



*Advanced Design Tools for Ocean Energy Systems Innovation,
Development and Deployment*

Webinar

Stage Gate Design Tool

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Wave Energy Scotland
25 Feb 2020



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



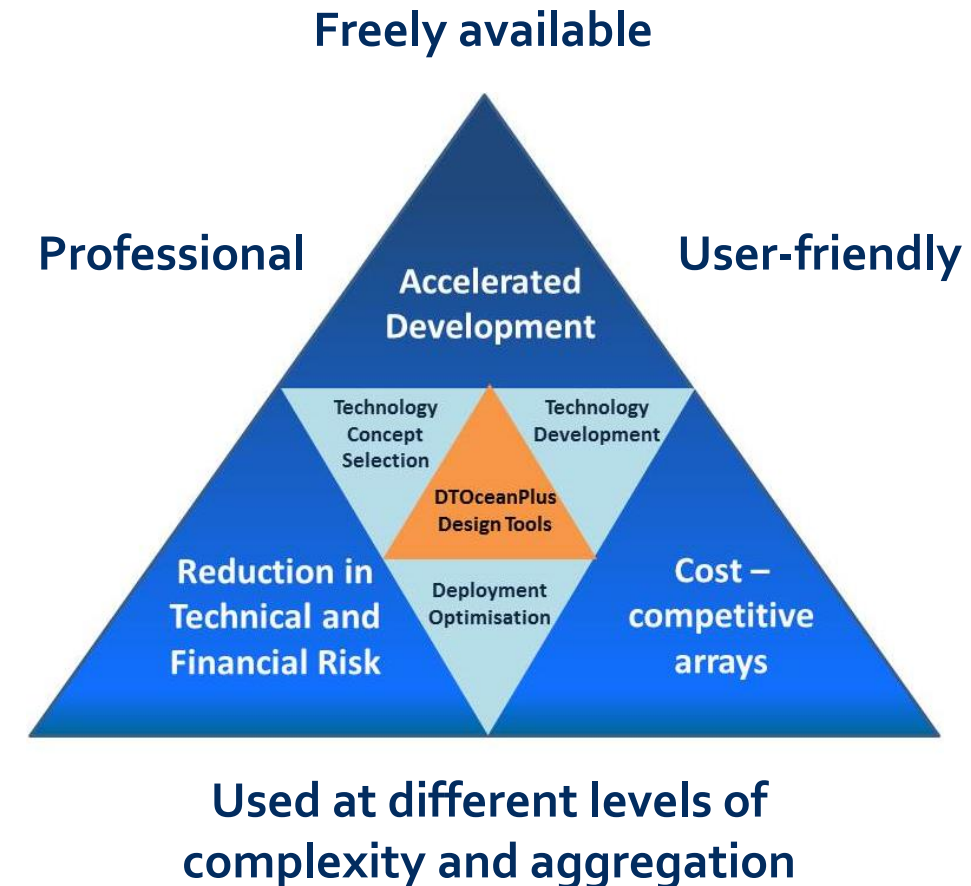
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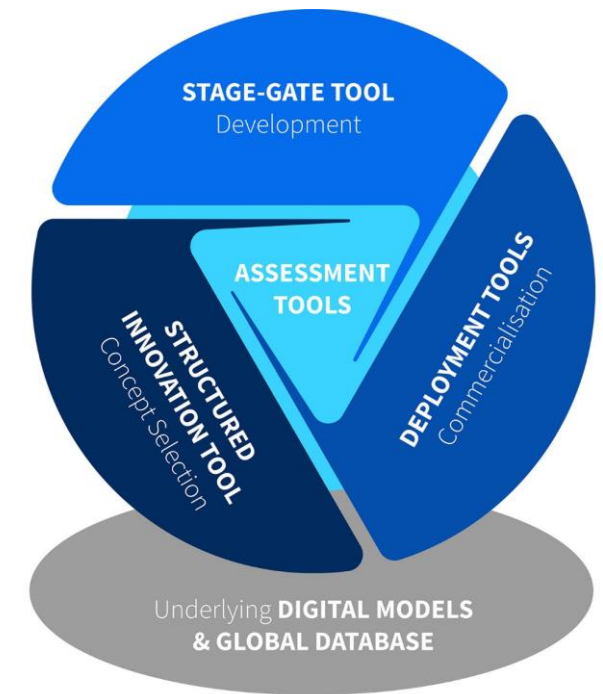
1. Introduction to DTOceanPlus (I)

- An **integrated open-source suite of design tools** to support the entire innovation and development process for ocean energy sub-systems, devices and arrays.
- Continuing **the development of DTOcean**, which produced a 1st generation of freely available, **open-source design tools for wave and tidal energy arrays**.
- Its operational capabilities and value will be **demonstrated (TRL6) with data from real case technology projects**.



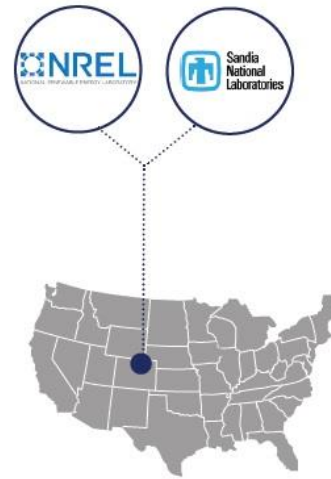
1. Introduction to DTOceanPlus (II)

- **Structured Innovation Tool**
 - For concept creation, selection and design.
- **Stage Gate Tool**
 - Assisting decision-making through the use of metrics to measure, assess and guide technology development.
- **Deployment Tools:** Site characterisation, Machine Characterisation, Energy capture, Energy transformation, Energy delivery, Station-keeping, Logistics and Marine Operations
 - Supporting optimal device and array deployment.
- **Assessment Tools:** Performance & Energy Yield, RAMS, Lifetime Costs, Environmental and Social Acceptance
 - Providing objective information to the developer or investor on the suitability of a technology and project.
- **Common digital models – Digital Representation**
 - Standard framework for the description of sub-systems, devices and arrays to allow sharing of design information.



