

The Wave Hub: A Case Study on Wave Energy Converter Technology

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Abstract

This case study examines The Wave Hub Project Wave Energy Converters (WEC) test site in Cornwall, England. A challenge with the commercial viability of WECs is the unique equipment and site conditions required to properly test the technology in real marine conditions. To bridge the gap from prototypes to commercial viability, the Wave Hub is a grid-connected test site, made to facilitate WEC development. The Wave Hub case studies how wave energy conversion technologies operate, stakeholder collaboration, and the challenges with the construction and operation of WECs. Through exploring stakeholder perspectives and environmental impacts, we can further understand the challenges faced by wave energy developers in the transition to commercial use. The goal of the case study is to assess the overall feasibility of implementing innovative renewable technology like wave energy.

Background

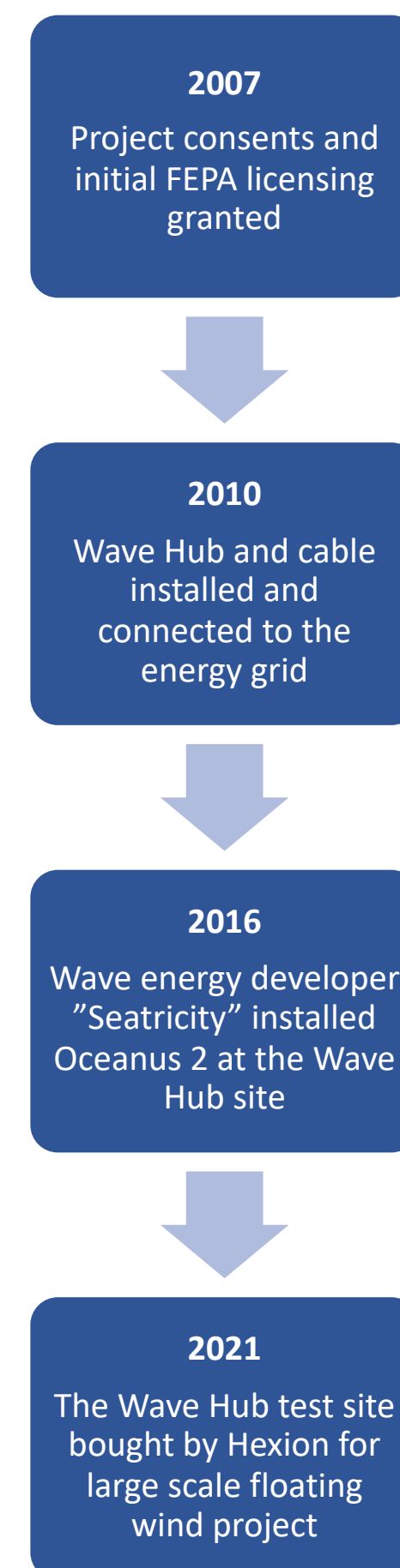


Figure 1: The Wave Hub test site; Located 16 kilometers off the north coast of Cornwall in Southwest England, with a water depth of about 50 meters. The total site area is 8km. Source: Smith et al.



Figure 2: In 2016 the Wave Hub had their first energy developer, Seatricity, install functioning WEC at the test site. The device was "Oceanus 2", with a generation capacity of 162kW. Source: BBC

