

# DTOceanPlus: Stage Gate Webinar

Questions and Answers

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## 1. How do you aggregate the evaluation areas into a score?

This particular logic is not yet finalised but at present there are two ways to aggregate the scores for each evaluation area. In Applicant Mode, a metric result is converted to a percentage score by comparing it to the threshold set by the user. The average of all of these scores for a single evaluation area is the score that you could see on each axis in the radar chart. We will more than likely use a weighted average for some of the evaluation areas (e.g. the LCOE metric is the most important in the 'Affordability' evaluation area), but we are still finalising these decisions. The second way is to use the scores given by the user when the tool is run in Assessor Mode. The questions of a Stage Gate assessment are weighted. These weightings will be combined with the assessor scores to obtain the aggregated scores in this case.

Note that this means if the user does not specify any thresholds or run the tool in Assessor Mode, it is more difficult to aggregate the results into single scores for each evaluation area. But we are thinking of ways around this.

## 2. Is it restricted to EU-members?

No. It will be open-source and freely available to everyone.

## 3. As a public-funder it would be interesting to understand the criteria being looked at for decisions on funding and also to understand the assurance around the validation of the data?

Wave Energy Scotland uses pre-commercial procurement approach to provide up to 100% funding to technology developers as they progress through a 3-stage development programme. At the completion of Stages 1 and 2, the technology developers pass through a robust Stage Gate assessment. This reviews their performance and achievement against target outcomes to date, their proposed approach for the upcoming stage, and it is completed by an independent panel of external experts in the technology area who are complemented by internal WES experts. Learning from these Stage Gate assessments has been incorporated into the functionality and the selection of the "Evaluation Areas" for the DTOceanPlus Stage Gate tool.

There are several Evaluation Areas as part of the Stage Gate design tool with associated metrics (or evaluation criteria) which are:

Evaluation Area	Example of metrics (Evaluation Criteria)
Affordability	LCOE (€/kWh)
	CAPEX (€)
	Internal Rate of Return (%)
Reliability	Mean Time to Failure, MTTF (hours)

	Probability of failure (%)
<b>Availability</b>	Availability (%) or Downtime
<b>Maintainability</b>	Mean Time to Repair, MTTR (hours)
	Probability that a maintenance action can be carried out (%)
<b>Survivability</b>	Probability of structural irreparable failure (%)
<b>Energy Capture</b>	Efficiencies: Captured, transformed, delivered (%)
	Total lost energy of the device or array during project lifetime (kWh)
<b>Acceptability</b>	Global Environmental Impact Assessment score (Global positive)
	Global Environmental Impact Assessment score (Global negative)
	Nb of jobs
	Cost of consenting (€/MW)
	GWP - Phase (gCO <sub>2</sub> /kWh)
	CED - Phase (kJ/kWh)
<b>Energy Capture</b>	Device or Array Annual captured energy (kWh)
<b>Energy Transformation</b>	Energy output from PTO (kWh/year)
<b>Energy Delivery</b>	Device or Array Annual delivered energy (kWh/year)
<b>Installability</b>	Installation duration (hours)
	Cost of Installation (€)
<b>Maintainability</b>	Cost of Maintenance i.e. OPEX (€)

For the Stage Gate design tool, the assurance around the validation on data comes from: 1) the users of the tools ticking off their Stage Activities – the expectations at the later stages of the stage gate design tool are that testing will have been completed with more continuous generation, validated with a numerical model. At the earlier stages there are less demands on the activities. 2) The justification narrative which is completed to support any quantitative metrics which the user inputs themselves

In terms of the whole DTOceanPlus suite of tools, there are specific verification tasks which have a focus of verifying the tools, using data from real projects with the help of the industrial partners as part of the validation of the tools.

4. How does the tool account for wave devices being optimised for different wave climates and sea states? Is the assessment performed at sea states preferred by the developer or predefined wave conditions to ensure that the analysis is carried out more evenly? I see that this would be a difficult area to directly compare devices due to different operating principles and conditions.

