DTOcean+, an open-source software suite to design and optimise tidal and wave farms, will be released soon

An ambitious European project to accelerate the development of the ocean energy sector

The FP7 funded DTOcean project (2014-2017) produced a first generation of freely available, open-source design tools for wave and tidal energy arrays. Built upon this solid foundation, DTOceanPlus (2018-2021) with a total budget of 8 million euros, developed and demonstrated a suite of second-generation **advanced design tools for the selection, development, and deployment of ocean energy systems**. The consortium was formed to **bring together representatives of all key user and stakeholder groups and developers** of Europe's leading ocean energy sub-systems, devices, and arrays. Two US institutions also took part in the project.

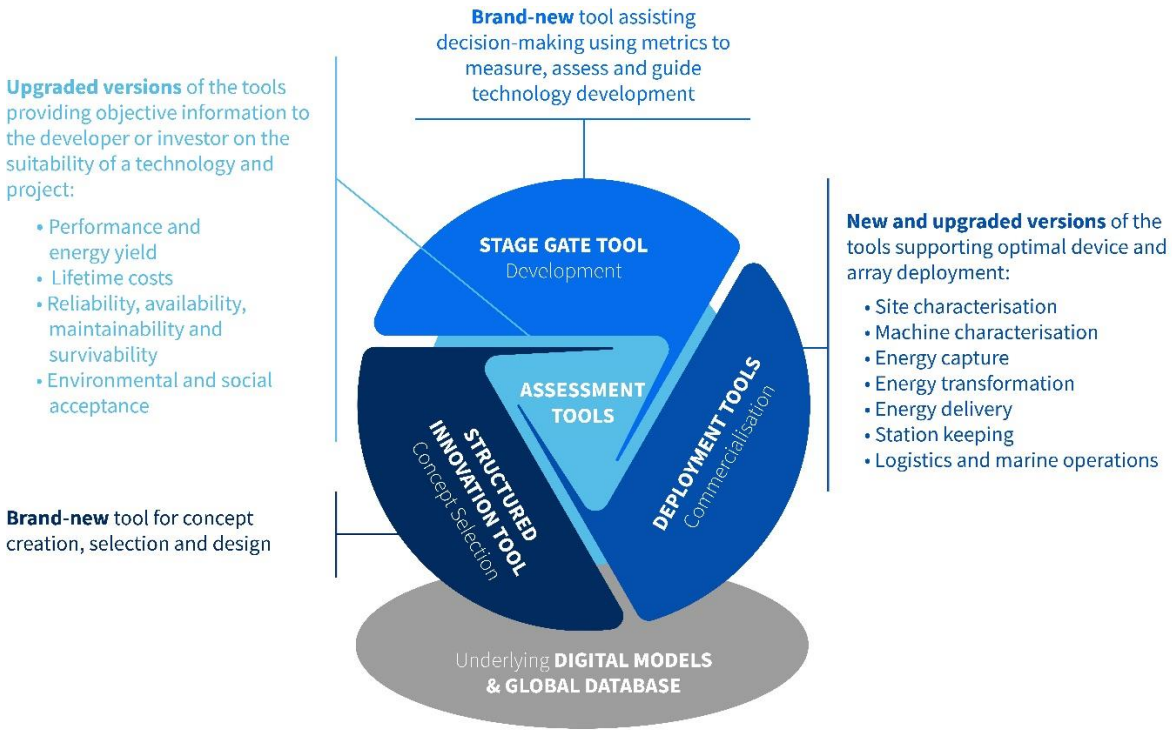
Users of the DTOcean+ suite of tools will be able to generate designs for **innovative ocean energy technologies** and deployments. These designs are **optimised for a wide variety of key metrics** including lifetime costs, reliability, availability, maintainability, survivability, performance, environmental impact and socio-economic impact. They also **balance technological and financial risk** which, in combination with greatly improved **cost effectiveness**, ensure that ocean energy technologies become significantly more commercially attractive.

Tecnalia
University of Edinburgh
Energy Systems Catapult
Wave Energy Scotland
France Energies Marines
WavEC Offshore Renewables
Aalborg Universitet
Enel Green Power
Bureau Veritas
IDOM Oceantec
Nova Innovation
CorPower Ocean
Open Cascade
Energias de Portugal
Orbital Marine Power
Sabella
Sandia National Laboratories
National Renewable Energy Laboratory

