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Ingenuity for life

High performance at a compact size

Transformers for the offshore transformer
module (OTM[®]) made by Siemens

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The challenge

In 2016, Siemens won the order to supply wind turbines and grid connection for the Beatrice offshore project. The wind power plant should have a total capacity of 588 MW. Therefore 7-MW turbines will be installed.

To be able to transmit the energy produced (that will be sufficient to supply 400,000 UK households) a heavy-duty offshore solution is needed. However, to reduce platform size and cost, and conserve the environment, a special transformer solution is needed.

Beatrice Offshore Windfarm Ltd.

is a partnership formed between SSE (40 percent), Copenhagen Infrastructure Partners (35 percent) and SDIC Power (25 percent). The project will be one of the largest private investments ever made in Scottish infrastructure.

The solution

For the Beatrice wind farm, Siemens offered, among other products, two units of its modular OTM[®] concept, that saves space, weight, and cost.

The technical specifications for the three transformer units were to deliver 310 MVA units for the 220-kV level in heavy-duty design with ONAN (oil-natural/air-natural) cooling. To withstand the harsh environmental conditions, offshore design and an earthing transformer were mandatory. Synthetic ester was chosen as an insulation fluid to protect the sea from potential pollution in the unlikely case of oil spillage.

In close collaboration between different Siemens units and the customer a state-of-the-art offshore transformer module was designed. It contains an ultra-compact offshore transformer with a built-in earthing transformer and extremely low maintenance demand.

“Our OTM[®]-transformer adds to the profitability of renewable power generation by reducing footprint and cost.”

Dr. Beatrix Natter, CEO Siemens Transformers

The compact method of large-scale grid access

Technical features

1. Offshore features

A special requirement for offshore transformers is the special coating of the tank, radiators, and mechanical parts. Salt water is a harsh environment for a transformer – this is why a special treatment is mandatory for all offshore units. The coating of these transformers is executed in category C5-M, which is suitable for use under maritime conditions.

2. Synthetic ester insulation

Nearly all transformers for offshore applications these days are insulated with synthetic ester instead of mineral oil. Their obvious benefits are well known: operational and fire safety due to the higher flash- and flamepoint and environmental-friendliness. In the case of offshore applications, compactness and less construction work are also important advantages.

3. Compact design

The transformers for Beatrice have very small dimensions: 13,100 x 7,300 x 7,700 mm (L x W x H) at a total weight of only 326 tons. This results in lower costs for the construction of the platform itself – another win for the operator.

To save additional space on the platform for an earthing transformer, the earthing unit is built directly within the same tank as the transformer's active part. This saves additional weight by omitting an extra tank for the device. The earthing transformer is built in together with the active part and assembled and tested in the same transformer factory as the main unit. This design also reduces potential fault risks since all equipment is tested in the factory as one unit.

4. Cooling

Cooling a heavy-duty transformer is of crucial importance for its operation and lifetime. However, maintenance of an offshore transformer is an expensive task. This is why the transformers for Beatrice rely on ONAN cooling with radiators without fans. This design without moving mechanical parts requires low maintenance effort, is very robust, and also reduces potential fault risks of the cooling to a minimum level.

Additional information on OTM®

Offshore transformer modules from Siemens are one-third smaller in size and weight compared to a conventional alternating-current (AC) platform. Focusing on the core electrical equipment and removing a number of optional ancillary systems made this space and weight reduction possible, which also results in a reduced maintenance regime.

Benefits of the OTM® at a glance:

- Ultra-compact offshore transformer (lower weight and reduced platform cost)
- Built-in earthing transformer (weight reduction) – 100 percent assembled and tested in the transformer factory
- Heavy-duty ONAN design (no sensitive fans)
- Use of synthetic ester reduces platform cost especially for oil-collecting facility



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