It would be up to the user (or funder) to specify an appropriate set of conditions that suit their requirements. The Stage Gate assessments are project level which means resource data must be specified to calculate metrics, e.g. LCOE. The user can choose what site they are being assessed in, so they may select the sea states preferred for the purposes of the assessment. Wave Energy Scotland have specified a set of standardised sea states for tank testing, which are available to download through the [WES Knowledge Library](#) to ensure fairness in the assessment of different technologies. However, these standardised sea states will not be included in DTOceanPlus.

5. Doesn't it all ultimately come down to cost? If a device failed a stage gate due to poor power performance, even if it promised a cheap LCOE, then this seems problematic.

The Stage Gate tool attempts to take a holistic view of all the evaluation areas and performance metrics. No one metric or evaluation area is prioritised over another. This is also the reason why the example of the radar chart was shown. These can show areas where the technology outperforms others and others where it is lacking or under-performing. It is incredibly difficult to assess the trade-off between these various metrics, but the tool will not do this. What it does do is give clarity on the outputs and highlight the strengths and weaknesses of the technology. The user can then use their own expertise to interpret and appraise what the results mean.

6. Are early stages newly launched from time to time to allow innovation?

From a DTOceanPlus perspective, the user is able to define the requirements of their own funding scheme.

For context and in terms of Wave Energy Scotland specifically; the WES programme is constantly evolving to address the questions and challenges of technology developers as their core technology's readiness progresses. The WES programmes commenced with the launch of the PTO and NWEK programmes in 2015, and to support these programmes they were followed by further calls for development of subsystems and enabling technologies (Structural Materials and Manufacturing Processes, and Control Systems) in 2016 and 2017. In 2019, WES released a fifth programme to investigate Quick Connection Systems that can be initially applied to early stage prototypes and in future support larger scale WEC deployments. The aim is that technologies will develop out of the various programme strands in a timely fashion to enable future integration. WES is currently considering future wave energy innovation programmes which will continue to facilitate advancement of the sector readiness.

7. How different are the results between the two modes? Does Assessor mode have additional outputs or is it a synthesized/maybe more high-level report than what is available in Applicant mode?

The results of the Assessor mode can be seen as a type of 'wrapper' around the Applicant mode results. The answers that were provided in Applicant mode will be reproduced in the results of Assessor Mode. But for each question and answer, the Assessor Mode will also contain the assessor's score (on a scale of 0 to 4) and the justification for each of the scores. There will be additional summary information in Assessor Mode for the assessment as a whole and for each evaluation area (see Q1 above).

8. Are you collaborating with floating wind developers? Particularly on the Quick Connection Systems work?

WES is not actively collaborating with floating wind developers. However, it is worth highlighting that in the Quick Connection Systems programme projects will be required to complete detailed simulations of the application of their connection approach to two different devices. One of these two devices must be a WEC, and they are free to select the alternate device from other marine systems.

9. The webinar has described a Stage Gate Process but not the actual method of evaluating the different stated criteria. Have these evaluation criteria not yet been formulated, and will these be decided in the IEA-OES project?

A user can calculate the metrics externally, using whatever evaluation criteria they want, and input the results straight into the Stage Gate tool but they would then need to provide additional justification and details on their chosen evaluation method. Alternatively, the user can use the DTOceanPlus Deployment and Assessment tools to calculate the metrics. The evaluation process is decided by the developers of these individual tools. We are working closely with these developers to ensure that they follow the appropriate standards as much as possible. The final deliverable of the suite of tools is scheduled for April 2021. This is also when all the final information regarding the evaluation procedure of the tools will be released. Technical notes that describe the evaluation processes of each individual module will be included in these additional deliverables. In fact, some of these deliverables have already been published (**NB:** for the *alpha* versions of the tool, so they are subject to changes over the remainder of the project). For example, the following documents describe three of the Deployment and Assessment tools (documents will continue to be added to this library):

- [Energy capture](#)
- [Performance and energy yield](#)
- [System lifetime costs](#)

#### 10. How does the Stage Gate design tool align with IEC and other standards?

The Stage Gate design tool has six stages; 0, 1, 2, 3, 4 and 5. These stages align with the IEC specification [*IEC TS 62600-103:2018 Power performance assessment of electricity producing wave energy converters*] with the exception of the addition of a Stage 0, which is included to make sure that the DTOceanPlus suite of tools also work for early stage technology. Before any tank testing is complete a user is able to run a Stage Gate assessment using a combination of:

- simplified assessments;
- default values and assumptions and
- the use of the deployment tools to generate design data where that data is missing.