Timeline of Major Events



Technology Details and Data

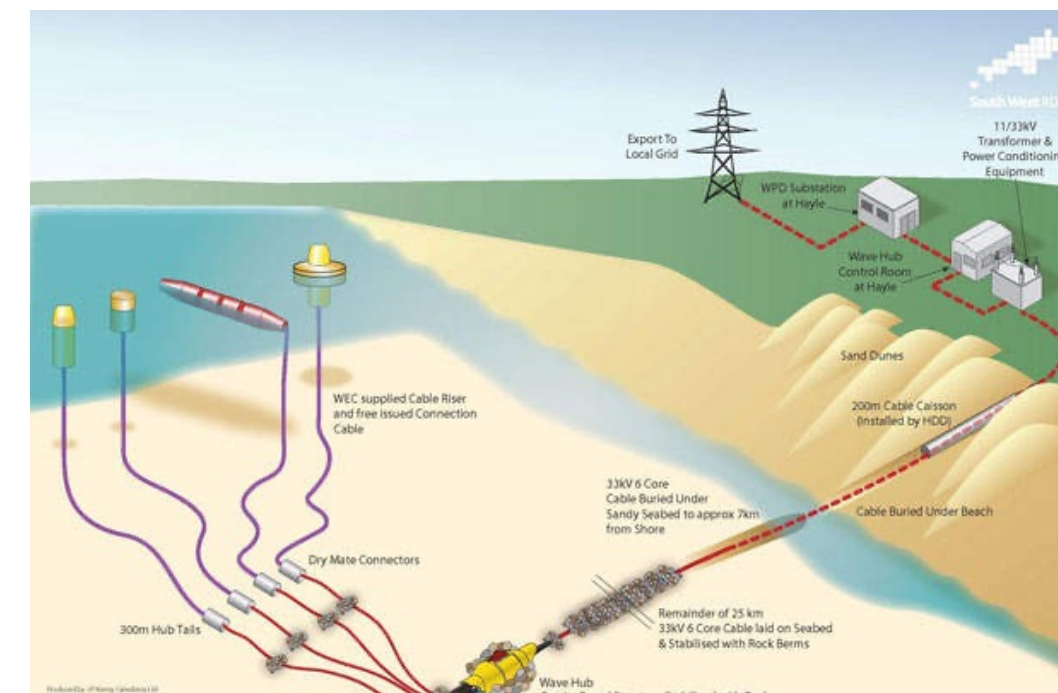


Figure 3: Displayed is a mockup of Wave energy generation site. Source: Power Technology

The Wave Hub is a 20 MW test site, consisting of four berths for wave energy converters (WECs) and their mooring spreads. Each berth has an underwater power converter acting as a transformers and circuit breakers for the power generated. This is then connected to a termination and distribution unit, then to onshore infrastructure through subsea cables.

There are several different types of WEC technology. The technology used by Seatricity at the Wave Hub can be classified as a point absorber type. This generation method utilizes the up and down movement of floating buoys from waves to pump and pressurize sea water. The pressurized water then is used in a hydroelectric turbine to generate electricity.

