TIDAL TURBINE FOUNDATIONS

SUPPORT AND INSTALLATION DESIGN

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The UK tidal stream resource is estimated at 10% of the world's supply and in the future this could provide 5% of the UK's electricity demand*.

There are current leases of 1GWe in UK waters and this is projected to grow to upwards of 40GWe by 2050**. This would represent tens of thousands of devices installed in the waters around the UK and elsewhere.

Fast Developing Technology

Tidal stream technology is developing rapidly and there are many promising device types at prototype stage operating at test sites such as EMEC.

By their trial nature, many of these are supported on foundations that are not suitable for mass production and the next critical stage is the development of repeatable efficient foundations that can be applied to arrays of 10 or more and then eventually to larger farms in the mode of the offshore wind sector.

Unique Tidal Stream Challenges

The challenges associated with tidal stream foundations are unique and require new ideas to design efficient and economically viable structures. Uneven rocky seabeds, combined with very high current speeds, water turbulence and a structure that can only be accessed remotely are among the many challenges being resolved by Ramboll.

Installation in tidal flows is a major consideration and the techniques used also need considerable development to go cost-effectively from prototype to array and large farm.

Ramboll is currently working on a 10MW array from concept study to detailed design for both foundation design and installation methodology. This is drawing on our considerable experience in marine engineering for both the Oil and Gas and Offshore Wind sectors.

Concept Development and Structural and Geotechnical Analysis

Ramboll have a long track record of inventive and innovative design in the marine environment and for taking advantage of the repeatability of structure for the renewable sector such as in offshore wind.
We have developed an in-house software package "ROSAP" that includes hydrodynamic, static and dynamic loading, structure/soil interaction, push over analysis and fatigue life calculations.
ROSAP has been instrumental in our success in the design of offshore wind foundations and it is being used extensively in our analysis of the 10MW tidal test array.

Offshore Installation Methodology

Ramboll have been involved in the installation of many offshore structures over the past three decades and installation and transportation analysis is integral to our work on the offshore wind foundations.

Ramboll is working closely with specialist sub-contractors on the installation methodology of a 10MW tidal test array to develop techniques such as dynamic positioning and subsea pile drilling that can reduce the critical installation programme.

Certification

Ramboll have extensive experience in gaining certification for novel and new offshore technologies from our experience in both Oil and Gas and Offshore Wind and are working closely with the 3rd party approver on the 10MW tidal test array.

Tidalstream Project References

- Aquamarine Tidal Stream, UK project 2007-2008 - Structural design of prototype and integration of electrical and mechanical systems.
- Tidal Generation Limited, UK project 2011-2012 - Structural and installation methodology design of prototype and integration of electrical systems.

Tidal Energy

Tides are caused by the gravitational effects of the sun and the moon on the water bodies of the earth, offering a limitless and highly predictable source of renewable energy. The water depth changes caused by the gravitational pull can be captured by tidal range devices and the water flow can be harnessed by tidalstream devices to produce electricity. The range and flow speed are effected by local conditions of sea shore and sea bed and some of the most promising areas for tidal stream power generation lie off the coast of the UK.

* Per the Carbon Trust
** Department of Energy and Climate Change

Ramboll is a leading engineering, design and consultancy company founded in Denmark in 1945. We employ close to 10,000 experts, and with more than 200 offices in 23 countries we emphasise local experience combined with a global knowledge base. We constantly strive to achieve inspiring and exacting solutions that make a genuine difference to our customers, end-users and society as a whole. Ramboll's Offshore Wind division has almost 100 dedicated employees situated in our three main offices in London, Copenhagen and Esbjerg as well as in our hub offices in Hamburg and New York.

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