1. Introduction to DTOceanPlus (III)

- A 3-year EU project (May 2018 - April 2021) with a total budget of **8 M€**.
- **Multidisciplinary team of 16 partners from 7 EU countries, with the collaboration of 2 leading research laboratories from the USA.**



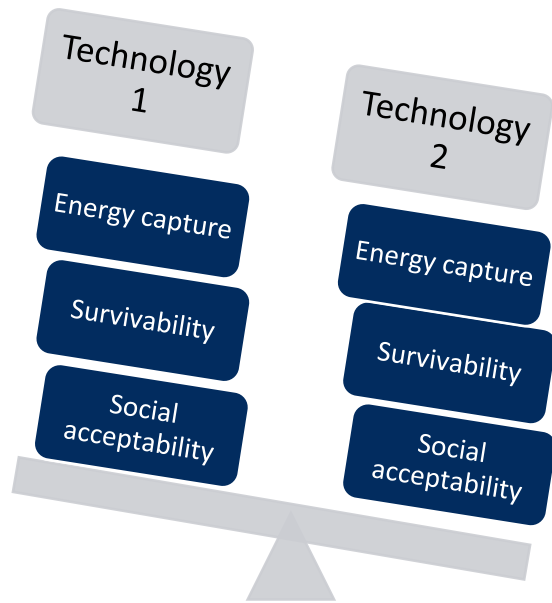
2. Stage Gate process for ocean energy (I)

Motivation and objectives

- Why it's needed
 - No consensus on technologies in ocean energy sector
 - Difficult to compare different concepts
 - Urgently need consistency in assessment processes
 - Pathway to demonstrate progress to investors
- The **Stage Gate design tool** aims to:
 - Provide a framework to assess ocean energy technology
 - Facilitate clear consistent assessment
 - Enable technology developers to demonstrate success
 - Enhance the DTO+ suite by bringing all assessment processes together



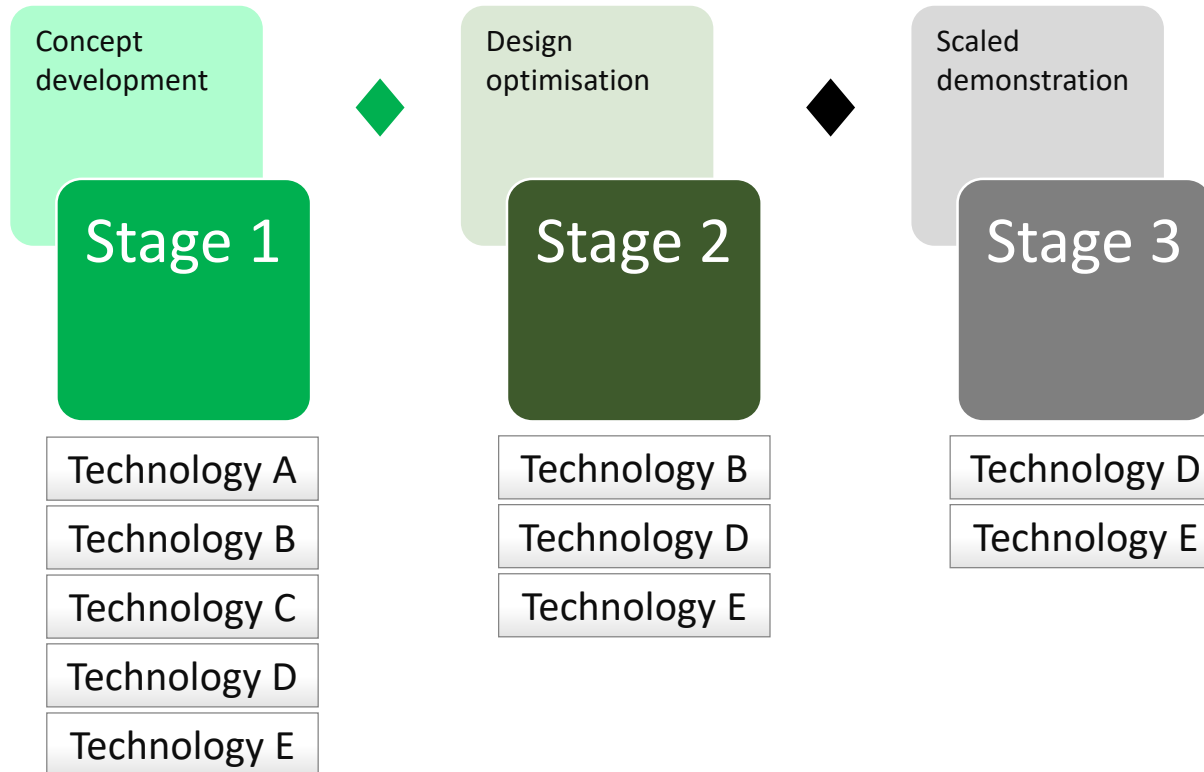
2. Stage Gate process for ocean energy (II)



Who benefits from it?

- Technology developers ~ to track progress of their development
- Public funders ~ to help allocate funding in a clear and objective way
- Investors ~ to give confidence in technologies' performance and investment opportunities

2. Stage Gate process for ocean energy (III)



◆ Stage gates ~ Metrics are calculated, success is measured

2. Stage Gate process for ocean energy (IV)



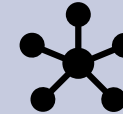
Established in November 2014 as a subsidiary of Highlands and Islands Enterprise



Five competitive programmes:
Power Take-Offs
Novel Wave Devices
Materials and Manufacturing
Controls Systems
Quick Connection Systems



