



Best practice in Benchmarking: TRL 1-5 ocean energy converters

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Structure

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- Options for benchmarking
 - TRL
 - TPL
 - CRL
 - Combined
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 - EMEC tool used in MEA
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- Q&A



Why benchmark?



Technology developer:

- Understand if you actually are where you think you are...
- Focus your technology development plan (find your blind spots)
 - Achieve what you really need to, not waste time/budget on what you don't
- Demonstrate to stakeholders your development plan is 'correct'

Funders / collaborators:

- Understand the + / -ve aspects
- Select / support the right technologies
- Focus your assistance (money, work scope, introductions to others)
- Be an informed 'Client'





Options for benchmarking (1)

- TRL: best known and most used at various levels of detail.
- TPL: focus on performance not development/readiness.
- CRL: focus on commercial not technology readiness.
- There are also other options, e.g., Equimar, OES, WES etc.
- There is some overlap between all these options.



A. APPENDIX - Technology Readiness Level: Guidance Principles for Renewable Energy technologies

In this section we present the guidance principles for the TRL of ocean energy technologies based as defined by the European Commission. For each TRL the gudiance provide a description and checkpoints.

A.1 TRL 1 - Basic principles observed

Description: Basic research. Principles postulated and observed but no experimental proof available

Identification of basic principles, performers and interfaces. The principles that underlie the technology are defined, and this analysis is supported by information that includes published research and/or other references investigating the identified principle. The concept exists only on paper / software form, no hardware still exists.

A prime-principle based analytical model of the principles exploited (i.e. not representing the whole device), implemented into a first approximation model, should be developed based on the available published research. A set of relevant operating conditions should be considered.

Usually no mechanical/electrical efficiencies are included at this stage. Interfaces (i.e. characterisation of the relationships) with other technologies (e.g. overall device or other subsystems) in the frame of system integration have been identified.

Checkpoints

Once readiness level 1 is achieved, the scientific concept is observed and documented. This mea

- definition of principles underlying the technology;
- evaluation of the benefit of the technology in comparison with other existing technologie
 first identification of interfaces with other systems.

APPENDIX B - COMMERCIAL READINESS LEVEL SCALE

Please note that proposed technologies are not expected to be commercially mature at the start of the project period, nor must any specific CRL be reached by the project's end.





Client: Sustainable Energy Authority of Ireland

Appendix 2 Technology Readiness Levels for Supply Chain Study for WestWave ESBloe-WAV-11-027





CES DEEAN

Options for benchmarking (2)

- Which is best?
 - Depends on what information is available and what you want to know...
 - Depends on experience of assessors (marine energy is not easy) and time / budget available.
 - Often, a combination and some simplification of the above options/metrics is needed.
- Assessing the TPL of low TRL technologies is hard, even with "low-TRL" TPL tool.
 - Valid to try to apply quantitative metrics but very hard to be sure of data – e.g., cost estimates.
 - "Helicoptering up" to a more "first principles" assessment based on experience may be as (or more) valid and be simpler and quicker.







Example – MEA Tool



- MEA had 9 service providers and undertook 103 services for 40 developers.
- Services could be technical or commercial or both, delivered collaboratively.
- MEA Phase 1 used a simple TRL assessment which did not fully assess MEA aims and did not result in clear service requirements leading to delays etc.
- MEA Phase 2 developed a Benchmarking Tool to meet MEA aims, accelerate the assessment process and led directly to agreed services to be provided.







Questions...with evaluation criteria, score and explanation

	Question (from application form)	Evaluation Criteria	S	core	Comments (scoring rationale, gaps to address)
	 Access to sufficient market(s) to reach LCoE 	0 - No answer provided or totally unclear. 1 - Weak answer provided indicating likely insufficient market (e.g. so	ole		
	requirements in chosen market(s) assuming credible	focus on very niche market). 2 - Reasonable answer provided indicating likely sufficient market. 3 - Good answ	ver		
	learning rates and support mechanisms.	provided indicating sufficient market and understanding of scale of market, likely learning rates and support			
		mechanisms.			

Assessor scores compared to self assessment...to flag clarifications

	Rfl Answer	Assessment Flag?	Assessor score
TPL			
1. Access to sufficient market(s) to reach LCoE requirements in chosen market(s) assuming credible learning rates and support mechanisms.			

Scores lead to whether gaps need to be addressed

Question (from application form)	Significant Gap / Issue to be addressed			
1. Access to sufficient market(s) to reach LCoE	Yes			
requirements in chosen market(s) assuming credible				
learning rates and support mechanisms.				

Gaps then prioritised \rightarrow draft services proposed \rightarrow potential provider \rightarrow discussion \rightarrow agreement

Question (from application form)	Address Gap in Proposed MEA Services	Proposed MEA Service (to be further detailed)	Proposed MEA Service (as stated in guidance)	Proposed MEA Service Provider
1. Access to sufficient market(s) to reach LCoE	Yes	Business Model demonstrating sufficient market	Business case development	
requirements in chosen market(s) assuming credible		given expected LCoE and likely learning rates and		
learning rates and support mechanisms.		support mechanisms.		EMEC, UCC, INNOSEA

12 TPL Qs, 32 TRL Qs (to TRL5), 13 CRL Qs (to CRL4)



Conclusions



- Benchmarking can help you understand where you are and do the right things.
- Benchmarking can help you select the right technologies / provide the right support.
- Tailored combination of assessment options probably needed, incl. TPL.
- First principles assessment of the TPL of low TRL technologies may be easier.
- Structured process can significantly improve overall delivery times.
- MEA Phase 2 benchmarking very successful.
- EMEC benchmarking tool further developed post MEA and has now also been used to support technology development roadmapping for developers.
- Do get in touch if you're a developer or funder and would like to know more.





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