Integration of an 88 km 220kV AC Cable into the Victorian Electricity Network in Australia.

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The Victorian desalination plant was commissioned in 2012 to provide a rainfall independent water supply for approximately 4 million people in Melbourne, Geelong and the surrounding areas. The plant is located near Wonthaggi 135 km southeast of the city of Melbourne. It treats seawater to potable standards using reverse osmosis technology. The plant has a production capacity of 150GLpa with the capability to expand to 200GLpa. The plant is capable of supplying approximately 30% of Melbourne's water requirements.

The plant is connected to the water and power networks via an 84 km transfer pipeline and an 88 km 220kV underground transmission line. The transfer pipeline and underground transmission line share the same easement for most of their length. The project also included a Booster Pump Station located approximately 75 km north of the plant

The design considered overhead, underground, HVAC and HVDC options for the transmission line. Following stakeholder engagement, the end client requested a dedicated, HVAC, underground link. The 88 km, 220kV alternating current underground cable is the longest of its type in the world.

The underground transmission line is designed to deliver 145MW to the desalination plant and 20MW to the Booster Pump Station. 500 mm^2 Cu XLPE 3x 1C cable is used for the first section connecting the electricity network at Cranbourne Terminal Station to the Booster Pump Station. 400 mm^2 Cu XLPE 3x 1C cable is used for the remaining sections to the plant. The cable system includes a 220kV shunt reactor station located approximately 38 km north of the plant.

The development of the cable system included detailed studies in order to determine the design arrangement and equipment specifications necessary to meet the functional requirements and those associated with the network connection. The studies identified many requirements particularly related to long cable systems:

- Cable specification
- Reactive power compensation
- Capacitive switching and DC aspects associated with switching a fully compensated cable
- Resonance following switching and due to harmonics
- Earthing and electromagnetic interference

This paper presents an overview of the cable system and the technical challenges that were overcome in its implementation. It provides a description of the various system components and the considerations that were used to define their specifications.