



Reference report: Surf 'n' Turf energy generation system

A world first: On the Scottish Orkney Islands, electricity is generated from wind and tidal energy. A DC/DC converter from ARADEx supports energy management there in order to utilize the stored energy more efficiently.

The key facts

- + Energy generation with wind and tidal turbines
- + The world's first system for producing tidal fuel
- + Conversion of electrical energy using a 0.5 MW electrolyzer
- + Energy storage in the form of hydrogen
- + 75 kW fuel cell for reconvertng hydrogen into electrical energy, use of waste heat to heat buildings
- + DC/DC converter from ARADEx for connecting the fuel cell
- + Use of energy for charging electric vehicles and supplying power to harbor buildings
- + No CO₂ emission

The projects

At the end of September 2017, an innovative system for energy generation was installed on the Scottish Orkney Islands. Electrical energy generated by wind and tidal turbines is used to charge electric vehicles and supply energy to the harbor buildings – a system that is currently unique in the world! The so-called Surf 'n' Turf project is a cooperation of the non-profit organization "Community Energy Scotland", "European Marine Energy Center" (EMEC)", the "Orkney Islands Council", "Eday Renewable Energy", as well as "ITM Power".

The challenge

Orkney offers favorable conditions for a wind- and tidal-operated hydrogen production system. The local environment has a lot of wind, large waves, as well as considerable tide changes.

However, the remote geographic location results in high costs for energy storage, transport, and logistics.

The solution

To generate energy, wind and tidal turbines are installed on and off the island of Eday. The energy generated by the turbines is converted into hydrogen using a 0.5 MW electrolyzer at the EMEC tidal testing station on the Isle of Eday and then stored in tanks. To utilize the energy, the hydrogen is shipped to the port town of Kirkwall on Mainland Island. On the pier of Kirkwall, the hydrogen is then converted back into electrical energy using a 75 kW fuel cell system. This energy is available for charging the batteries of ferries and vehicles as well as for supplying energy to houses. The fuel cell system was provided by Arcola Energy in cooperation with Proton Motor Fuel Cells.

Because the fuel cells have a low (approx. 80 V) and fluctuating voltage level, a DC/DC converter is necessary to stabilize the voltage level and increase it to that of the overall system, in order for fuel cells to be efficiently integrated in an energy system. The Surf 'n' Turf project uses a VECTOPOWER DC/DC converter from ARADEX. The VP5000 DC/DC converter not only efficiently converts hydrogen to electrical energy, but its voltage compensation also protects the fuel cell against load changes that are too fast – which can considerably increase the life of the fuel cell.

In low-carbon Scotland, energy generation with wind and tidal turbines has a great potential for supplying energy with hydrogen. The initiator of the project, Paul Wheelhouse, the Scottish Minister for Business, Innovation, and Energy, has announced continued support for hydrogen as a substitute for CO₂ in the future as well.

The DC/DC converter allows efficient energy conversion with the fuel cell.



Fuel cell system of PM with DCDC converter



DCDC converter: VP5000

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