Atikokan Hydro DER Capacity Calculations

Purpose

The purpose of this document is to provide a detailed explanation of how remaining DER capacity is calculated. There are many factors that determine the remaining capacity on a feeder. These include thermal capacity of the lines as well as thermal capacity at the station, short circuit capacity and upstream transmitter capacity. When multiple factors apply, Atikokan Hydro displays the lowest as the remaining capacity.

Factors

Upstream Transmitter Capacity

Upstream Transmitter Capacity is determined by Hydro One Networks Inc. (HONI) and provided to Atikokan Hydro.

Short Circuit Capacity

Atikokan Hydro determines short circuit capacity by taking the interrupting rating of applicable feeder breaker and subtracting the available fault current at that breaker. Inverter based generation short circuit contribution has been assumed to be 1.2x nameplate rating for Atikokan Hydro's calculations. Non-inverter-based generation (e.g. rotating machines) short circuit contribution has been assumed to be 7x nameplate rating for Atikokan Hydro's calculations.

Feeder Thermal Capacity

Atikokan Hydro determines feeder thermal capacity by taking the ampacity of the overhead wire of the main trunk of the feeder. Then, a safety factor of 60% is applied to allow for contingencies and switching ability. After converting the ampacity to MVA, the connected total DER capacity on the feeder is subtracted from the conductor capacity to provide the remaining DER capacity.

Station Thermal Capacity

Atikokan Hydro determines station thermal capacity as 60% of the first contingency station transformer ONAN rating plus the minimum load. Minimum load is determined by taking the average daily recorded minimum load on the feeder excluding outliers. Connected DER on the station is then subtracted to determine the remaining station thermal capacity.

Categories

Micro

Remaining micro capacity is determined by taking 50% of a minimum load. Minimum load is calculated by taking the average daily minimum from SCADA data excluding outliers. Research have shown that islands will quickly collapse if the generation is less than half the load, so allowing DER without communications is acceptable.

Inverter Based Exporting

Inverter based exporting considers all categories. As outlined in the short circuit description a factor of 1.2x nameplate is used when determining short circuit contribution. In Atikokan Hydro's system, that has typically been the feeder thermal capacity. The limiting factor is displayed as the remaining capacity on the map.

Inverter Based Non-Exporting

Inverter based non-exporting distributed energy resources do not need to consider the feeder thermal capacity. However, upstream transmitter capacity, station thermal capacity and short circuit capacity still apply. Whichever is the limiting factor has been displayed on the map.

Non-Inverter Based Non-Exporting

Non-exporting DER does not need to consider feeder thermal capacity as the current will never be on the lines. As with inverter based non-exporting, upstream transmitter capacity, station thermal capacity and short circuit capacity still apply. For the short circuit contribution, a factor of 7x DER nameplate has been considered. Once again, the limiting factor is displayed on the map.

Non-Inverter Based Exporting

All factors are applicable for non-inverter based exporting DER. The limiting factor is displayed on the map.

References

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