

Case Study - Hammerfest Strøm

Project Name	Hammerfest Strøm
Location	Norway
Installed capacity	300 kW
Technology Type	Tidal stream horizontal axis turbine (Blue Concept)
Project Type/Phase	Prototype testing
Year	Installation, 17 September 2003

Project Description

Hammerfest Strøm AS, a Norwegian company, in collaboration with ABB, Rolls Royce and Sintef, as well as Statoil, developed the first grid connected marine turbine rated 300 kW. The prototype was installed on 17 September 2003, in the Kvalsundet outside Hammerfest, northern Norway, at 50 metres depth. The submerged structure weighs 120 tonnes and has gravity footings of 200 tonnes. Its three-bladed turbine have been made in glass fibre-reinforced plastic and measure 10 metres from hub to tip.

By rotating the propeller blades around their own axis at slack water when the current turns, the mill is ready for the reversing current (pitch control) keeping the nacelle fixed. Each propeller is coupled to a generator from which the produced electricity is fed via a shore connecting cable to a transformer and then on into the grid. The turbines are designed to be maintenance-free for three years, but divers can go down if needed.

Locality and installation

Kvalsund county

- 1088 inhabitants;
- electricity consumption ~21 GWh.

Environmental and natural conditions

- the narrowest width of the strait is 400 meter;
- the mean velocity at the locality is 1.8 m/ sec;
- the depth is 50 m, allowing a sailing depth of 19 meter;
- an artery for ship traffic;

- abundant fish life;
- extensively used by the locals for rod fishing and trolling;
- sea mammals (e.g. seals, small whales) are common;
- many kinds of diving sea-birds have been observed including several protected species on the red list.

Thorough site surveys were completed to monitor the physical conditions of the energy capture and of the local eco-systems to assess their impact. Surveillance will continue as a part of the planned research work in Kvalsundet. Results will provide answers to some pressing questions to facilitate the commercial exploitation of tidal and other marine currents.

In order for surface vessels to maintain a stable position in the stream, two moorings are readied on the Kvaløy shore, one to the east and one to the west of the mill site. The required moorings on the mainland side are secured with anchor chains. For installation of the structure, which is the first sub-sea phase, a floating crane is used. When the crane lifted the structure off the transport barge in Kvalsundet, the first phase in the construction of the world's first tidal stream power plant was started.



Deployment of the first grid connected marine turbine in Kvalsundet (Norway)

The turbine has been in operation since 2003 with good results. It supplies 700 MWh per year – corresponding to the electricity consumption of 35 Norwegian homes. The only interruptions to production were to clean the rotor wings. According to the Norwegian Institute for Nature Research (NINA), no negative effects on marine life have been reported after several years of experimental operation in Kvalsundet.

The first generation of commercial mills is designed with twice the output of the prototype. The objective was for the tidal power plant in Kvalsundet to have 20 units which will deliver 32 GWh per year.

In the spring of 2007, Hammerfest Strøm signed a contract with the Scottish energy company Scottish Power to develop Norwegian technology for tidal energy in the UK. Scottish Power and Hammerfest Strøm have together founded the tidal power company Hammerfest Strøm UK. The goal is to install a full-scale tidal turbine in the UK in 2009. This is an important step on the path to commercialisation and mass production of tidal power technology.

Project Partners

The project consortium consists of partners with state-of-the-art competence from leading Norwegian research institutions and industrial companies. By integrating theoretical competence with practical experience, solutions are technically and economically sound, based largely on established technology.

Hammerfest Strøm AS is a Norwegian tidal water energy technology company established in 1997. It has been engaged in research and development of state-of-the-art tidal energy technology, and has obtained patents and rights to commercial use by delivering turn-key stream turbines. Hammerfest's two largest owners are Statoil, the Norwegian oil and gas company, and Hammerfest Energi, a power utility located in northern Norway.

Norwegian technological research institutions, such as SINTEF Energy Research and the Norwegian University of Science and Technology (NTNU), participate in the tidal power project of Hammerfest Strøm, together with many corporate R&D units. Outstanding among the latter are Statoil, ABB (Offshore Systems and Corporate Research), Rolls-Royce (technology, and products for ship thrusters), Selmer Skanska (technology for sub sea structures and their construction) and Venturos, all important partners technologically as well as financially.

SINTEF was on site with data acquisition and monitoring equipment, surveying the operation and securing the orientation of the propeller axis in line with the recorded current. StatoilHydro has played an important role in the development of technology for the tidal power turbine. They have applied their experience and expertise from subsea technology in the oil and gas industries to develop technologies for sustainable energy.

Cost and Financing

According to a statement from Harald Johansen, the managing director of Hammerfest Strøm, the project cost to date is \$6.7 million (50 million NOK) and will cost almost \$15 million, a total investment of 100 million NOK, to complete installation of all 20 turbines. The production cost of the electricity is 4.3 to 5 cents/kWh, three times that of typical hydro-generated electricity in Norway.

Further Information

<http://www.hammerfeststrom.com/content/view/48/78/lang,en/>

<http://www.e-tidevannsenergi.com/>