ETIP OCEAN
European Technology & Innovation Platform for Ocean Energy

OES OCEAN ENERGY SYSTEMS

Use of internationally agreed performance metrics in project development as part of Horizon Europe Ocean Energy funding applications

Pablo Ruiz-Minguela

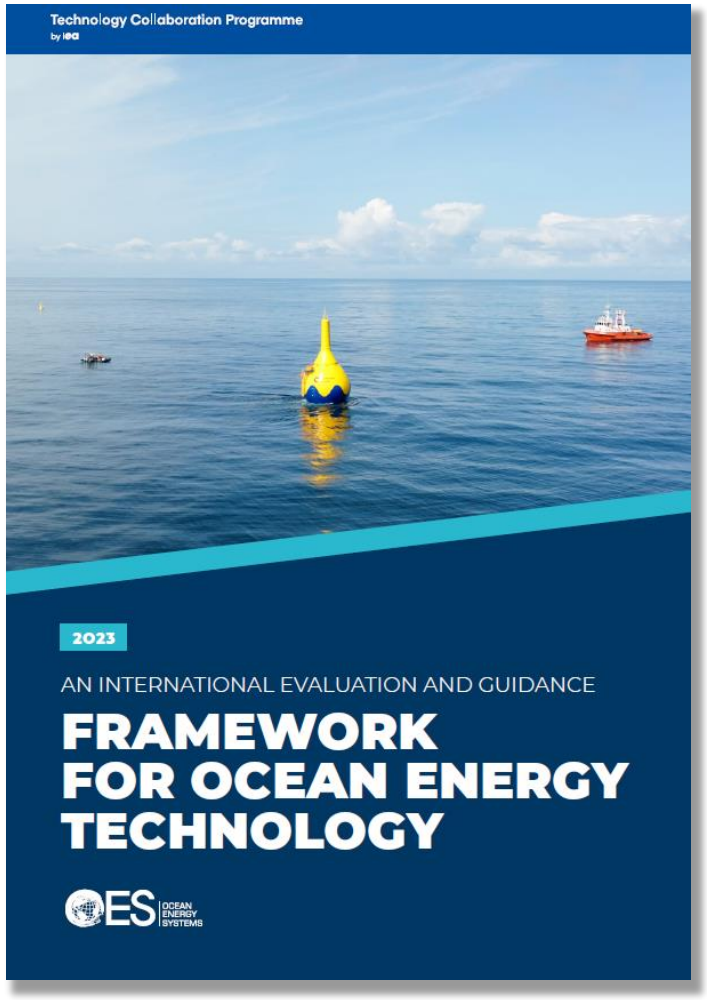
Assessing the readiness of an ocean energy technology

Technology Collaboration Programme
by IEA

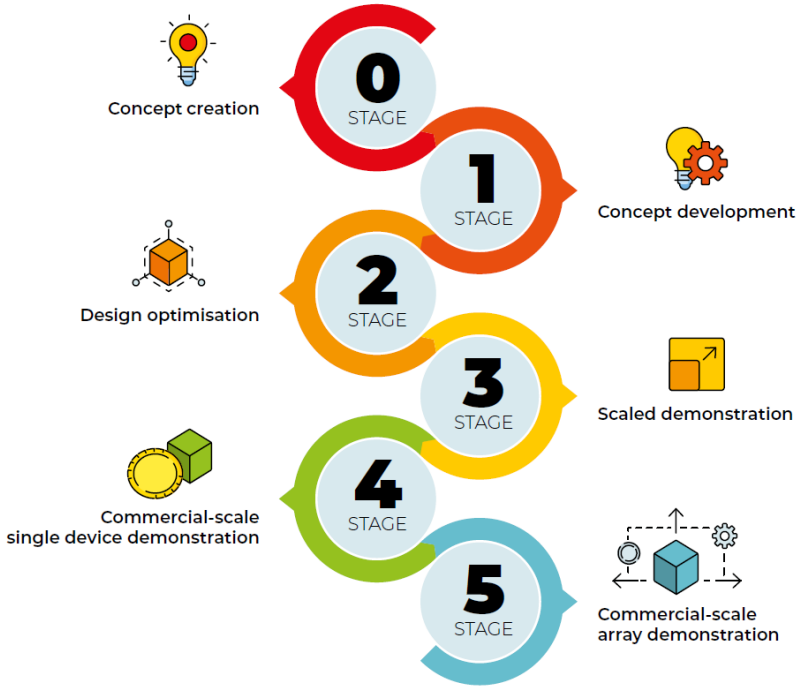
Contents

- OES Framework 2nd Edition
- Stage Activities
- Self-Assessment
- Activity Checklist
- Illustrative Example

