

A photograph of several white offshore wind turbines in the ocean under a clear blue sky. The turbines are arranged in a line, receding into the distance. The water is a deep blue, and the sky is a lighter blue. A semi-transparent blue rectangular box is overlaid on the bottom half of the image, containing white text.

OFFSHORE WIND ENERGY

Capability statement

WWW.RAMBOLL.COM/ENERGY

CONSULTANCY SERVICES WITHIN OFFSHORE WIND ENERGY

Currently, 3GW of global wind energy is installed offshore, equalling 3% of the installed wind energy capacity worldwide. This number is expected to increase 25 times by 2020. The advantages of placing wind farms at sea are numerous. They are able to produce up to 100% more electricity than onshore wind turbines due to higher and steadier wind speeds across open water. Other advantages include greatly reduced visual impact, opportunity of larger turbines – allowing a larger production of wind energy.

Ramboll offers a full range of services on offshore wind projects from planning and project development, to design, implementation and follow-up on operation and maintenance, and finally decommissioning. Our unparalleled track record in the design of offshore foundations for wind turbines enables us to produce cost optimal foundation designs using any relevant foundation concepts in steel or concrete.

Project development

Development and evaluation of project feasibility is often an iterative process, based on constant refinement of basic data and assumptions, and by provision of increasingly detailed factual data. Ramboll is experienced in evaluating project feasibility via estimates and assessments of life time costs and income, usually performed on a probabilistic basis, and often in connection with the complete time schedule.

Basic project data

Based on factors such as the

choice of turbine and site conditions, Ramboll carries out all the necessary analyses to select the foundation type best suited for the project. These analyses include modelling and assessment of met-ocean data, geophysical and geotechnical investigations, wind studies, EIS and EIA, and navigational risk analyses.

World-leading foundation design

Ramboll is the only company in the world that has carried out detailed design of 21 offshore wind farms for five different turbine types, and we are currently one of the few design firms capable of performing load iterations with the turbine manufacturers. The designs are carried out by means of advanced state-of-the-art software developed in-house.

Project approval and certification

Most projects require a project certification, and some require e.g. the German BSH approval, in order to have them approved by the financial community and the insurers. We have obtained certification of 21 offshore wind projects. Further, we have obtained approvals of projects by both the German BSH and the Prüfungsingenieur institution.

Contract management

We contribute with engineering and design services to all phases of the construction work and perform supervision of fabrication of elements for the project. We act on behalf of the developer during the testing, commissioning and handing over of the projects to ensure that the project fulfils the contractual requirements.

What is offshore wind energy?

A wind turbine captures the energy of moving air and converts it to electricity. Most turbines have three aerodynamically designed blades. When the wind passes over the blades, they spin a shaft, which connects to a generator that produces electricity. The output of a wind turbine depends on the turbine's size and the wind's speed through the rotor. Typically offshore wind turbines have a capacity of at least 3 MW, producing more than 12 million kWh in a year – enough to supply 2,500 average households with electricity.

CONTACTS

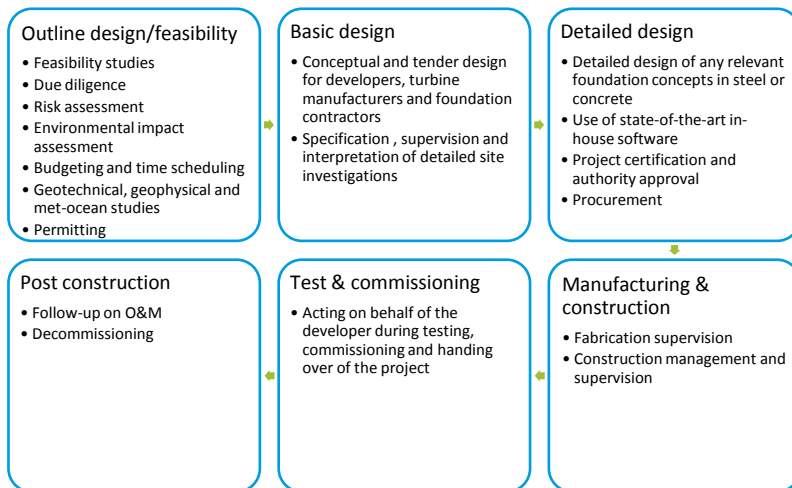
Klaus Jacob Jensen
Division Director
kjj@ramboll.com
Phone +45 51618617

Søren Juel Petersen
Business Devl. Director
sjp.ramboll.com
Phone +45 51618760

Henrik Carstens
Technology Director
hec@ramboll.com
Phone +45 51617124

Ramboll's services

Once an offshore wind farm has been decided, Ramboll typically provides support and advice as the owner's engineer throughout the development process on relevant technical, environmental and financial matters. Our clients include project developers, utilities and contractors, and our services include:



Why choose Ramboll for your offshore wind energy project?

- World leader in offshore foundation design for wind turbines
- Have performed more than 1200 individual foundation designs for 21 offshore wind farms around the world, totaling more than 50% of installations
- Offer full-range services
- 25 years of experience from offshore oil and gas structures, which is applied for detailed design of transformer platforms

Selected project references

- **Greater Gabbard:** Flour Limited, 26km off the Suffolk coast, UK, 504 MW, 2008-2010
- **Walney I and II:** DONG, 13.5 km off the Isle of Walney, Irish Sea, UK, 367 MW, 2007-2010
- **Gwynt Y Môr I and II:** Gwynt Y Mor Offshore Wind Farm LTD (a joint venture between RWE Innogy, Stadtwerke Munchen and Siemens), 13-20 km off the coast of North Wales, UK, 576 MW, 2009-2011
- **Anholt:** DONG/Energinet.dk, in the Kattegat strait of the North Sea between Jutland and the island of Anholt, Denmark, 400 MW, 2010-2011
- **Amrum Bank:** E.On GmbH. The North Sea 50 km off the Germany coast, 288 MW, 2011-2012



Ramboll's geographical offshore wind project experience



Offshore wind energy in Ramboll

Number of specialists: **100**
 Annual turnover: **€9Million**
 Years of experience: **20**

Biomass
Biogas
Combined heat and power
District heating
Energy and climate
Energy efficiency
Energy strategy and planning
Geothermal energy
Hydro power
Offshore wind
Onshore wind
Power
Power transmission
Solar energy
Tidal and wave power
Waste-to-energy