>230 Organisations
96 Projects



Developing Cost Competitive Wave Technology



£39.6M committed expenditure



Delivering objectives through a Research, Development and Innovation Programme



13 Countries

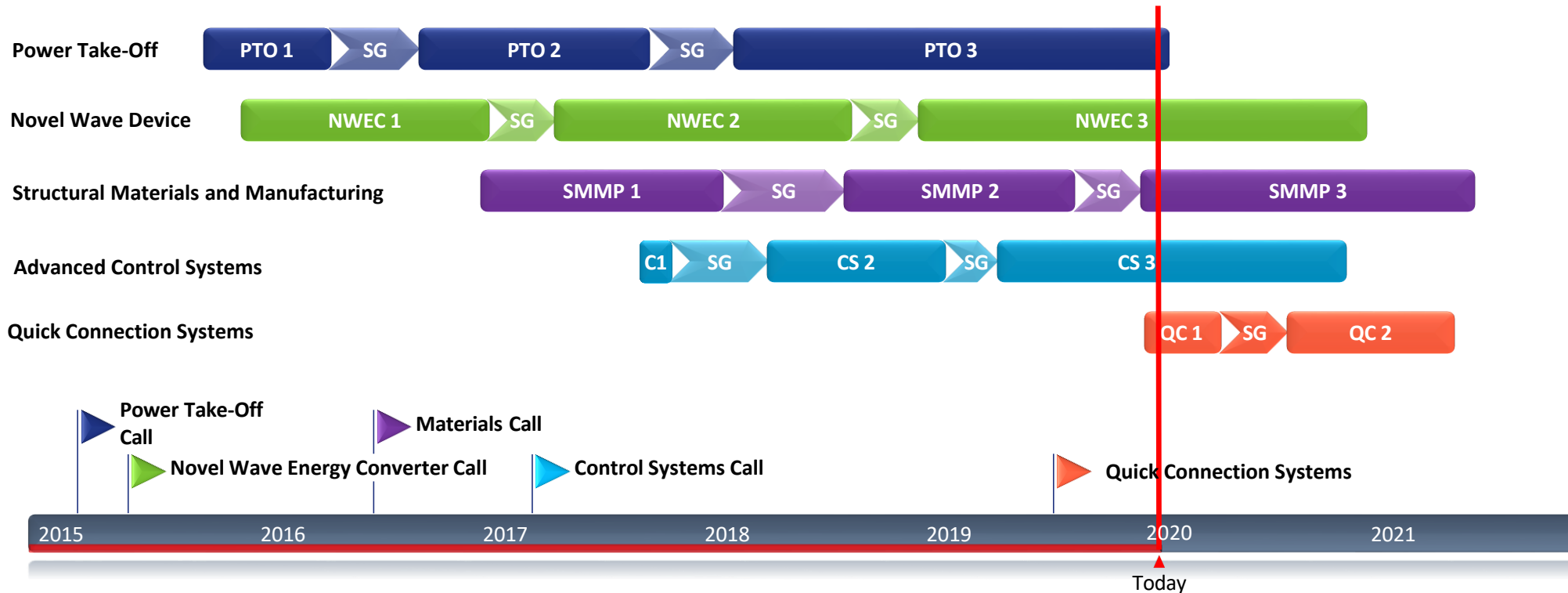


Funded by the Scottish Government



2. Stage Gate process for ocean energy (V)