OES Framework 2nd Edition



Technology Development Stages



Evaluation Areas

+ Stage Activities & Evaluation Criteria
+ Alignment with complementary guidance, e.g. IEC standards

Stage Activities

Used to check prerequisites and demonstrate your compliance against them

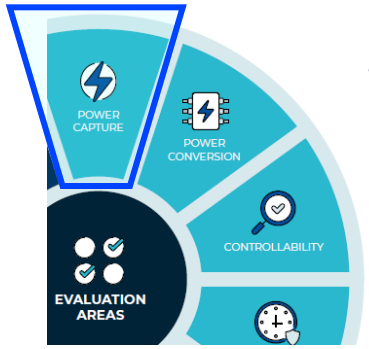
Stages: Entry/Exit TRL

Stage	Description	TRL
Stage 0	Concept creation	1
Stage 1	Concept development	2 3
Stage 2	Design optimisation	4
Stage 3	Scaled demonstration	5 6
Stage 4	Commercial-scale single device demonstration	7 8
Stage 5	Commercial-scale array demonstration	9

Early (1-3)
Analytical and numerical models

Mid (3-6)
Experimental tests in controlled environment

Late (6-9)
Experimental tests in representative environment



Expected Outcome

Activities: Detailed research scope

Stage 4
Commercial-scale single device demonstration

- Further development and refinement of a detailed numerical model with integrated subsystems to cover full operational envelope
- Open-water testing (uncontrolled environment) of a single device at commercial scale in a commercially representative site, with fully functional commercial-standard subsystems
- Open-water test campaign should be of sufficient duration, with no significant periods of operational interruption, to thoroughly evaluate the device power capture performance. For wave and tidal stream devices, this is expected to be at least 12 months in order to experience the full range of expected operating conditions, taking account of seasonal variations and providing the opportunity to evaluate different system and subsystem settings
- Validation of the numerical model using all available appropriate data.

