)	-4%	N	N
Exporting	60	25,300	30,100	4,800	19%	N	N
Exporting	60	16,700	11,400	(5,300)	-32%	N	N
Exporting	20	25,300	15,500	(9,800)	-39%	N	N
Exporting	180	16,700	12,600	(4,100)	-25%	N	N
Exporting	20	16,700	11,700	(5,000)	-30%	N	N
Exporting	90	16,700	11,400	(5,300)	-32%	N	N
Exporting	100	37,900	32,900	(5,000)	-13%	N	N
Exporting	20	25,300	21,200	(4,100)	-16%	N	N
Exporting	95	16,700	19,800	3,100	19%	N	N
Exporting	30	25,300	15,300	(10,000)	-40%	N	N
Exporting ³	40	14,100	5,700	(8,400)	-60%	N	N
Exporting	30	19,000	15,000	(4,000)	-21%	N	N
Exporting	70	18,700	9,500	(9,200)	-49%	N	N
Exporting	70	27,000	19,200	(7,800)	-29%	N	N
Exporting	50	16,700	11,100	(5,600)	-34%	N	N
Exporting	100	28,600	15,100	(13,400)	-47%	N	N
Exporting ⁴	50	16,700	8,200	(8,500)	-51%	N	N
Exporting	30	24,400	20,400	(4,100)	-16%	N	N
Exporting	30	16,700	10,700	(6,000)	-36%	N	N
Exporting	30	16,700	10,600	(6,100)	-37%	N	N

Exporting	20	19,000	15,800	(3,200)	-17%	N	N
Exporting	50	16,700	9,000	(7,700)	-46%	N	N
Exporting	90	30,200	22,400	(7,800)	-26%	N	N
Exporting	100	16,700	12,200	(4,500)	-27%	N	N
Exporting	150	44,800	51,300	6,500	15%	Y	N
Exporting	50	16,700	9,400	(7,300)	-44%	N	N
Exporting ⁵	100	25,300	11,900	(13,400)	-53%	N	N
Exporting ⁶	30	16,700	7,400	(9,300)	-56%	N	N
Exporting	100	16,700	10,500	(6,200)	-37%	N	N
Exporting	100	39,200	26,700	(12,500)	-32%	N	N
Exporting	40	17,800	9,500	(8,300)	-47%	N	N
Exporting	230	21,600	15,600	(6,000)	-28%	N	N
Exporting	80	18,400	12,400	(6,000)	-33%	N	N
Exporting	30	16,700	13,400	(3,300)	-20%	N	N
Exporting	75	32,200	25,300	(6,900)	-21%	N	N
Exporting	60	18,400	11,600	(6,800)	-37%	N	N
Exporting	150	20,700	17,200	(3,500)	-17%	N	N
Exporting	75	18,000	11,300	(6,700)	-37%	Y	N

Notes

1. Project management and labour costs were higher than estimated
2. Overall design was simple; design, labour and meter installation costs were lower than estimated
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Table 2: DER Projects with a Nameplate Rating ≥ 250 kW and ≤ 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	900	57,000	47,100	(9,900)	-17%	N	N
Non-Exporting	999	20,000	17,800	(2,200)	-11%	N	N
Exporting	350	43,100	24,800	(18,300)	-42%	N	N
Exporting	260	45,400	31,900	(13,500)	-30%	N	N
Non-Exporting ⁷	330	32,800	13,400	(19,400)	-59%	N	N
Exporting	470	53,000	31,600	(21,400)	-40%	N	Y
Exporting	500	45,400	48,000	2,600	6%	N	N
Non-Exporting	980	40,000	47,700	7,700	19%	N	N
Exporting	500	63,900	76,300	12,400	19%	N	N

Notes

7. SCADA and telecom work costs were lower 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	1,200	312,000	316,500	4,500	1%	N	Y
Non-Exporting	10,700	516,000	378,900	(137,100)	-27%	N	Y
Non-Exporting	5,000	63,000	48,300	(14,700)	-23%	N	N
Non-Exporting	1,070	11,000	12,600	1,600	15%	N	N
Non-Exporting	6,180	250,000	243,100	(6,900)	-3%	N	Y
Non-Exporting	3,000	92,000	66,900	(25,100)	-27%	N	Y
Exporting ⁸	10,000	1,008,000	399,000	(609,000)	-60%	N	Y
Non-Exporting	1,270	142,000	119,200	(22,800)	-16%	N	Y

Notes

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