WES Technology Programmes

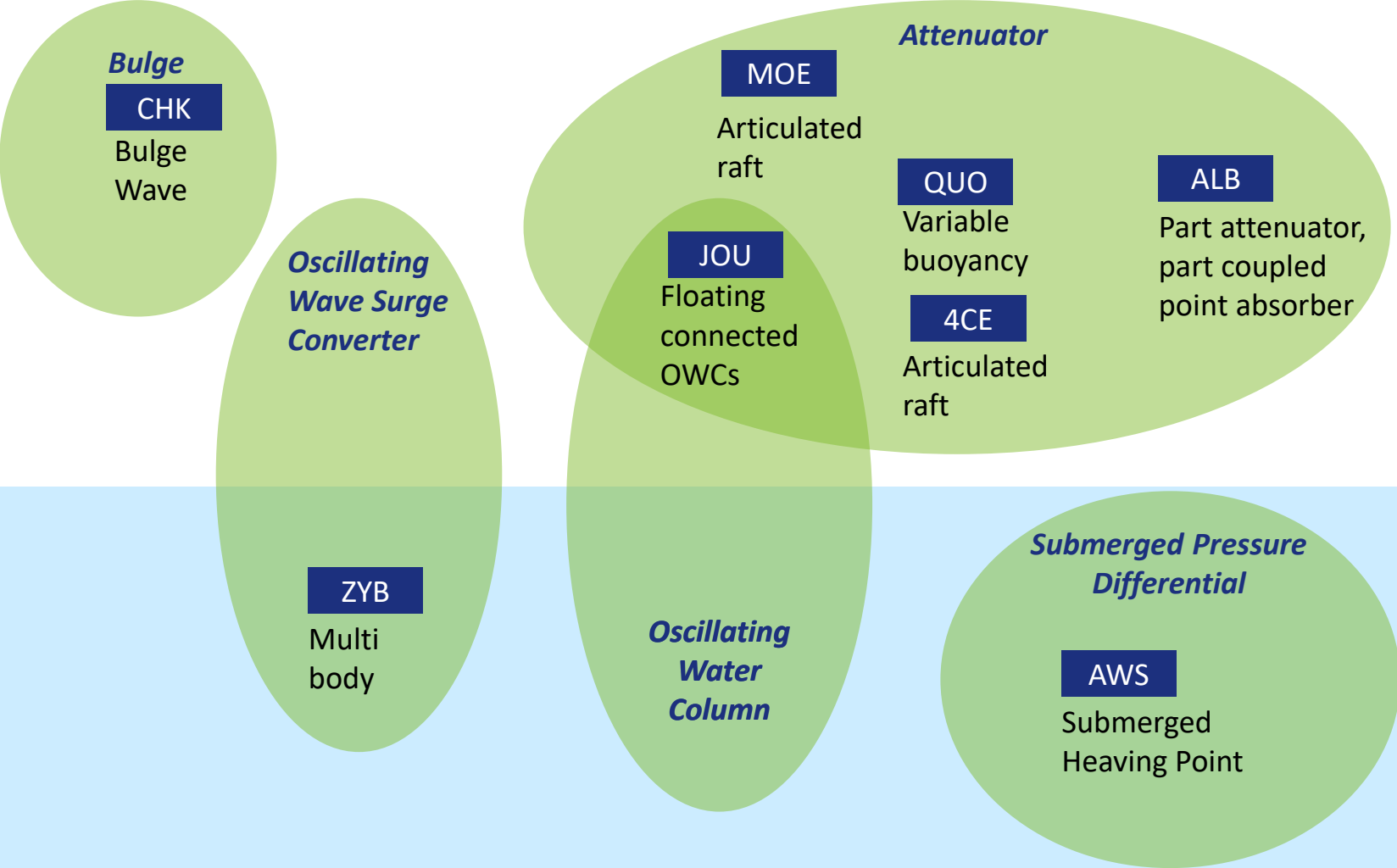


2. Stage Gate process for ocean energy (VI)

NWEC Projects Stage 1

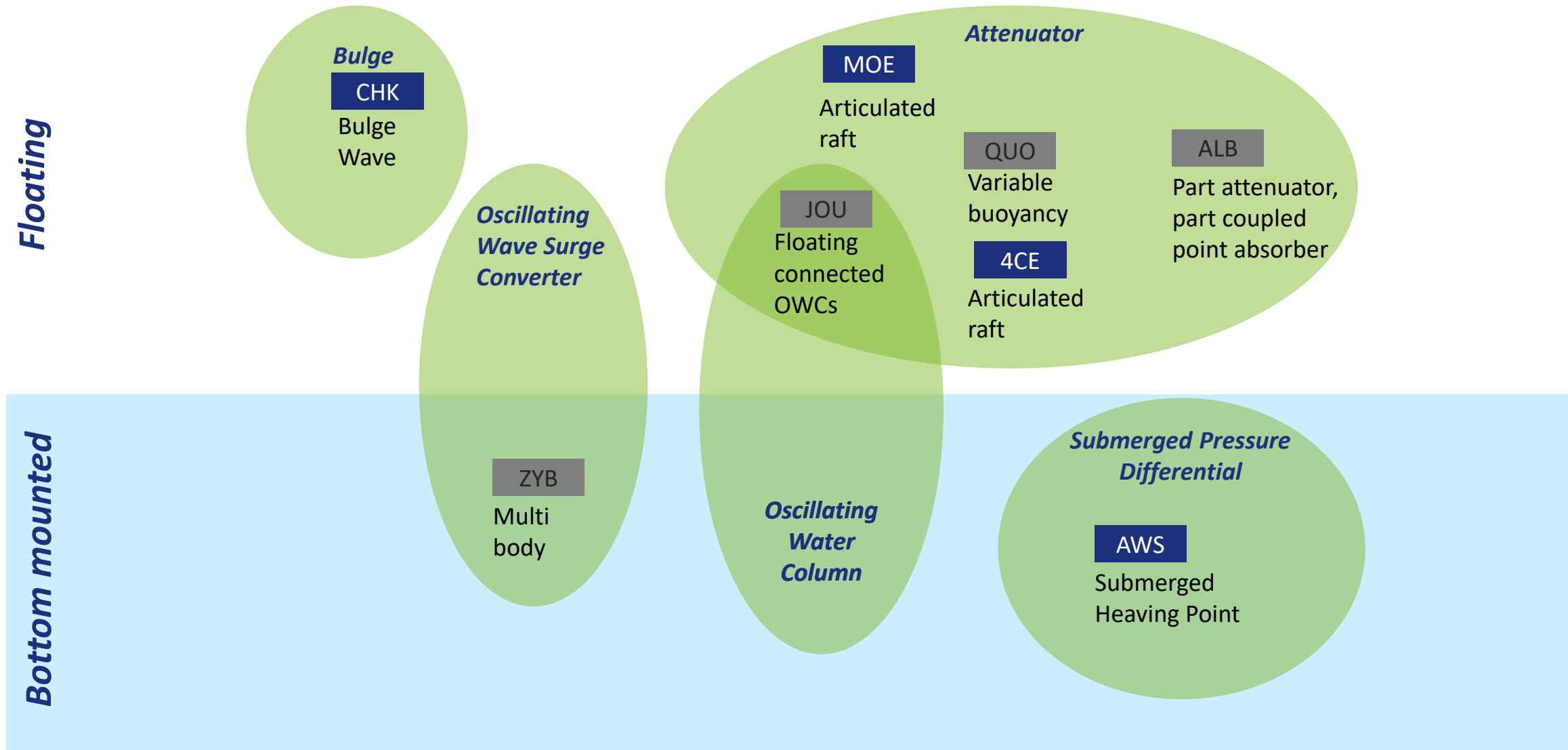
Floating

Bottom mounted



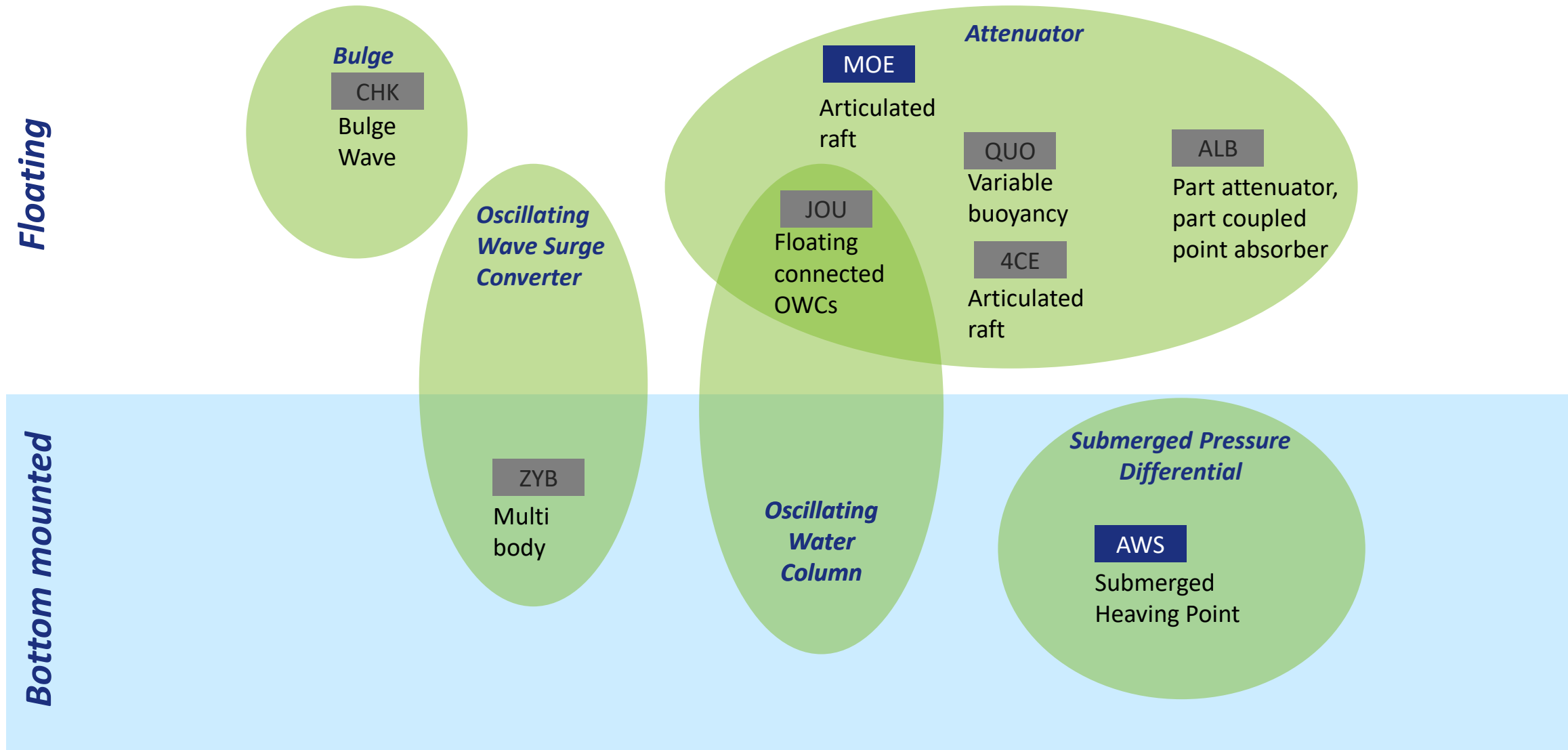
2. Stage Gate process for ocean energy (VII)