Already completed

Stage 5
Commercial-scale array demonstration

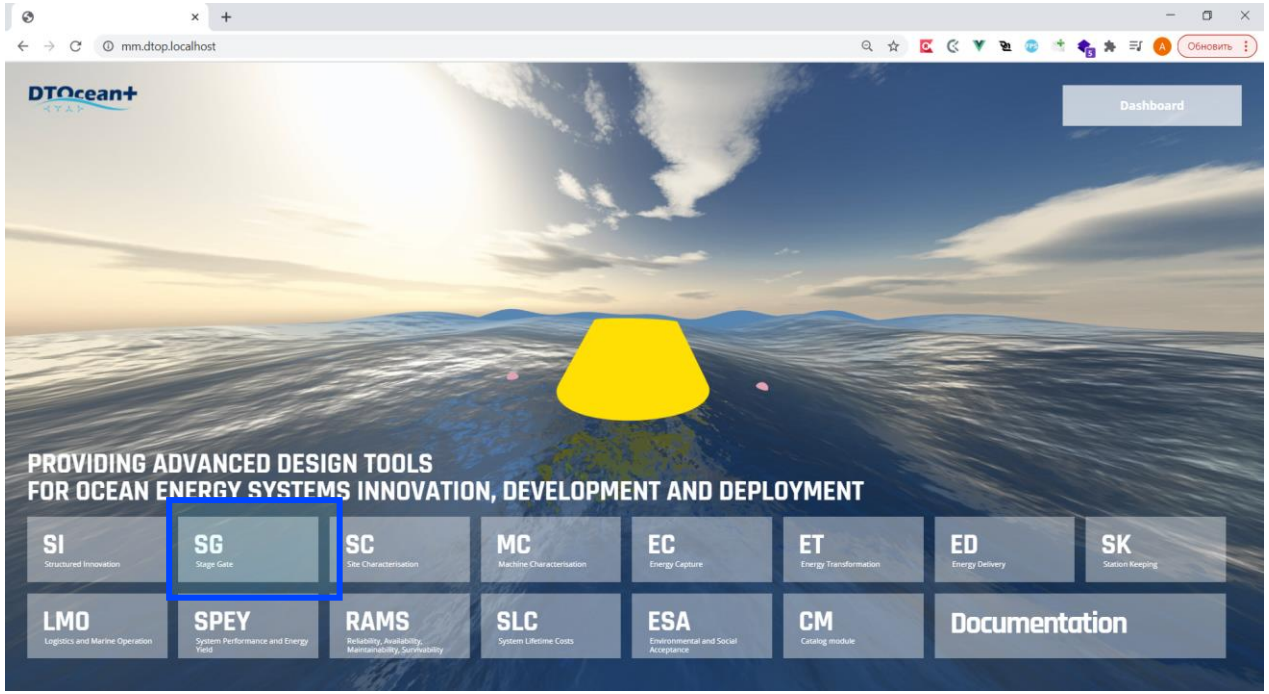
- Additional numerical modelling and analysis to assess array-related hydrodynamic interaction between devices to reflect the installed array configuration and future array deployments
- Selection of array layout based on hydrodynamic modelling and array interaction analysis
- Open-water testing (uncontrolled environment) of an array of at least 2 commercial-scale devices[1], in a commercially representative site, with fully functional commercial-standard subsystems
- Open-water test campaign should be of sufficient duration, with no significant periods of operational interruption, to evaluate the array power capture performance to a high degree of confidence. For wave and tidal stream devices, this is expected to be at least 2 years in order to experience the full range of operating conditions and build statistical significance of performance characteristics
- Ongoing validation of a detailed numerical model with integrated subsystems, to cover the full operational envelope
- Validation and ongoing optimisation of any algorithms to vary controllable parameters, such as PTO settings (damping, force or speed restrictions) or device geometry.

