Using an Evidenced Based Approach to Define the Future for Wave Energy

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Introduction

Innovating clean and cheap technologies for tomorrow.

Wave energy has great potential and is predicted to be capable of supplying 10 – 50 TWh of the 350 TWh of the UK's annual electricity demand, which equates to 2.8 – 14% of renewable electricity [1]. However in order to achieve this target, a new innovative approach is required to greatly reduce the cost of energy associated with wave energy to improve the economic viability and encourage further investment.

Project Outline

The aim of the project is to use an evidence based approach to identify:

- What technology can meet the requirements of the utility companies,
- How can this technology get to market.

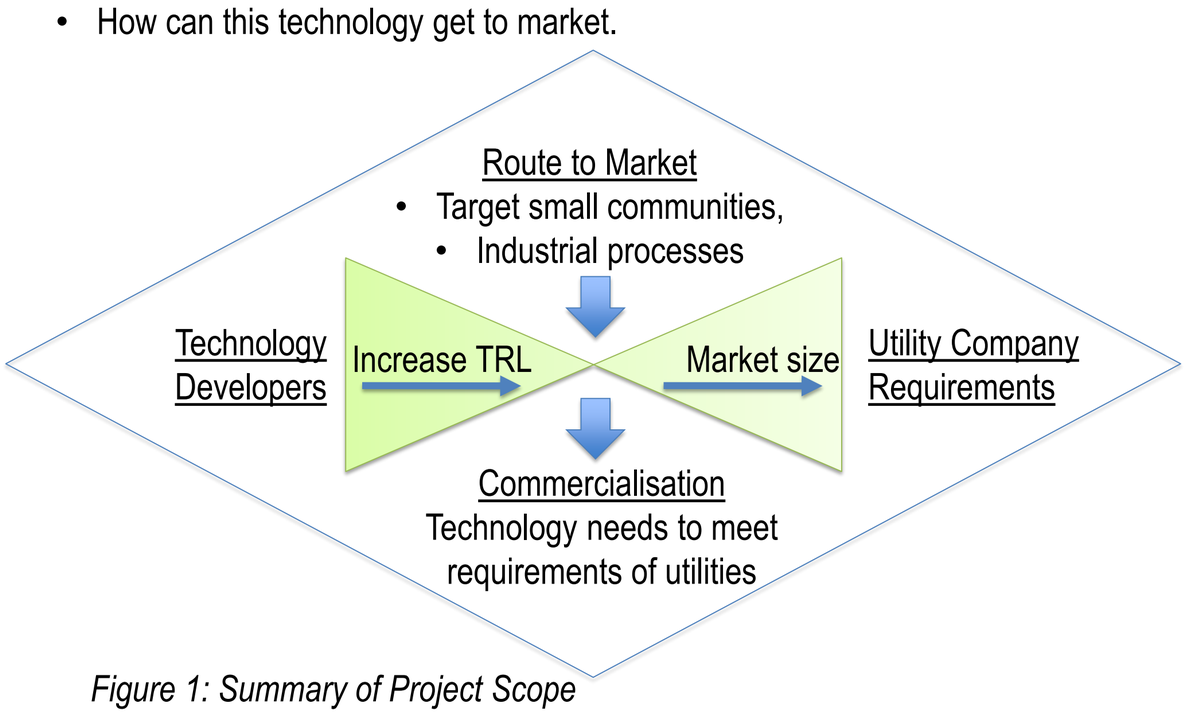

Figure 1: Summary of Project Scope

Client Requirements

This shows the general consensus from a small survey of key utility companies and other potential customers.

What the Customer wants		Minor										Major
Primary	**Secondary**	0	1	2	3	4	5	6	7	8	9	10
Low Cost Energy Supply	Reduced Commercial Risk										X	
	Scalable Technology, Array Deployment						X					
	Flexible Deployment Capability									X		
	Effective Grid Integration									X		
Reliable Energy Supply	Security of Power Supply								X			
	Predictable Power Supply							X				
	Survivability									X		
Safe Energy Supply	Maximum Operating Safety								X			
	Minimised Environmental Impact							X				

Table 1: Summary of importance rating of customer requirements from survey

These requirements form the basis for Quality Function Deployment (QFD) analysis which rates the importance of certain design aspects, and identifies potential ways these can be achieved. Initial results have highlighted;

- Reducing £/kW by increasing power density of device
- Increase energy yield by improving hydrodynamic efficiency, adaptability to sea spectra, and control methods
- Increase availability with reduction in down time, and autonomous and remote operation

Understanding Existing Solutions

Before considering a new technological approach to a problem, it is important to understand what has been achieved in the industry to date.