NWEC Projects Stage 2



2. Stage Gate process for ocean energy (VIII)

NWEC Projects Stage 3

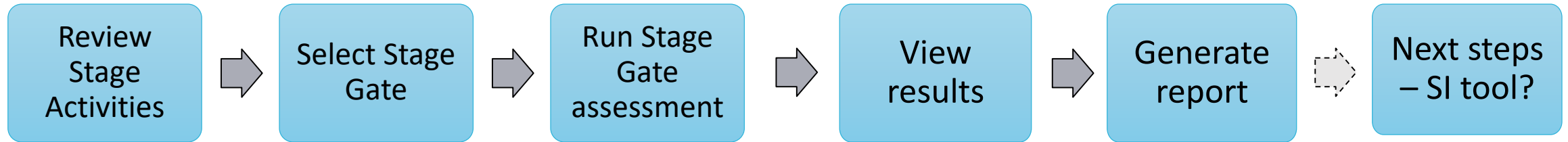


3. DTO+ Stage Gate design tool (I)

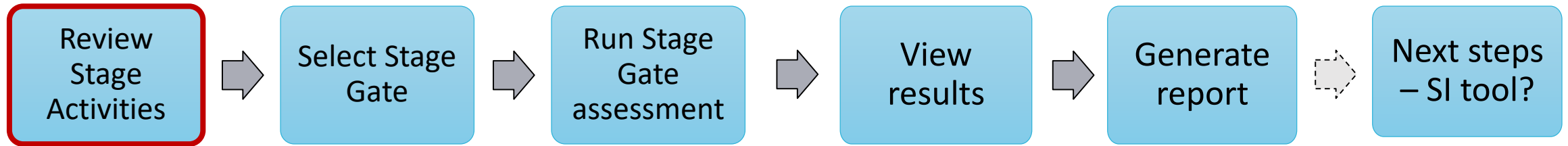
- Taking experience from WES stage gate programme, developing a module for DTO+ “Stage Gate design tool”
- Applicable for wave and tidal energy sub-systems, devices and arrays
- To be used by:
 - Funders and investors
 - Innovators and developers
 - Project developers
 - Policy makers and regulators



3. DTO+ Stage Gate design tool (II)



3. DTO+ Stage Gate design tool (III)



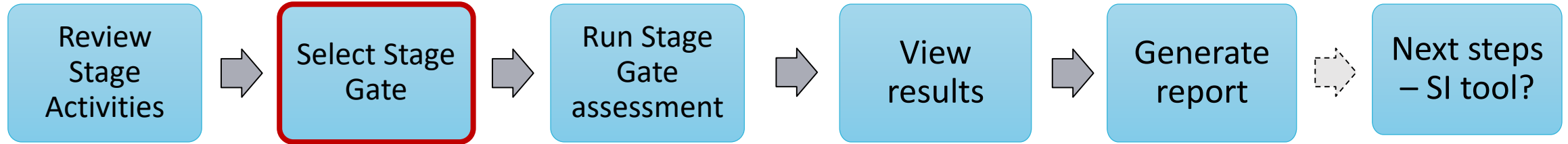
User checks off what technology development activities have been completed, in each of the following categories:

Survivability	Affordability
Energy Capture	Reliability
Acceptability	Availability
Energy Transformation	Maintainability
Installability	Energy Delivery

For example:

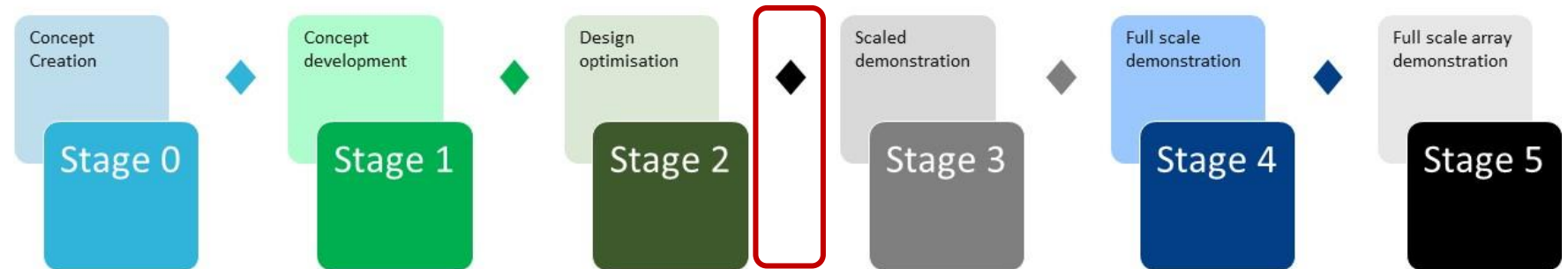
- ✓ Tank testing at 1/25th - 1/10th scale
- ✓ Development of basic FMEA based on tank-test & modelling data
- ✓ Development of basic O&M schedule for planned maintenance
- ✓ Identification of main failure modes and associated estimates of MTTR (hours) for each mode

