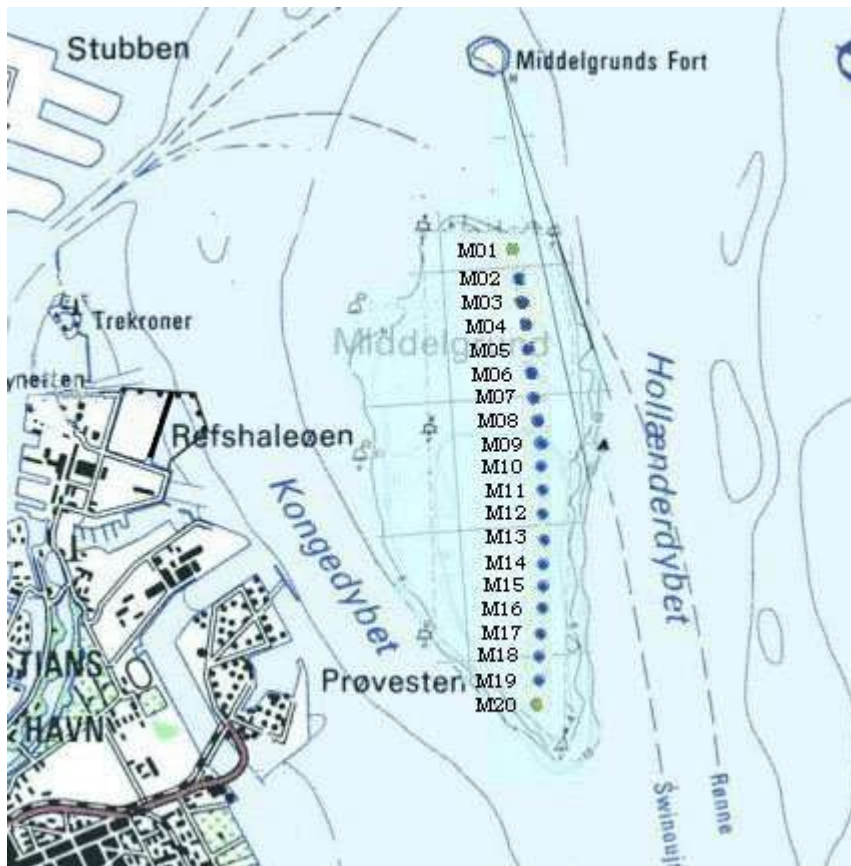
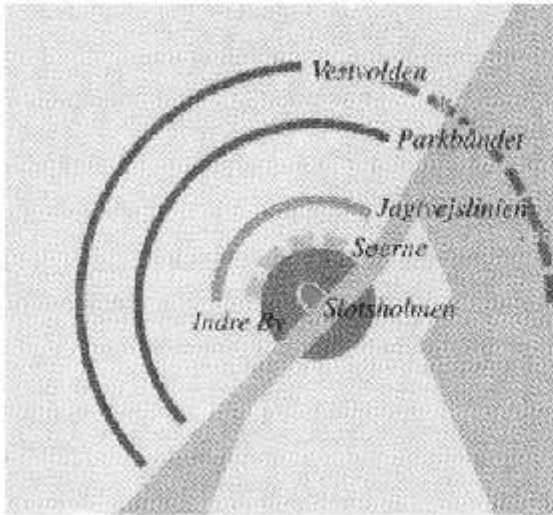