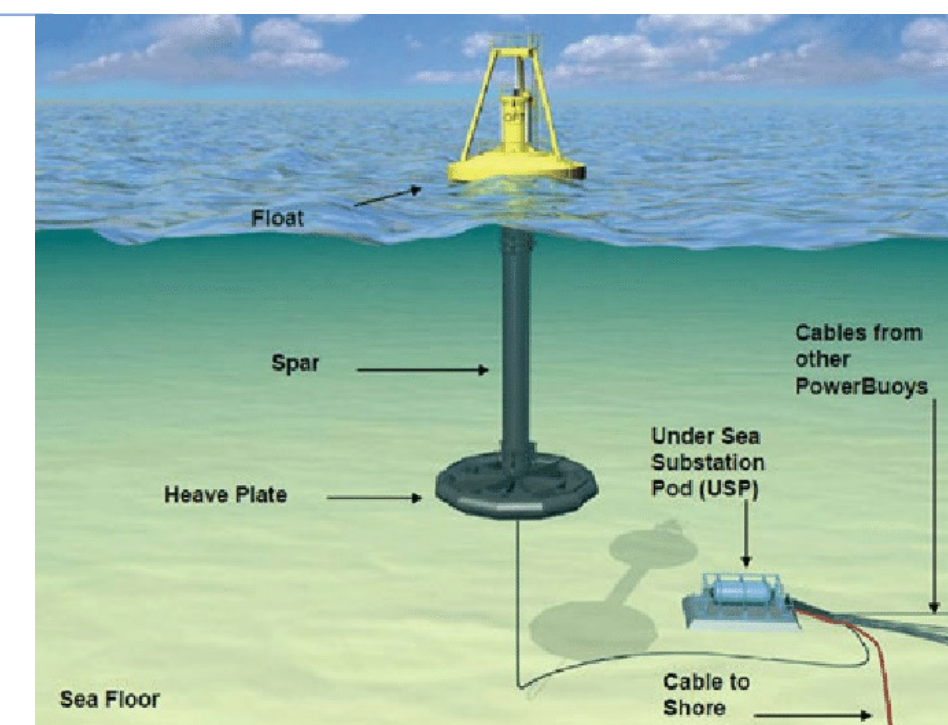
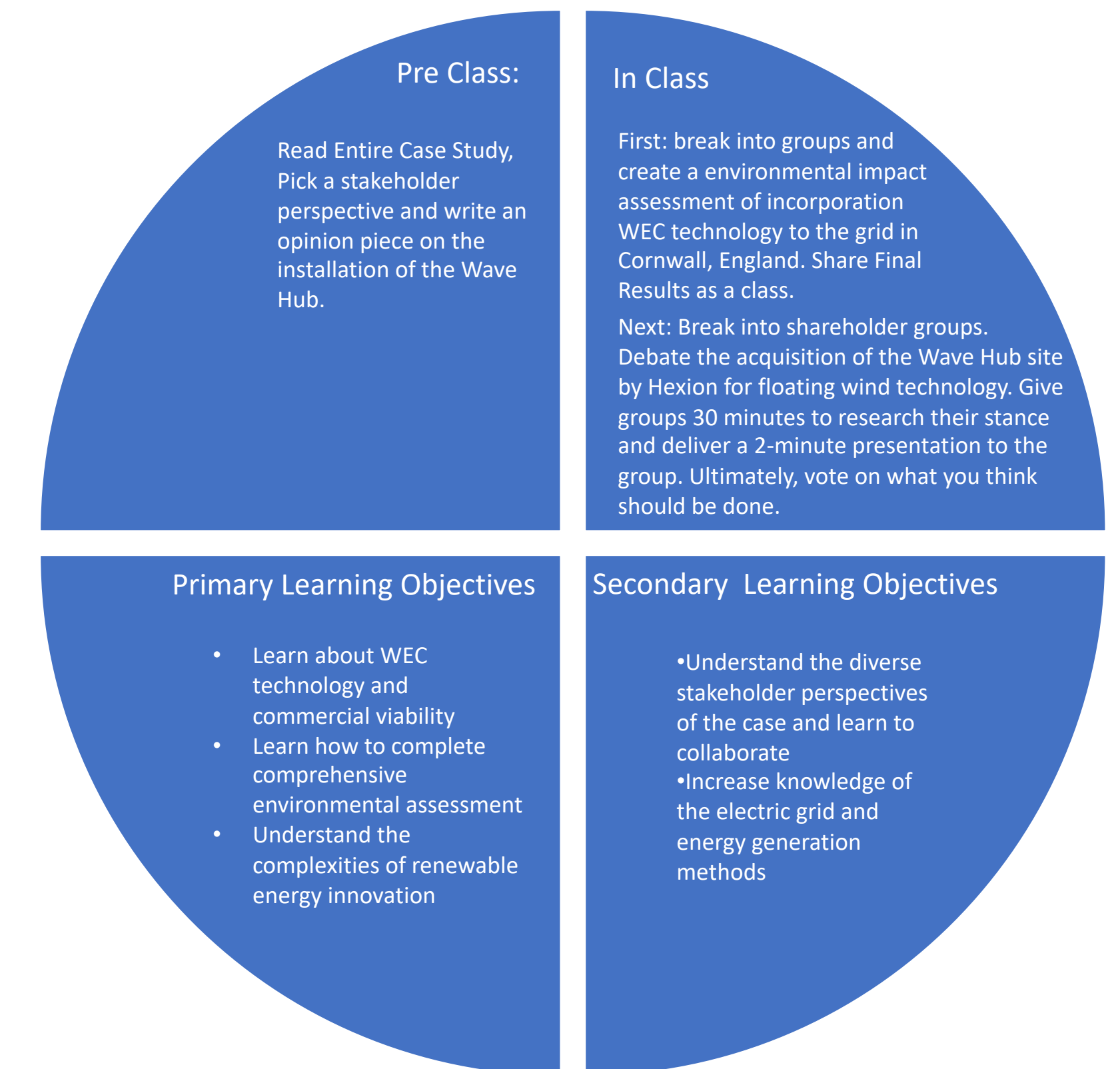


Figure 4: Labeled diagram of point absorber WEC technology. Source: Zheng et al.

Teaching the Case



Stakeholders and Analysis

Key Considerations:

- Environmental concerns**
 - The main environmental issues associated with the Wave Hub are the following:
 - Increased human activity and disturbance to birds and marine animals
 - Seabed and marine habitat loss during construction
 - Accidental pollution and water quality during construction
- Resource Allocation**
 - Over £42 Million was invested into the project
- Service to the community and other institutions**



Conclusion

The Wave Hub Project in Cornwall, England illustrates an innovative solution to the problem of WEC commercial viability. The potential of the ocean as a renewable energy source is immense, and largely not utilized. The case embodies diverse stakeholder collaboration and aims to highlight the technological opportunities for wave energy. Further, it displays both the environmental concerns associated with the project, as well as the comprehensive mitigation strategies enacted to minimize construction and operational impacts. The case aims to illuminate translatable lessons on stakeholder collaboration, environmental responsibility, technological innovation and versatility, and the broader deployment of renewable energy technology.

Sources

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