Structured Innovation for the Wave Energy Sector

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Contents

Structured innovation

- Previous development efforts haven't worked…
  - **We don't know what to build.**
  - **We don't know how to reach commercialisation.**

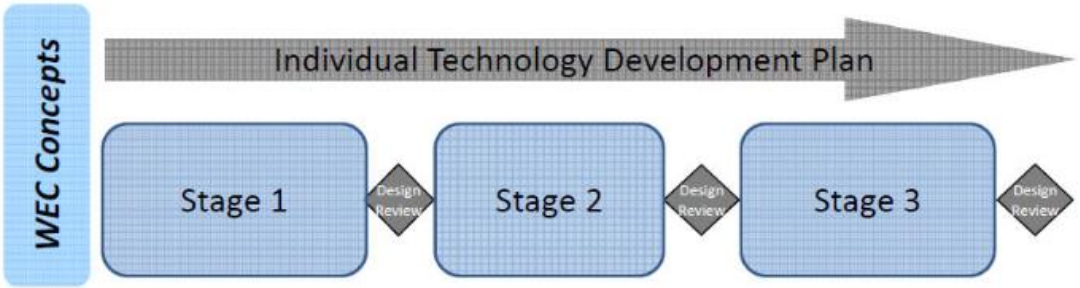
- Wave Energy Scotland and US Department of Energy: new structured approaches to WEC development.

WAVE ENERGY PRIZE
U.S. DEPARTMENT OF ENERGY

Development stages

Decision Phase:
How should it perform?

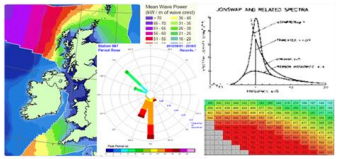
Conceptual Phase
What should we build?



Different approaches

wave energy SCOTLAND

Wave Energy Resource



Project Design

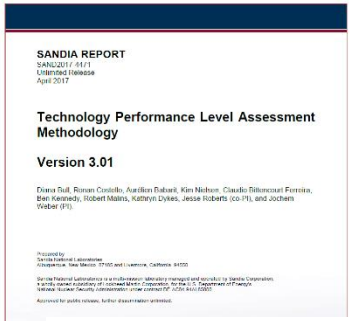
Device Design

?

Commodity/Market

Rate of return

U.S. DEPARTMENT OF ENERGY



SANDIA REPORT
SAND2017-4471
Unlimited Release
April 2017

Technology Performance Level Assessment Methodology

Version 3.01

Diana Bull, Ronan Costello, Aurélien Babarit, Kim Nielsen, Claudio Bittencourt Ferreira, Ben Kennedy, Robert Malins, Kathryn Dykes, Jesse Roberts (co-PI), and Jochem Weber (PI)

C1	Have market competitive cost of energy
C1.1	Have as low CAPEX as possible
C1.1.1	Be a low cost design
C1.1.2	Be manufacturable at low cost
C1.1.3	Be inexpensive to transport
C1.1.4	Be inexpensive to install
C1.2	Have as low an OPEX as possible
C1.2.1	Be reliable (cost of maintenance)
C1.2.2	Be durable over the lifetime of the plant

Aim

- Create a tool for evaluating alternatives
- Generate scenarios and calculate a score to indicate design merit

Resource			Device				Project	
Location	Power level	Distance from shore	Scale	Foundation type	Material	PTO	Sea floor area	Farm capacity
North Atlantic	10	500	5	monopile	Steel	Linear	1	1
Mid Atlantic	30	1000	10	Gravity base	Concrete	Hydraulic	2	5
North Sea	50	10000	20	3 moorings	GRP	Air	5	10
Norwegian Sea	70	100000	30	4 moorings	Wood	Mechanical	10	50
	90		40	5 moorings		Direct Drive		100