3. DTO+ Stage Gate design tool (IV)

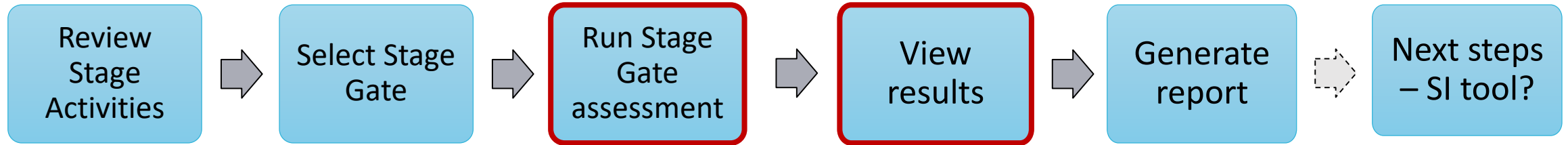


Based on Activities complete, the user selects which stage gate they would like to select:

- Stage Gate 0 – 1
- 1 – 2
- 2 – 3**
- 3 – 4
- 4 – 5



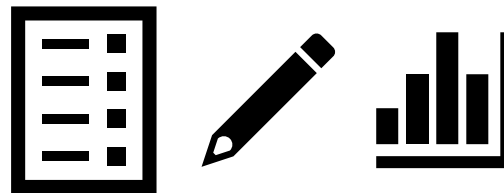
3. DTO+ Stage Gate design tool (V)



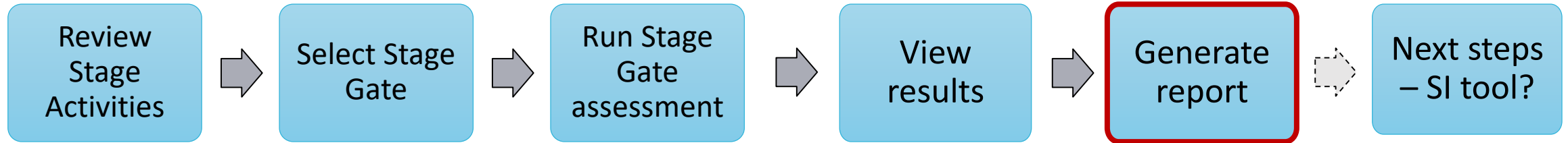
When the Stage Gate assessment is run, the user will be asked to fill out **questions** about their technology

To calculate metrics, the user will be prompted to open each of the relevant Deployment and Assessment tools

In order to run the Deployment and Assessment tools, the user will be asked to provide **critical input parameters** about the technology being assessed



3. DTO+ Stage Gate design tool (VI)

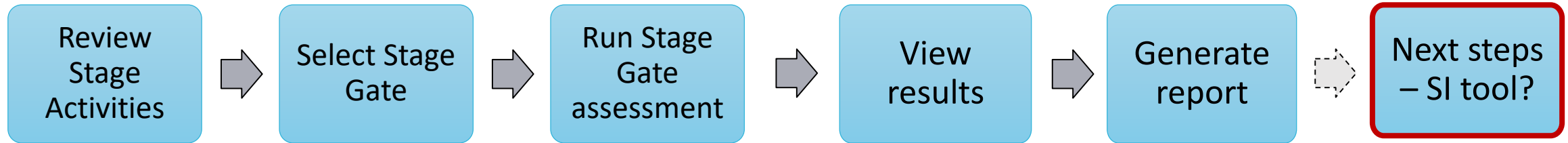


One of the main outputs of the Stage Gate design tool is a standardised report that summarises all the input and output data of the module

Example results shown later



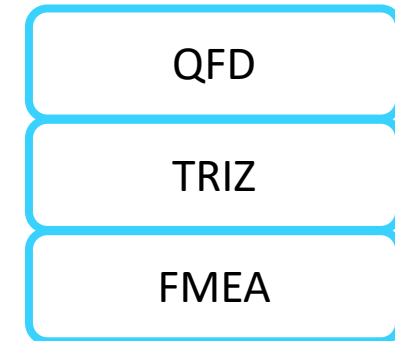
3. DTO+ Stage Gate design tool (VII)



If an area of improvement is identified, the user will be prompted to open the Structured Innovation (SI) module.

Examples of improvement areas:

- If running a stage gate assessment identifies a missing Evaluation area
- If the metric results deviate significantly from the thresholds set by the user

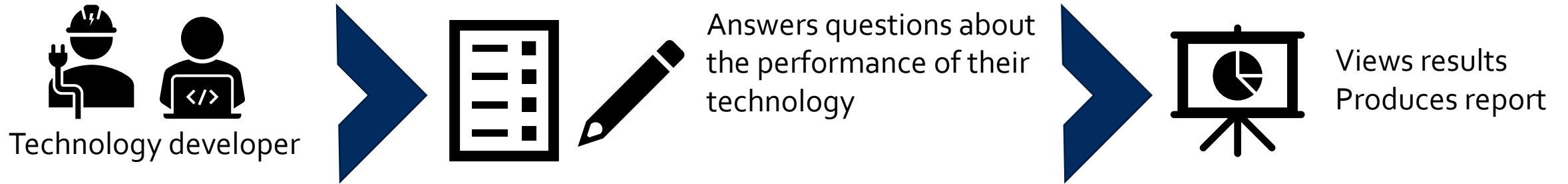


N.B. Webinar for the Structured Innovation design tool;

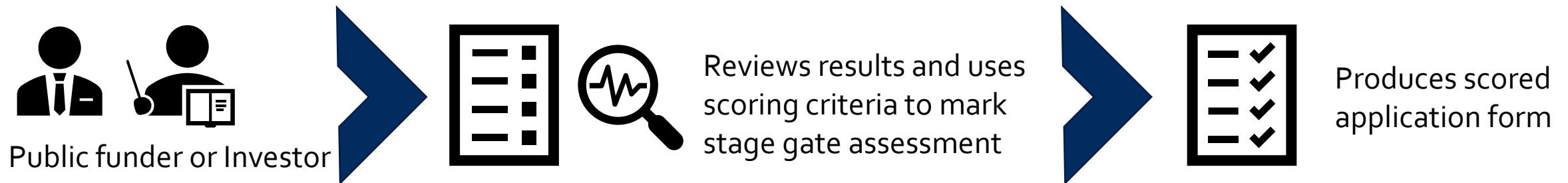
Tue, Mar 17, 2020 3:00 PM - 4:00 PM (GMT)