A total of 240 WECs (Wave Energy Converters) were categorised based on their working principles. The database includes historical devices that have been superseded, and devices and patented technology, ranging from TRL (Technology Readiness Level) 1 – 8.

Initially devices that had a TRL greater than or equal to 5 were considered. Their power take off method, and if the company was ongoing or ceased (indicated by X) was compared.

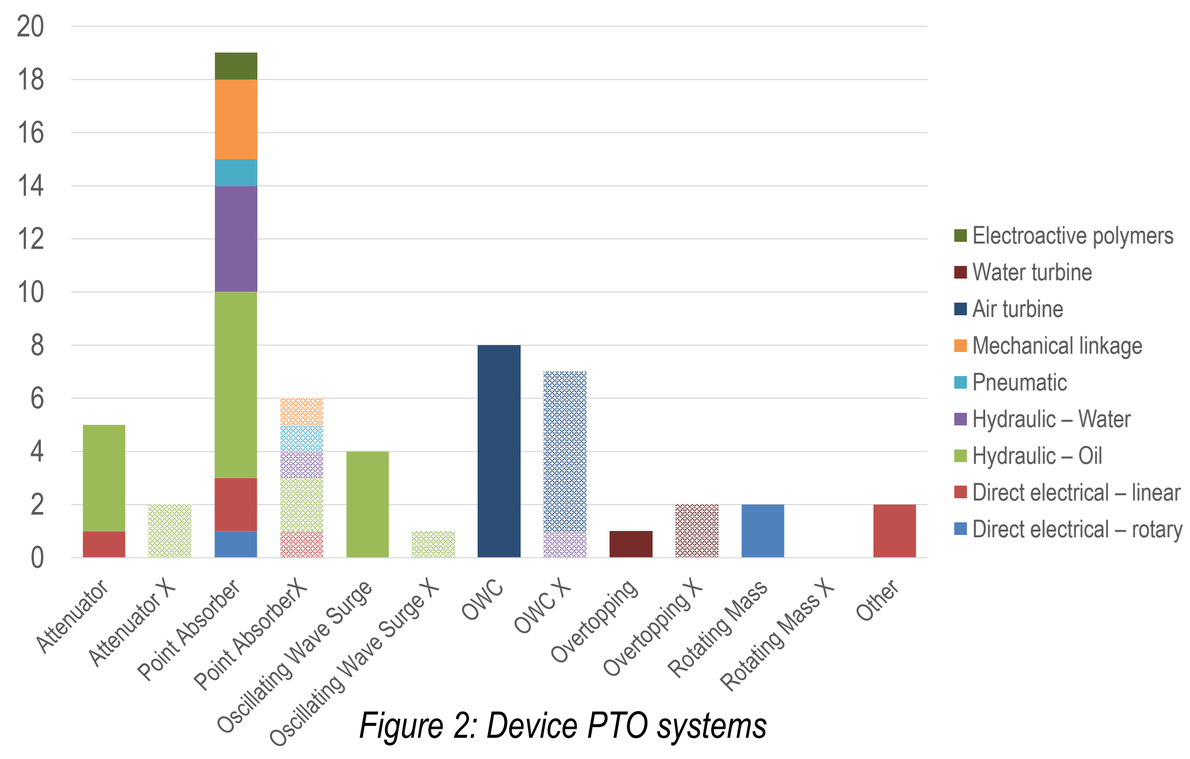

Figure 2: Device PTO systems

Figure 2 shows that there are several similarities between the power take off designs of ongoing and ceased devices.

- Has there been a step change in the technology to overcome a historical problem?
- Are developers making the same mistakes as their predecessors?
- What are the reasons for a company to be ongoing or ceased with the same working principle and PTO?

Next Stage

- Using results from the existing device assessment and the QFD analysis a design matrix will be developed highlighting the important requirements for wave energy devices.
- Existing technology will be rated and compared with how well they fulfil the requirements. It will be possible to see if any design changes can positively effect the device.
- Interviews will be conducted with innovation specialists across several industries to identify possible solutions to the design requirements to explore further possibilities.
- New concept ideas will be created that meet the important requirements to a sufficient level.

References

1. ETI, Stuart. Bradley. (2015). Wave Energy Insights from the Energy Technologies Institute Key findings

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