



Substation Design and Installation for Canada's Largest Wind Farm

S&C Featured Solution: Project Management

Location: Sault Sainte Marie, Ontario

Customer Challenge

The Prince Wind Farm is the largest wind generation facility in Canada. Located on the northeast shore of Lake Superior in Sault Sainte Marie, Ontario, the facility can provide 189 megawatts of power from 126 wind turbine generators...enough energy for nearly 40,000 homes. It is an important contributor to the provincial government's goal to generate 5% of Ontario's energy requirement from renewable sources.

The wind farm has two collector substations that consolidate power from the 1500-kW wind turbine generators. The Prince 1 Collector Substation receives power from four feeders through the underground collector system connected to 66 of the generators. The Prince 2 Collector Substation receives power from three feeders through the predominantly overhead collector system connected to the remaining 60 generators.

Each collector substation includes a 60/80/100-MVA, 34.5-kV delta/240-kV grounded-wye transformer with automatic tap changer, which steps up the 34.5-kV collector system voltage to the 230-kV transmission system voltage level. SF₆ circuit breakers protect both the 34.5-kV and 230-kV systems. A main grounding transformer stabilizes and controls collector system voltage during ground faults. Each feeder also includes a grounding transformer that maintains the ground reference if the feeder circuit breaker is opened. A wind farm management system controls the individual turbines to maintain the required voltage at the interconnect substation. Extra-high bus maintains safe clearances during times of heavy snow cover, which can exceed 5 feet (152 cm).

The two collector substations are connected to a 6.6-mile (10.6-km) long transmission line. The Heyden Interconnect Substation at the other end of this line is the interface to the power transmission company.

S&C Solution

S&C Electric Company was the primary contractor for the two collector substations, the transmission line, and the interconnect substation, and it provided design and installation services, including:

- Project management
- Civil, structural, and electrical engineering and design
- Power system studies, including load-flow, short-circuit, coordination, and harmonic studies, and grounding analysis
- Equipment procurement
- Scheduling
- Permitting
- Construction and construction management, and start-up testing and commissioning

230-kV/34.5-kV Prince 1 Collector Substation.





S&C received notice to proceed with the project, and specific milestone dates had to be met. But with the demand on the transmission system and the criticality of this important infrastructure, outages needed to be planned very carefully—and only scheduled for off-peak times.

Heyden Interconnect Substation would need to be online and connected to the transmission system by a crucial completion date; missing it would result in many months delay to reschedule the necessary transmission line work. Close coordination with major equipment suppliers was essential, too. Woodland clearing could proceed during the winter but had to be completed prior to the spring thaw...when substation construction activities could begin.

Results

With relentless effort and an unfailing “can do” outlook, the S&C team met the crucial completion date. But even after the interconnection was completed, no respite was possible. The remaining facilities had to be completed quickly to get the turbine generators online and in operation before Lake Superior’s legendary “gales of November.” Commissioning of the Prince 1 Collector Substation was completed within the next two months. The Prince 2 Collector Substation was commissioned two months later...ahead of schedule.

230-kV Heyden Interconnect Substation.



230-kV/34.5-kV Prince 2 Collector Substation.