3. DTO+ Stage Gate design tool (VIII)

Applicant Mode



Assessor Mode



3. DTO+ Stage Gate design tool (IX)

- Tested and validated using data supplied by the project's industrial partners
- Important step in the development of DTO+



Technology developers



Public and private investors

To satisfy the use cases of:

Identify what needs to be done to meet the next stage

Assess what stage their technology is at

Identify R&D opportunities

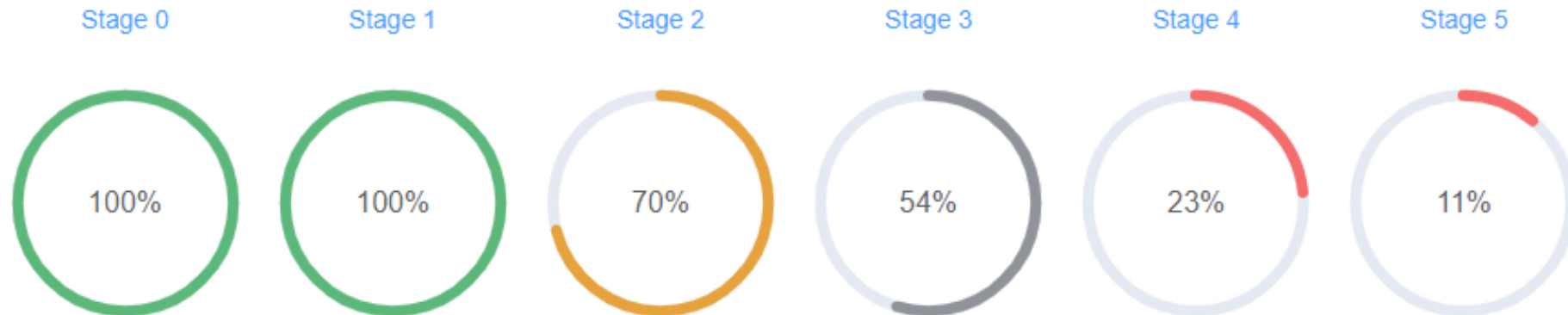
Assist in investment decisions



3. DTO+ Stage Gate design tool (X)

- Main outputs include:
 - A summary of the status of the technology

Percentage of activities completed in each stage

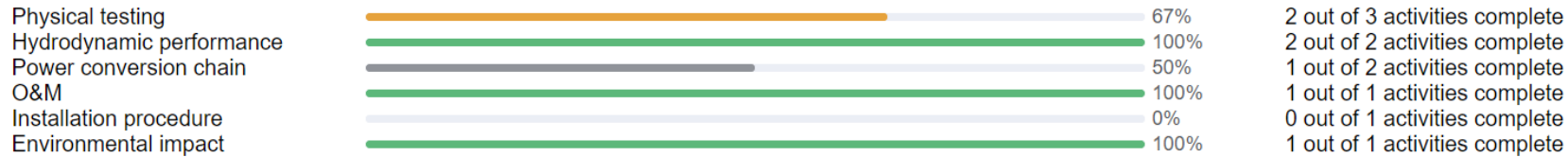


3. DTO+ Stage Gate design tool (XI)

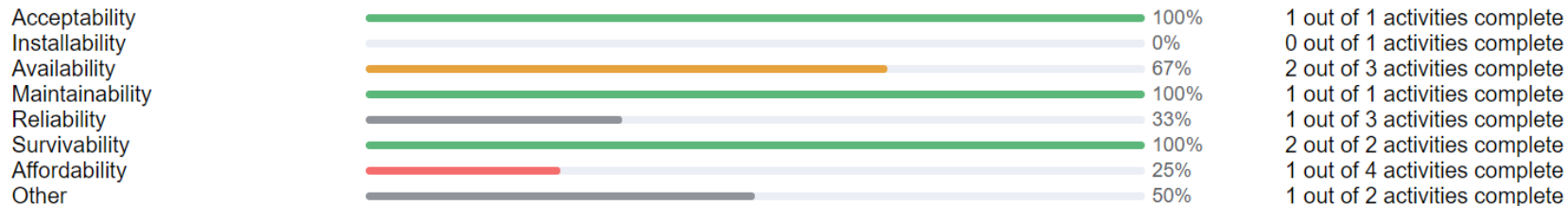
- Main outputs include:
 - Breakdown of completed and outstanding activities

Stage 2

Activity Categories



Evaluation Areas



Outstanding Activities

Activity Category Evaluation Area

Physical testing

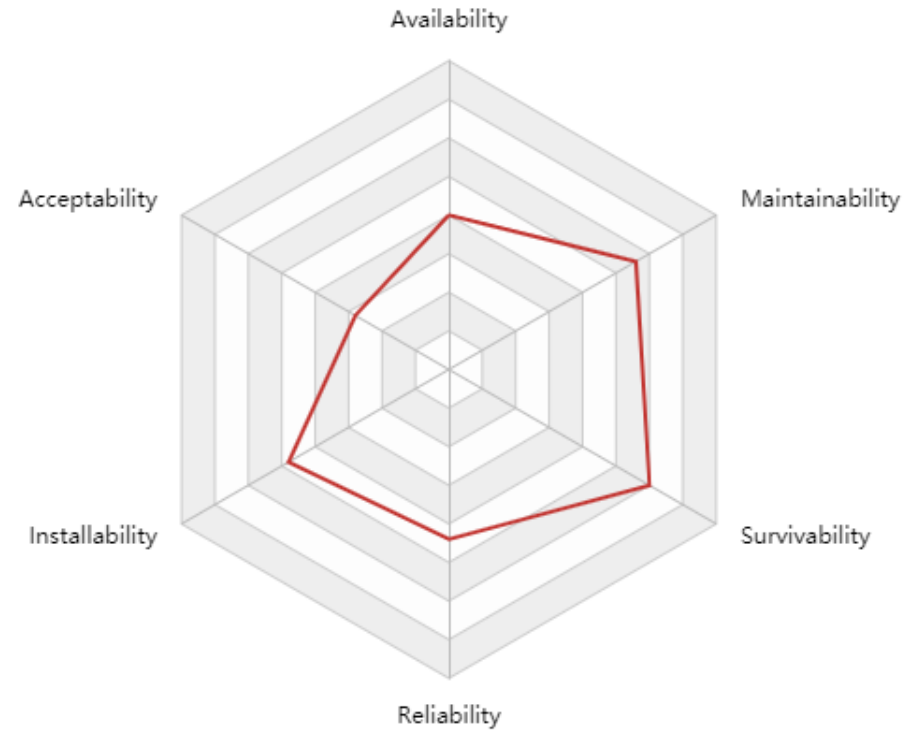
Power conversion chain

Installation procedure



3. DTO+ Stage Gate design tool (XII)

- Main outputs include:
 - Graphical and tabular results for metrics/evaluation areas