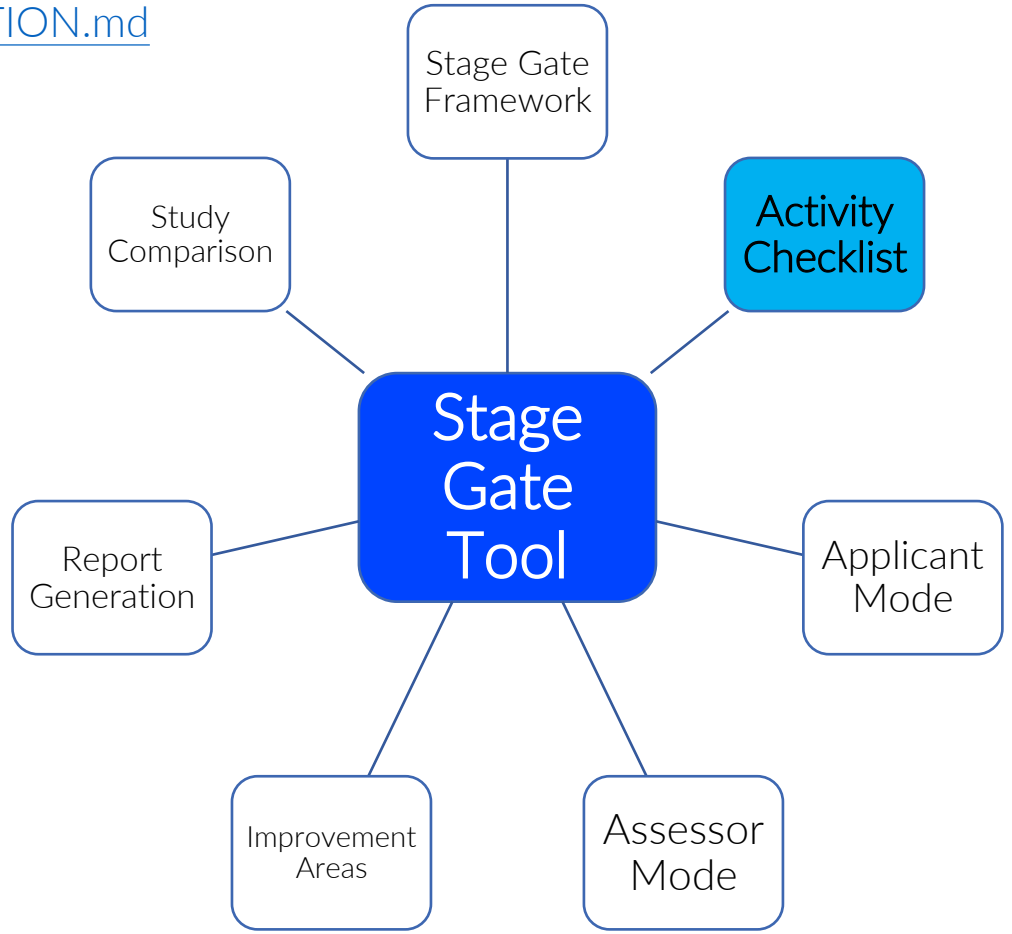
Technical work plan

Self-Assessment Tools

DTOceanPlus: An integrated open-source suite of modular design tools for ocean energy systems

- https://dtoceanplus.gitlab.io/documentation/
- https://gitlab.com/dtoceanplus/dtop_inst/-/blob/master/INSTALLATION.md

