

## Release of DTOcean+, an open-source software suite to design and optimise tidal and wave farms

### 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.

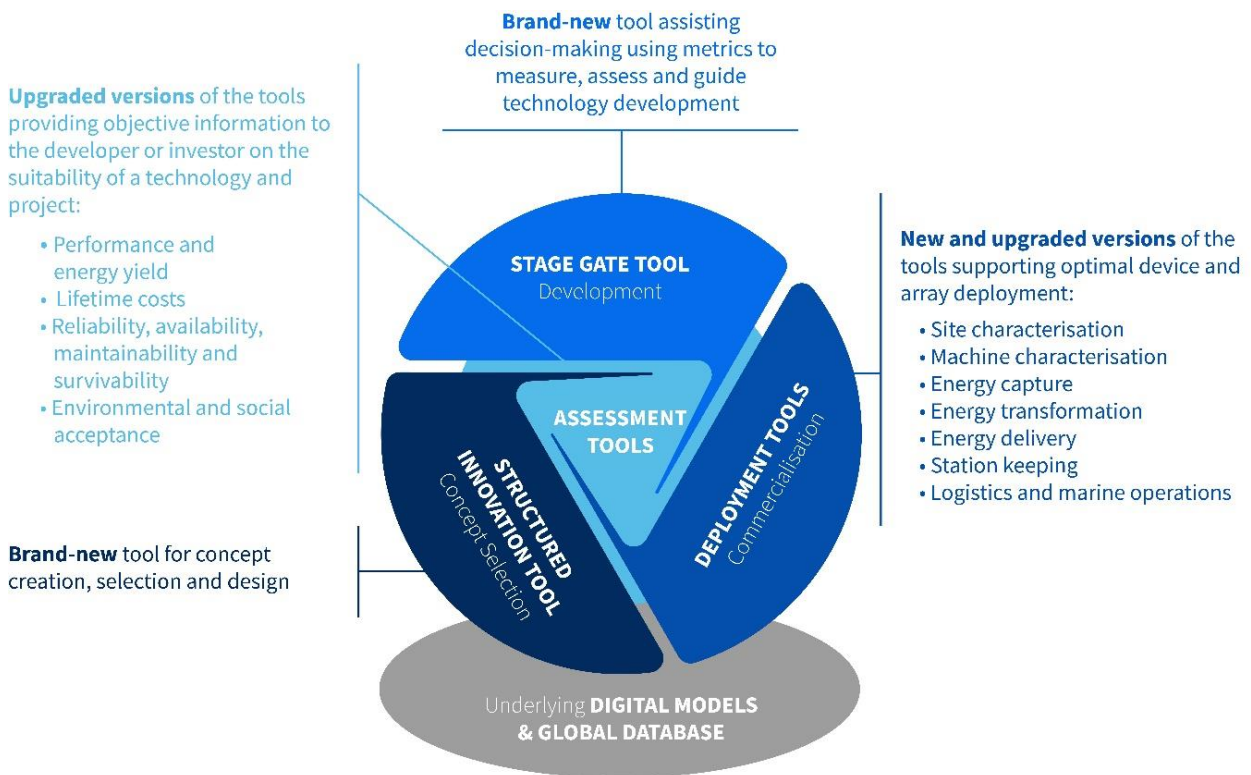


- Tecnalia
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- Energy Systems Catapult
- Wave Energy Scotland
- France Energies Marines
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- Open Cascade
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- Sandia National Laboratories
- National Renewable Energy Laboratory

*DTOceanPlus partners*

### A TRL6 open-source integrated suite of design tools

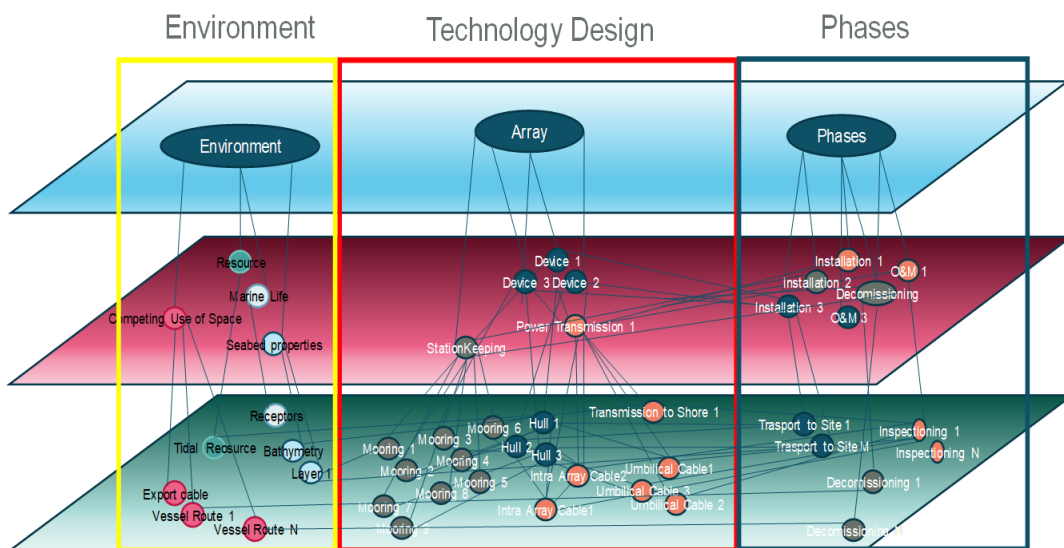
The **functional requirements** of the software suite were developed considering both the expectations of potential users, identified during a consultation phase, and the functionalities not covered by the various tools available on the market. Feedback from the DTOcean project has also proved very valuable. **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**. This has resulted in the creation and the implementation of a **global database**, and the development of a **main application** to manage projects and design workflow among and between the different modules. Then, **real scenarios** were run by the industrial partners of the project demonstrating the applicability of the tools. **The final release of the software is now available** in the form of a **TRL 6 product** with tutorials and user guides. The open-source nature of the tools allows **the open-source community to continue** the development, the optimisation and further validation of the tools, as well as adding functionalities as the ocean energy sector develops and new needs are identified.



*Simplified presentation of the design tools composing the DTOceanPlus software suite*

### A data format standardisation for ocean energy systems design

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** (from component to farm) and accounting for **different levels of complexity** of the project (from simplified to detailed case). 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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[dtoceanplus.eu](http://dtoceanplus.eu)