The other modules are aligning with standards as far as is appropriate whilst maintaining the user friendly goals of DTOceanPlus. For example; Energy Delivery has considered standards like the Subsea Power Cables in Shallow Water Renewable Energy Applications from DNV, and aligned with these as far as is practical.

#### 11. Will the tool be straightforward and easy to use or will training be provided?

When DTOceanPlus is downloaded, user manuals for each of the modules will be provided. Alongside this, there will be:

- Education materials on website e.g. tutorials. This includes a repository, involving JRC, where stable releases of the 2nd generation tools are deployed on a regular basis,
- An official forum in the form of a LinkedIn group to support the community,
- At least 4 training sessions near the end of the project to teach different users about the tools,
- At least 2 workshops to demonstrate the use of the tools.

#### 12. Can the user assess their technology at different locations around the world, or are they restricted to a few?

The user is not restricted to just a few sites. Within the “Site Characterisation” module the user can either:

- Select resource data from up to 9 reference sites which correspond to combinations of a High/ Med/Low energy site for wave energy and High/ Med/Low energy tidal currents,
- Upload their own resource data they have this in the correct format and DTOceanPlus will use this in the running of the tools.

#### 13. Who will be the main users of the Stage Gate design tool?

From the results of the User Groups consultation (Deliverable 2.1), a range of stakeholder types were identified, comprising both prospective ocean energy design tool users and other interested parties, in the following categories:

- i. Public funders, commercial investors, and insurance providers;
- ii. Innovators and developers;
- iii. Project developers, utilities, and supply chain; and
- iv. Policy makers, regulators, and standardisation bodies.

All of these groups were asked if they were Not likely/Likely/Very likely to use the DTOceanPlus Stage Gate design tool with the results quite evenly spread across Likely and Very Likely, with Policy & Regulators group being the most likely.

#### 14. When will the Stage Gate tool be available for use?

The end of the project and planned release date is the end of April 2021.

#### 15. Is this process meant to supersede TRL assessment and how are third party certification processes meant to be integrated?

The process or design tool is not meant to supersede the TRL (or TPL) assessment. Third party certification processes will not be integrated directly within the Stage Gate design tool. The tool provides the framework and structure that comes with a Stage Gate programme. Users of the tool will be informed of the activities, metrics, evaluation areas and questions that they will need to consider. The tool also provides concrete examples of how the assessment processes works. It is important to re-iterate that the user will not obtain a "PASS/FAIL" mark at the end of the process if they are using the tool in a purely independent manner. Such an assessment is the responsibility of the informed decision-making user (e.g. a funder) using their own success thresholds and particular objectives. The Stage Gate design tool is a tool that aims to guide the user through the process rather than being an 'assessment' tool.

#### 16. In the success metrics and measurements, I don't see power output in the 'ilities list. Where is it considered?

Energy Capture, Energy Transformation and Energy Delivery will calculate various stages of the power conversion chain, so that detailed information on the power output of the sub-system/device/array will be considered.

#### 17. Are all of the measurement methods in the metrics fully compatible with the IEC Standards?

IEC guidance and standards don't exist for the majority of the measurement methods, but for those that do, we are aligning with these as far as is possible whilst adhering to the usability goals of DTOceanPlus.

#### 18. Investors are usually interested in the bottom line - will affordability translate into LCOE?

LCOE is the most important metric in the 'Affordability' evaluation area, and will be calculated by the Deployment and Assessment tools.

### 19. Is it up to the user to define thresholds for the metrics?

Yes – the thresholds for the metrics are entirely input by the user. The reason for this is that we're in no place to put a threshold on an individual Evaluation Area since a technology could perform very well in one Evaluation Area and not so well in another. Furthermore, specific users will have specific objectives and requirements which might not be satisfied by a certain definition of "success" - they would, however, be evaluated using the same metrics.

What the Stage Gate design tool will do is provide a framework which includes:

- Evaluation Areas to indicate the key areas which must be assessed to measure success of ocean energy technology,
- Metrics within those Evaluation Areas and
- Stage Activities to indicate what technology development activities must be completed and when.