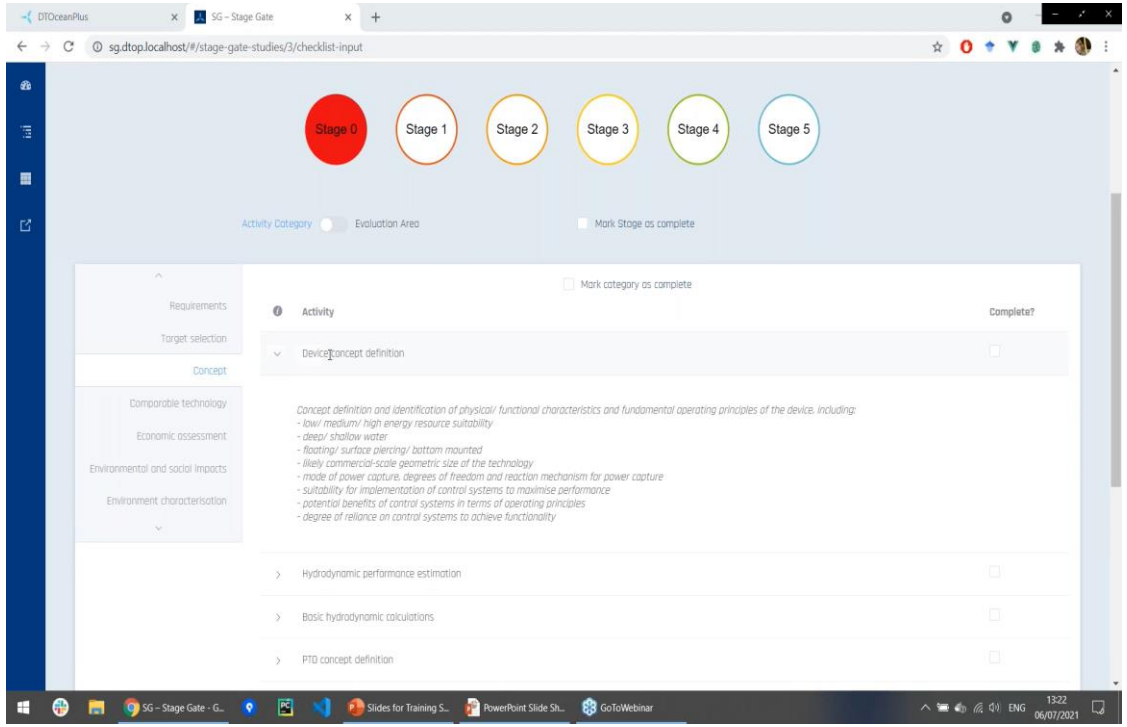




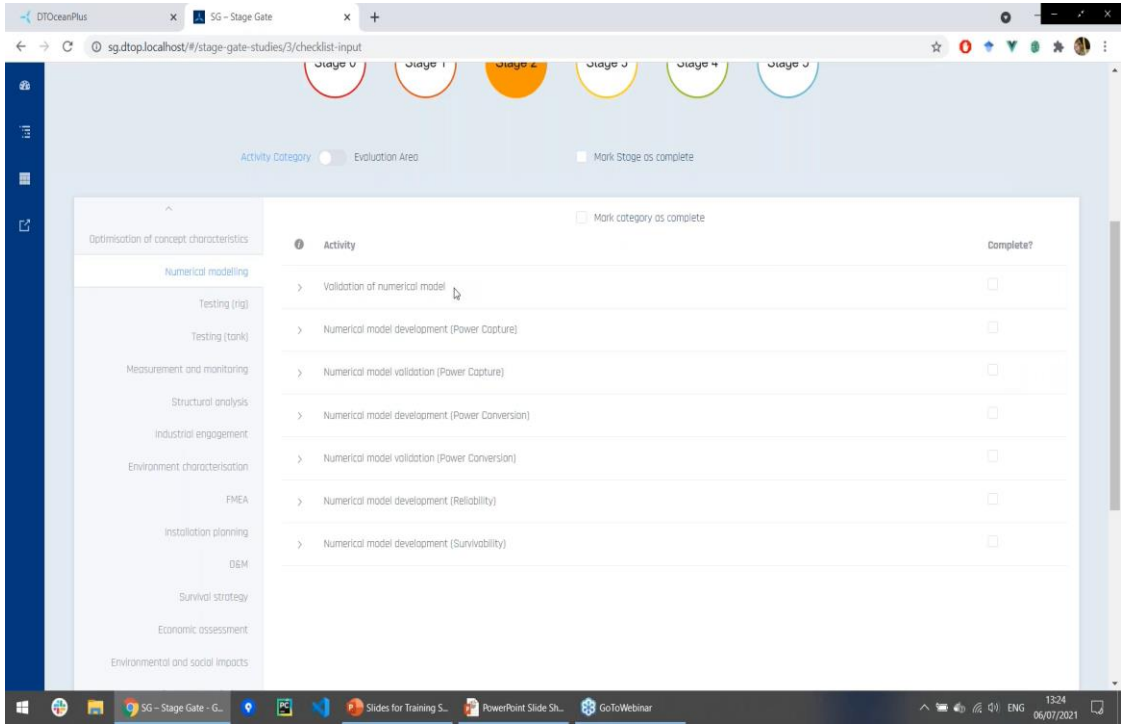
Activity Checklist

Presents the set of activities that need to be completed at each Stage organized by:

