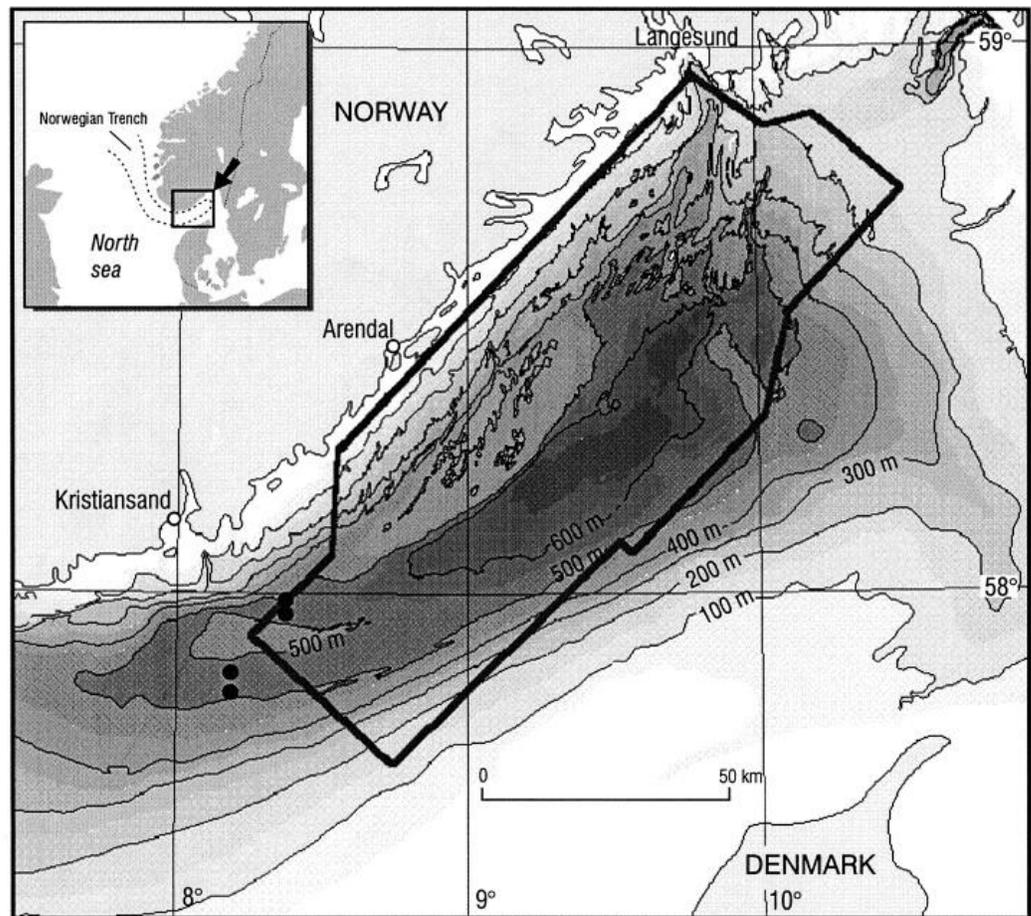


PUMP STORAGE DENMARK 2020



4/30/2012

Project Sketch

Pump storage station of Norwegian trench under Denmark

Pump storage Denmark 2020

PROJECT SKETCH

INSTIGATION

Denmark is one of the leading nations in the area of the wind power. Up to 2050 the country would like to cover 100% of his complete stream need about wind energy. However, Denmark owns no potential for conventional pumping storage technology. The topography of the country with maximum 170.86 m NN is not suitable for this form of the energy storage.

PROJECT DESDRIPTION

A pumped storage power station can use the hydraulic pressure of the North Sea at 500 m depth of the Norwegian trench. The following structure is necessary for this.