■ Example project/technology



3. DTO+ Stage Gate design tool (XIII)

- Main outputs include:
 - **Standardised report** summarising all input and output data



4. Summary and future work (I)

- Stage gate design tool aims to:
 - Provide a consistent assessment framework
 - Facilitate the comparison of different technologies
 - Enable a range of stakeholders to perform a guided and objective assessment
 - Enhance the DTO+ suite by bringing all assessment processes together
- Benefits to stakeholders:
 - Guide technology developers
 - Allow investors to see standardized assessment processes to gain confidence in ocean energy technology progress

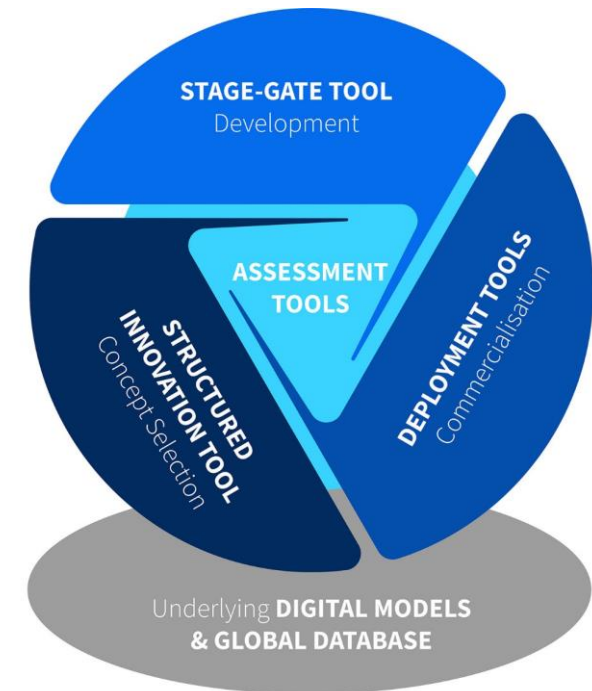
IEA-OES Task 12:

- Task aims to achieve consensus on how success is measured in ocean energy i.e. Metrics
- The objective is to establish a common international stage gate metrics framework to be used by technology developers, investors and funders.
- 25 contracting parties from around the world



4. Summary and future work (II)

- The Stage Gate design tool will be integrated with the other DTOceanPlus design tools
 - **Structured Innovation Tool (SI).**
 - **Deployment Tools**
 - **Assessment Tools**
- ... and tested with data from real case technology projects

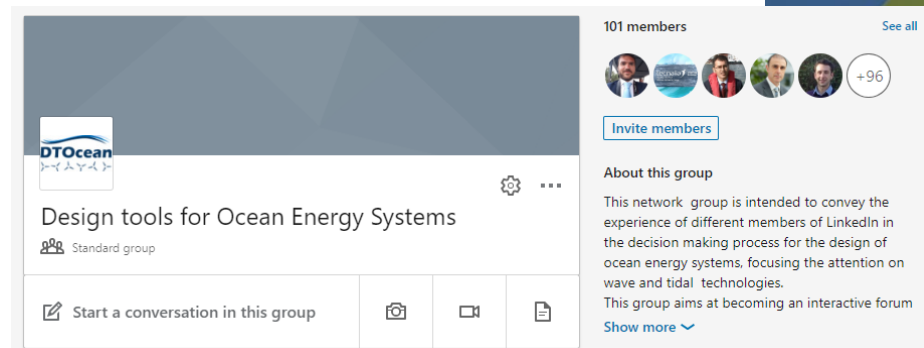


4. Summary and future work (III)

- The concept of the Stage Gate design tool has been/ will be presented to stakeholders during a set of dissemination and training actions:
 - Conferences such as All Energy 2020, Ocean Energy Europe 2020, etc.
 - Scientific publications
 - Webinars and tutorials

dtoceanplus.eu

Online forum LinkedIn Group



5. Reference Material



Advanced Design Tools for Ocean Energy Systems
Innovation, Development and Deployment

Deliverable D4.1

Technical requirements for the implementation of a world-class Stage Gate Assessment Framework in Ocean Energy

Lead Beneficiary WAVE ENERGY SCOTLAND
Delivery Date 30/04/2019
Dissemination Level Public
Status Released
Version 1.0
Keywords Technical requirements, software development, Stage Gate Framework



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

Deliverable D4.1 "Technical requirements for the implementation of a world-class Stage Gate Assessment Framework in Ocean Energy" is a publicly available deliverable describing the technical requirements of the Stage Gate design tool.

Document Information

Grant Agreement Number	785921
Project Acronym	DTOceanPlus
Work Package	WP 4
Related Task(s)	T4.1
Deliverable	D4.1
Title	Technical requirements for the implementation of a world-class Stage Gate Assessment Framework in Ocean Energy
Author(s)	Jonathan Hodges, Jillian Henderson, Matthew Holland (WES), Vincenzo Nava, Imanol Touzon Gonzalez; Joseba Lopez Mendia (Tecnalia), Marta Silva, Francisco Fonseca (WavEC), Inès Tunga (ESC), Nicolas Germain, Georges Safi (FEM), Francesco Ferri, Yi Yang (AAU), Frédéric Pons (OpenCascade), Donald Noble, Anup Nambiar (UEDIN)
File Name	DTOceanPlus_D4.1_Tech_Requirements_Stage_Gate_Design_To ol_WES_20190430_v1.0.docx





Advanced Design Tools for Ocean Energy Systems Innovation, Development and Deployment

Thank you for your attention!

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Disclaimer: This presentation reflects only the author’s views and the Agency is not responsible for any use that may be made of the information contained therein.



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