DTOceanPlus partners

An open-source integrated suite of design tools

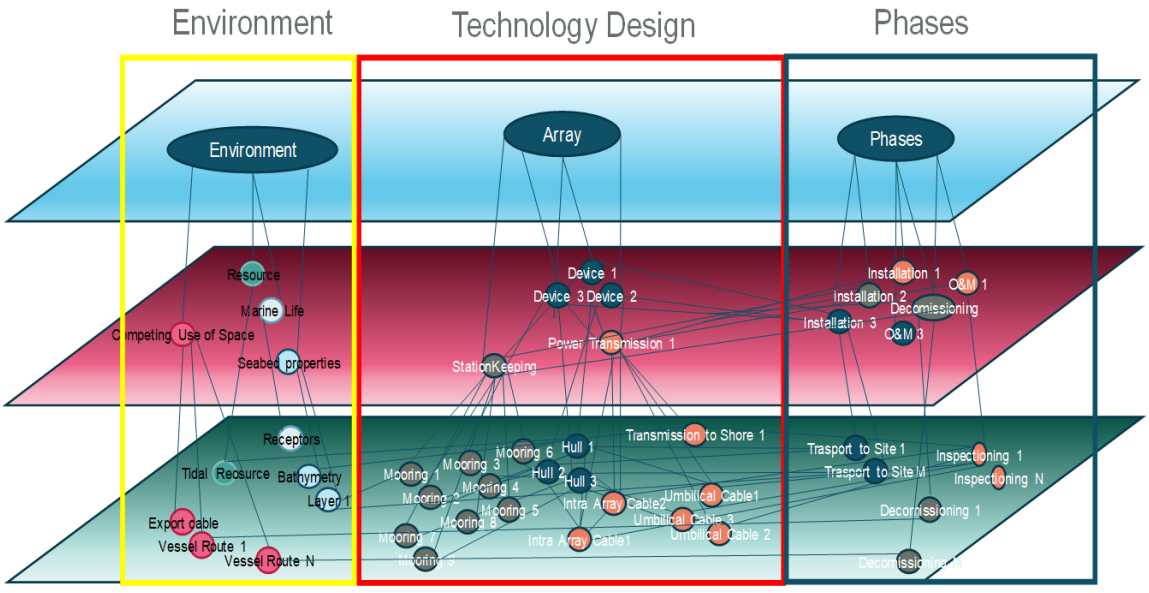
The **functional requirements** of the software suite were developed considering both the expectations of potential users, identified during a consultation phase, and the functionalities not covered by the various tools available on the market. Feedback from the DTOcean project has also proved very valuable. **Standalone versions of the different tools** were first developed: the core functionality of each individual tool or module was complete and could run independently. In order to provide additional valuable results to the users, the **whole software was integrated and data flow between modules were optimised**. Then, **real scenarios** were run by the industrial partners of the project demonstrating the applicability of the tools to concept generation and selection, technology development, farm deployment and optimisation. **The final public release of the open-source software will be at the end of August 2021**. To support the future users in their various uses of the suite, project partners are preparing tutorials and user guides that will be released at the same time.



Simplified presentation of the design tools composing the DTOceanPlus software suite

A framework to standardise the data formats of ocean energy systems design

There is currently no standard method of describing the key characteristics and attributes of ocean energy technologies. Without such a standard, it can be difficult, if not impossible, to objectively analyse innovative technologies and compare competing technologies. In the context of DTOceanPlus project, a framework was developed to **standardise the data formats describing an ocean energy design so that it can be used as a common interchange language among different sector actors**. This has been done by means of the definition of a digital representation for the elements of the whole system at **different levels of aggregation** and accounting for **different levels of complexity** of the project. In order to fully capture the main aspects of an ocean energy system, the digital representation framework has accounted for: elements of the technology design, phases of the technology lifecycle and constraints from the context; a vertical dimension that describes a set of hierarchical connections among subsystems and components; a transversal dimension accounting for the individual and specific components of the system.



Incomplete example of the digital representation of an ocean energy system

A detailed analysis of the ocean energy market

Given the large potential of ocean energy sector, a review of **current market** sizes, potential applications, geographical locations, and **future outlook** of the markets was prepared. Then, an assessment of the **supply chain across Europe** was carried out to deliver a complete understanding of the current and future supply chain, and to guide sustainable exploitation of the software in the sector. A cost-benefit analysis was conducted considering both **technology push and market pull funding** options for achieving or surpassing **long-term cost reduction targets.** In combination, the analysis considered gross value-added and other **environmental and socioeconomic** benefits. Standard approaches to business management models were developed; combining the value of the DTOcean+ toolset with a knowledge of both the potential markets that ocean energy technology can be applied to and the supply chain in place to exploit the opportunities. They include pricing methods which can support development of business, funding and support cases. A critical evaluation of the ocean energy sector's **legal, institutional and political frameworks** was carried out by analysing barriers or enabling features for the deployment of ocean energy during both the development and industrial roll out stage of both wave and tidal energies.

DTOceanPlus in short

Subject
Development and testing of a suite of digital tool for the design of tidal and wave systems

Duration
40 months
(May 2018 to August 2021)

Budget
€8 million

Funding
EU Research and Innovation Programme H2020

Leader
Tecnalia (Spain)

Partnership
16 EU partners + 2 US laboratories

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 785921.