- Weathering and inspection shaft on mainland of Denmark (starting point tunnel drilling machine)
- storage tunnel under Denmark
- cavern for hydroelectric power plant at the edge of the Norwegian trench (turning point of tunnel drilling machine),
- pressure tunnel with intake structure from cavern to the Norwegian trench,
- regulating and closure devices (globe and check valve),
- hydraulic pump turbine with generator and electric diversion (separate cavern),

The storage is formed of two separate tunnels in the continental shelf of mainland Denmark. The twintunnels will be excavated in a depth of 400 to 500 m with a diameter of 12 to 15 m under the mainland of denmark to norway. The tunnel drilling machine is placed in the weathering and inspection shaft at the lower cretaceous and drives the tunnel 50 km. In the end of the tunnel in the rock under the North sea at the turning point of the tunnel drilling machine will be built a cavern for hydroelectric power plant. The distance from the cavern to the outer side of the rock massif is about 500 to max. 1000 m. A separate pressure tunnel with the intake structure will be connected the Norwegian trench with the cavern. At the intake structure will be installed regulating and closure devices.

The water flows through the pressure tunnels and pipelines to the storage tunnel and thereby drives 4 - 6 separate pump turbines (synchronous 2 - 4 and asynchronous machine). About these machines, the storage tunnels are also discharged again. The inspection shaft at mainland Denmark will be used for air shaft. An additional revision an assembly tunnel between the twin tunnels have to checked up.

The pump storage station will be have a min. Capacity of 2180 MW about 6 h with a storage of 12.000.000 m³. This is bigger as the pump storage stations Goldisthal and Adorf in Germany. It is possible to expand the capacity in the future.