The location of the Middelgrunden Shoal

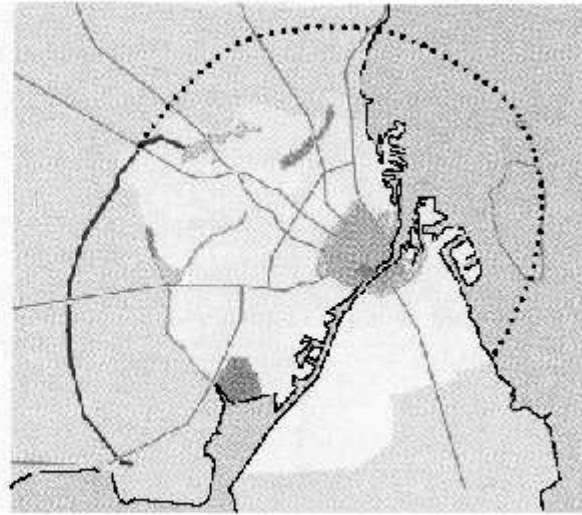


The Site

The shallow area of Middelgrunden is situated East of the northern tip of Amager. Here 20 wind turbines are installed in a slight curve with 180 metres distance and a total length of 3.4 kilometres. The total area is about 1 hectare. The curve draws a continuation of Copenhagen's structure, which has the shape of a superellipse represented by Vestvolden, Parkbuen and Ring road 2. Thorough pre-studies, financed by a DKK 5.1 million grant from the Danish Energy Agency and power utilities, have clarified all important project matters (planning, geotechnology, environment, etc.). The wind farm is established as a collaboration between the Middelgrunden Wind Turbine Cooperative and Copenhagen Energy, each installing 10 turbines. SEAS Wind Energy Centre is a business manager for both owners and as such for the whole project.



Logo



Kort

Middelgrunden

From 1980 the Middelgrunden shoal has been used as a dumping area. It is filled with materials from harbour construction work, building materials, etc. Today the water depth is 2-6 meters. To the north of the area lies a small artificial island, the protected Middelgrunden Fort. To the east of the area is the Flak Fort.

Wind Conditions

Wind conditions at the Middelgrunden site are well documented. The Wind Energy and Atmospheric Physics Department at Risø National Laboratory has measured the wind potential at Middelgrunden. The measurements show that the energy content at Middelgrunden is good enough to achieve a high energy production. The total effect of the wind farm will be 40 MW. The twenty 2000 kW turbines have a total estimated electricity production of about 89,000,000 kWh per year. This means that approximately 3% of the electricity consumption within the municipality of Copenhagen can be covered by these wind turbines.

Contractors

The wind farm consists of twenty 2 MW wind turbines from Bonus Energy A/S. The wind farm is built in co-operation with Copenhagen Energy that owns 10 turbines. The foundations are built by Monberg & Thorsen A/S that have experience from many large-scale constructions and who made the foundations for the Vindeby offshore wind farm. Finally the grid connection is provided by NKT Cables. Since all chosen companies are Danish owned, the entire project has been carried out by Danish labour force.



Bonus Wind Turbines

The wind turbines Bonus 2 MW are delivered by Bonus Energy A/S. It is the oldest wind turbine factory in the world. It has delivered more than 3,500 turbines since 1980. So far, the 2 MW turbine is Bonus' biggest with a generator effect of 2000 kW, a hub height of 64 metres, and a rotor diameter of 76 metres. It has the same basic concept as the Bonus 1 MW and Bonus 1.3 MW. Like these, it is based on experiences from the 600 kW turbine type, which is installed at Lynetten in the Copenhagen harbour. The basic construction of the Bonus 2 MW turbine is adjusted to the rough offshore climate conditions. It has hermetically closed machinery and is cooled with heat exchangers. A built-in crane can assist in turbine maintenance. The state of the turbines and their output can be surveyed and regulated by an advanced control system. Bonus gives the Middelgrunden project a five-year guarantee on the blades and the gear.

Grid Connection

The wind turbines are connected by a 30 kV electricity grid. Each turbine can produce independently of the farm's other turbines. The energy is routed to the central turbine (#10) which is the main connection point of the farm. The co-operative has paid for and owns the switchgear and the cables between their turbines. From the central turbine the energy is transported through a 30 kV submarine power cable to the Amager Power Plant at the eastern coast of Amager. This cable is constructed and managed by Copenhagen Energy.