Activity Category



Evaluation Area

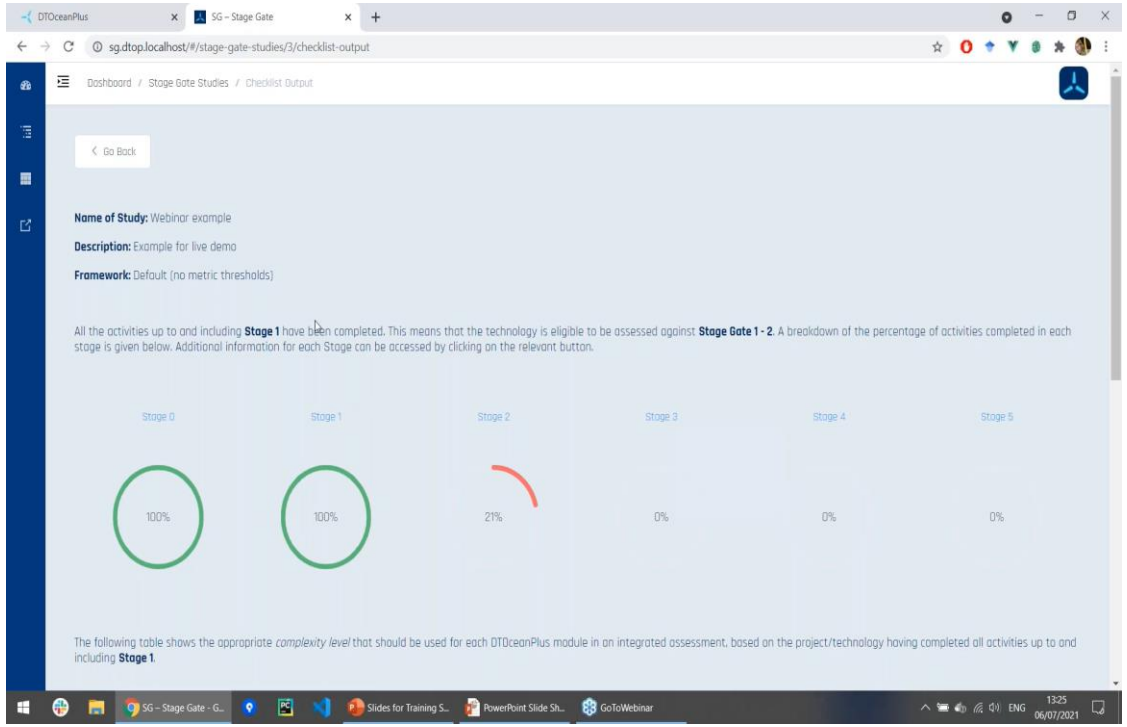


Helps identify the technology readiness level of a device or technology

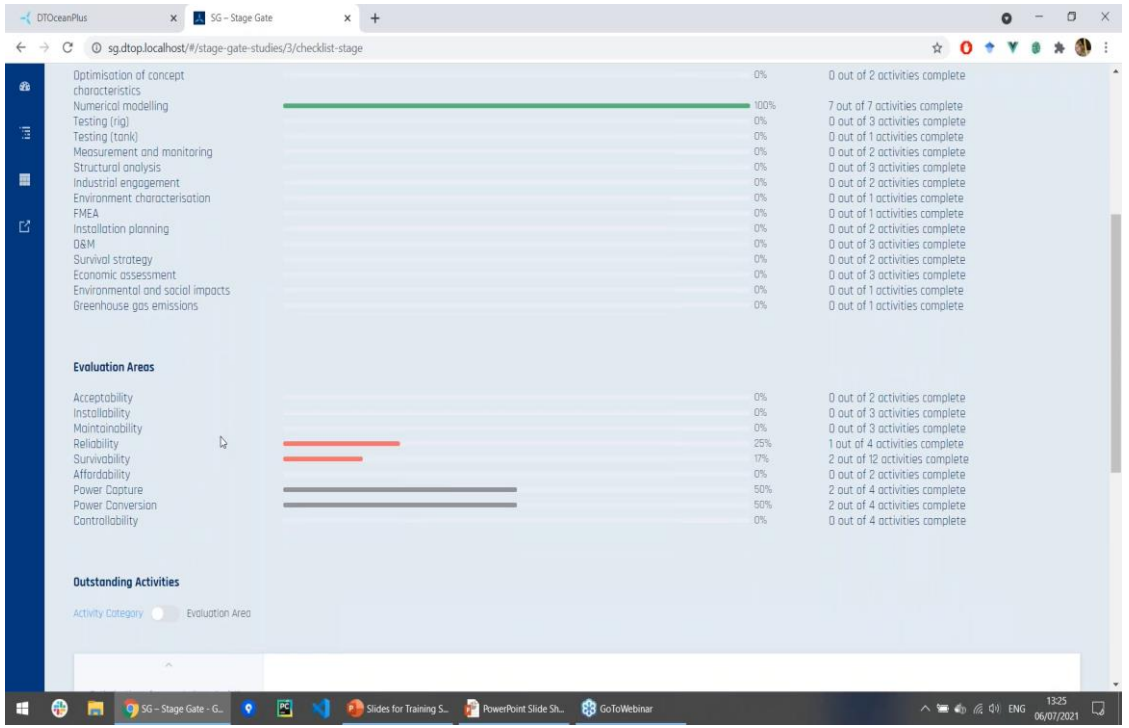
Activity Checklist

Main outputs include:

A summary of the status of the technology



Completed and outstanding activities



A standardised report summarising all input and output data

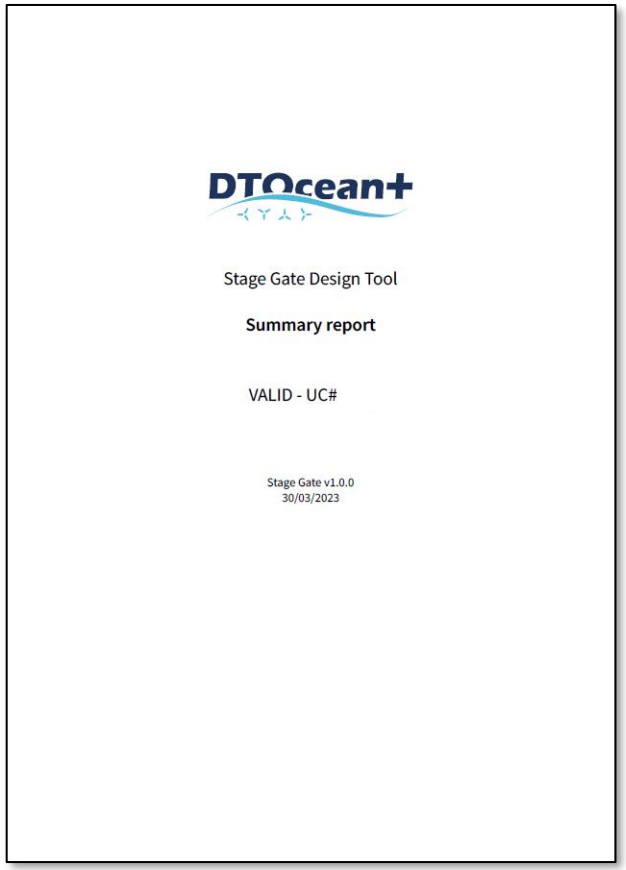
Illustrative Example

VALID

CorPower Ocean

IDOM

WAVEPISTON

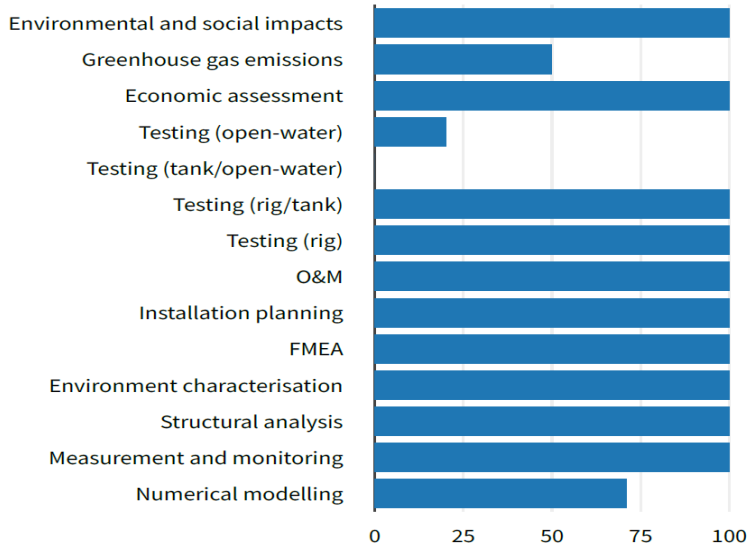


ETIP OCEAN
European Technology & Innovation Platform for Ocean Energy

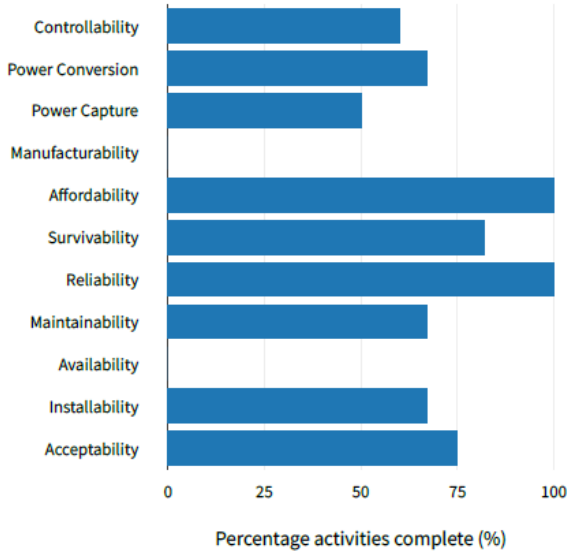
OES OCEAN ENERGY SYSTEMS

Percentage of activities completed in each stage

Activity Categories



Evaluation Areas



ETIP OCEAN
European Technology & Innovation Platform for Ocean Energy

OES OCEAN ENERGY SYSTEMS

Thank you