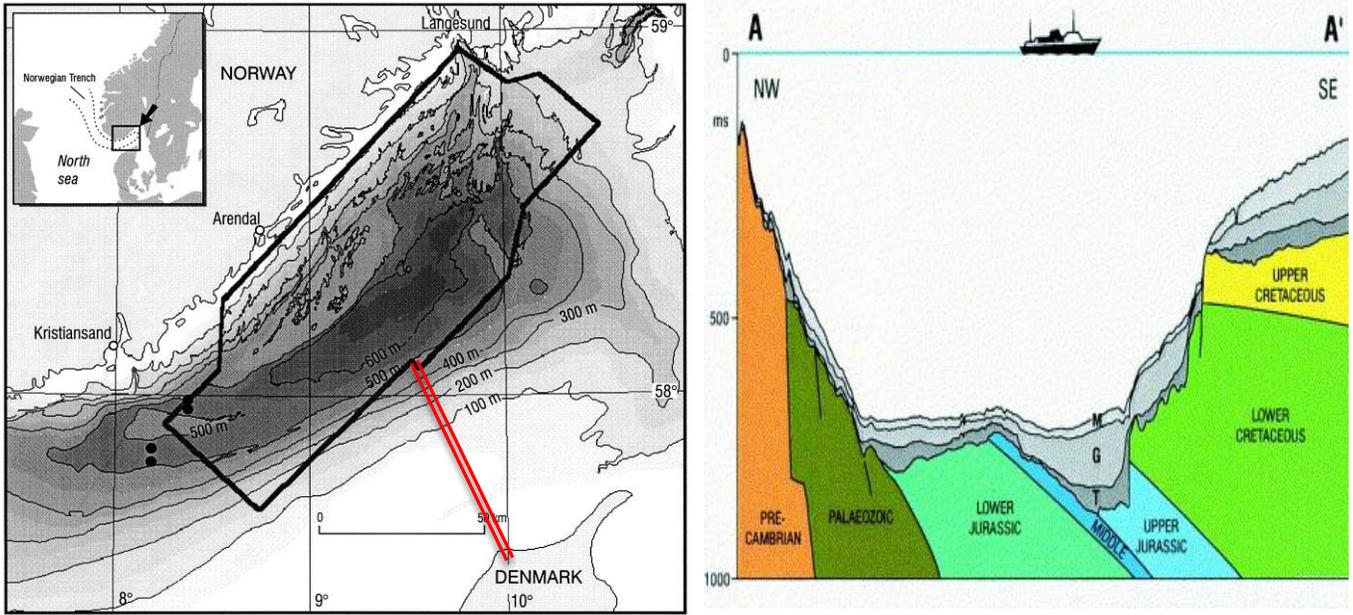


FIGURE 1 OVERVIEW AND CROSS SECTION

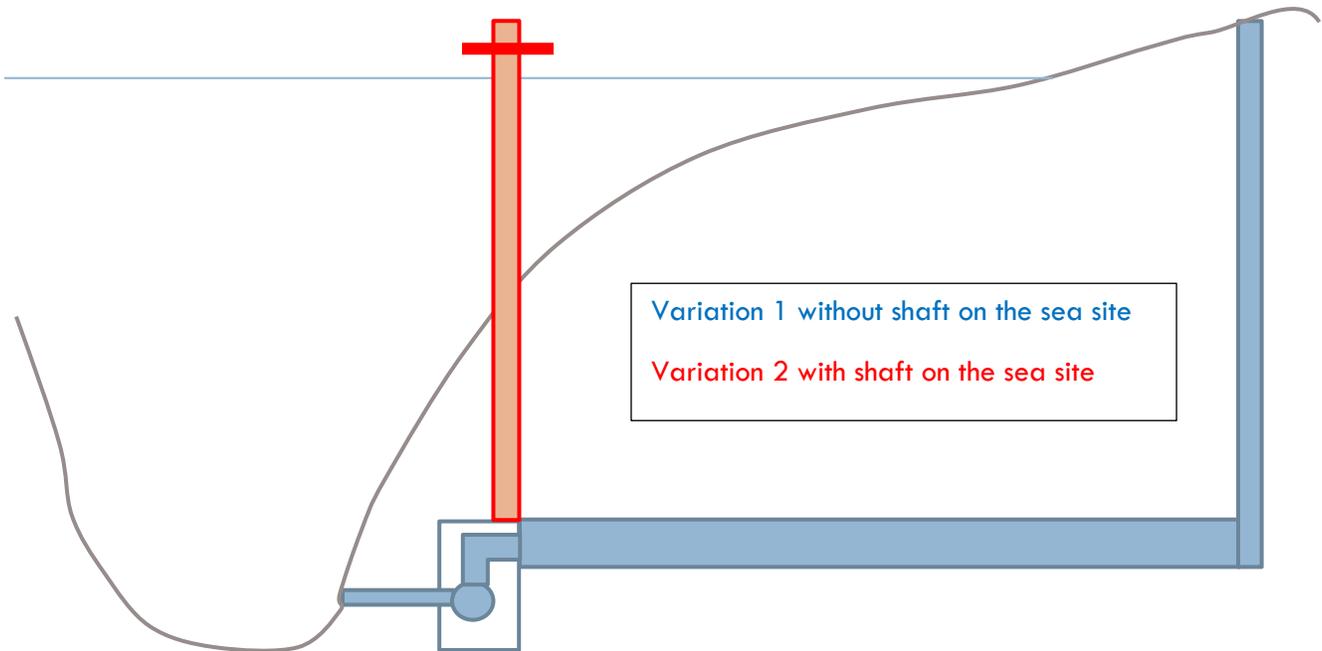


FIGURE 2 CROSS SECTION

PLANNING PROCESS

In a first step, we have secured the rights for the construction as part of an international patent. The Basis of the patent is a feasibility study. Currently, we review the framework for specific location in a potential and site study. After the completion of the site inspections, we submit the permit to the competent public authorities. The next steps for the design will be the measurement and the foundation ground expertise of the geologic formation. After the analysis of the foundation ground expertise we create the final design. Parallel we make the environmental impact study for the water use of Norwegian trench for fauna, hydraulic analysis. Our investor is looking for a regional partner and contact person in the political board of Denmark for encouragement.