Scoring design merit

Commercial Attractiveness

Accurately modelling the effect input characteristics have on cost

Technical Achievability

Providing a measure of technical risk

- Distance from current technology
- Maturity of the technology

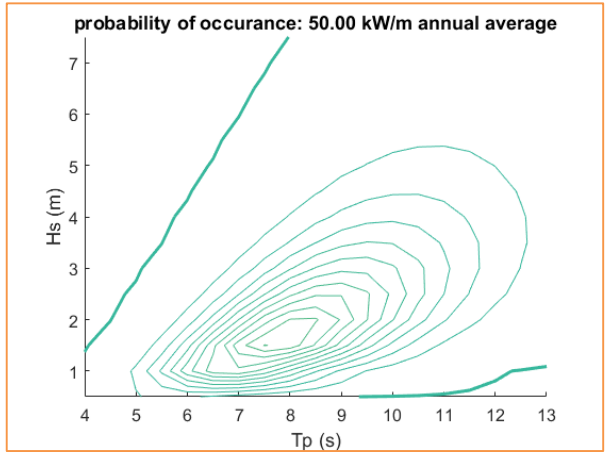
Recent work: tool development

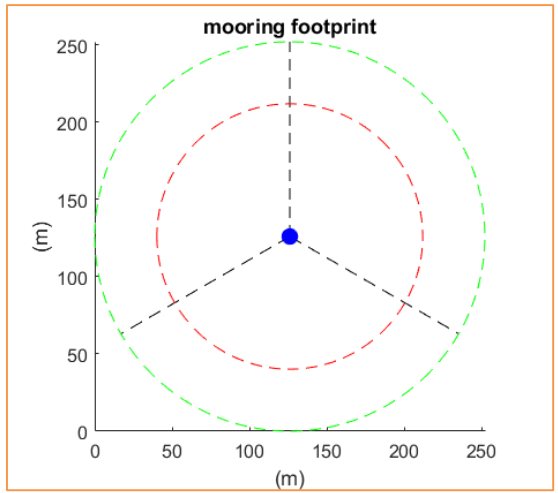
Site choices

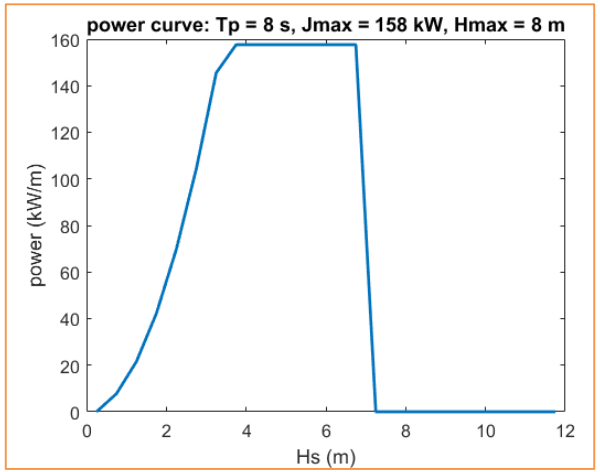
- North Atlantic
- 50 kW/m annual average
- 25km from shore

Device choices

- Heaving buoy type
- 10m diameter
- 3, 150 kg/m mooring lines



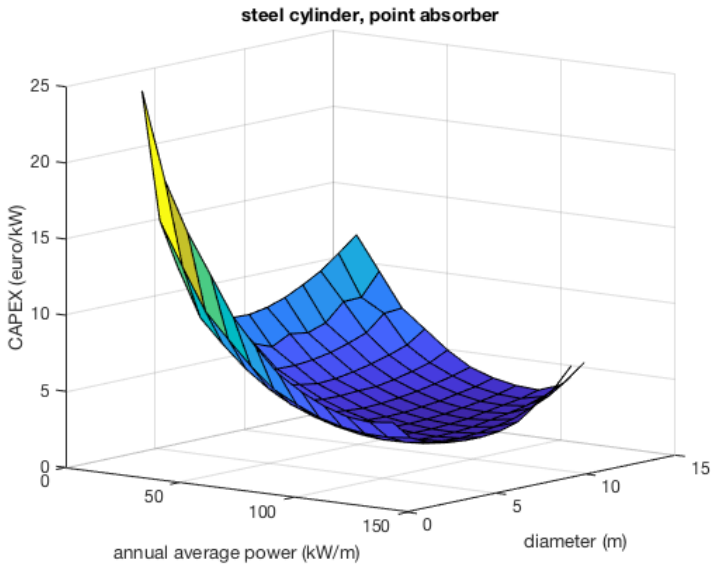


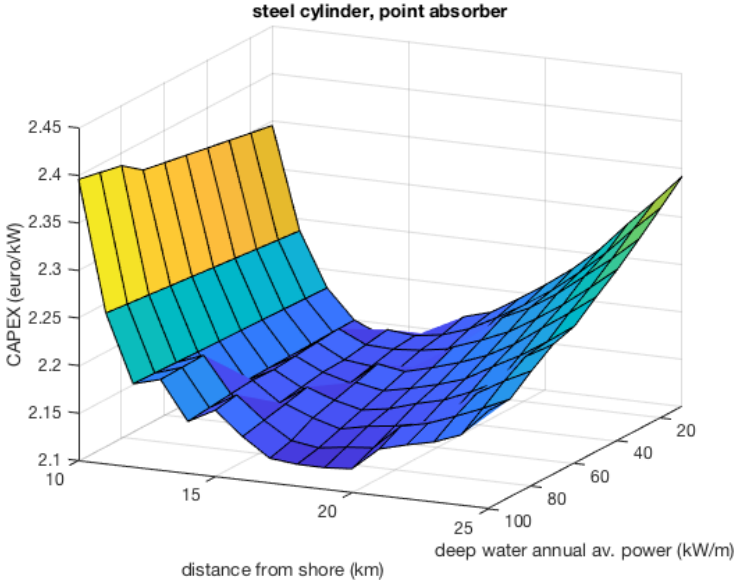


COSTS/MW

Recent work: tool development

COSTS/MW





Ranking to establish concepts worth further investigation

Further Work

- ‘Technical achievability’ metric to consider current technology and risk.
- Establish right level of complexity to be user-friendly whilst meaningful.
- Validation/ verification of the model.

Thank you for listening

Research Gate:
www.researchgate.net/profile/Owain_Roberts4

Policy & Innovation Group:
www.policyandinnovationedinburgh.org

INORE:
www.inore.org

futureWind 2018 & Marine