Toward Best Practices for Public Acceptability in Wave Energy: Whom, When and How to Address

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Abstract

Wave energy (WE) has the potential to eventually cover more than half of the world's electricity demand. The WE sector is still nascent; some technologies are approaching commercialization but others are in their infancy. Likewise, public opinion about WE is emerging. Public perception has been identified as a non-critical barrier of WE development provided public opinion is properly handled from the early stages of the sector. The public is now having its first acquaintance with WE, thus, the sooner there is an effective approach, the more opportunities will there be for the sector.

Research shows there are different techniques of addressing the public. This paper discusses different approaches as to whom, when and how developers should address by focusing on the experience of several renewable energy projects and the achieved results. The experience proves that early information dissemination to all interested parties via two-way communication methods contributes to achieving public acceptability most effectively.

Keywords: Best practices, opinion, public acceptability and wave energy

1. Introduction

Ocean energy is one of the largest renewable energy (RE) sources available on the planet. It includes different conversion principles, wave energy (WE) being one of them. The global WE resource has been estimated to be between 1-10 TW, which can provide 25-200% of the world's electricity demand by 2005 [1]. Numerous technologies have been proposed for its extraction, some approaching commercialization while others are still in the concept stage. Likewise, public opinion about WE is emerging. Acceptability of RE projects is very high generally, but when it comes down to implementing specific projects, acceptability turns to negativity and even hostility. It is important to know why this happens, especially after the literature attests NIMBY (Not In My Back Yard) is not the most crucial factor that defines public opposition to RE projects [2-6]. Particularly, the deployment of wave energy converters (WECs) raises concerns in relation to their environmental impact (EI) and about prioritization in the uses of the ocean commons.

It has been shown that RE projects often fail not because of technical difficulties but because of the lack of attention to stakeholders' concerns. Although there is no general and simple formula that guarantees obtaining full acceptability, several approaches to public engagement have turned to be successful. The paper is written from a developers' perspective. It discusses different actions undertaken by developers toward achieving public acceptability and focuses on providing answers as to **whom**, **when**, and **how** needs to be addressed in the initial stages of a WE project.

1.1 Best Practices

What are best practices? What distinguishes best practices from any other practice in gaining public acceptability for developing WE projects? Is there a difference in best practices for WE projects in comparison to developing other RE projects? Are best practices globally defined or site specific? Can we talk about best practices in Europe versus best practices in the United States or other regions and countries?

For the purposes of this paper, *best practices in gaining public acceptability for developing WE projects refers to achieving positive endorsement of WE projects among stakeholders (i.e. individuals or* *organizations with a stake in something, usually in the local economy or environment* [7]*) without alienating key members of the local to the project communities.* In other words, best practices do not center on the speed for going through regulatory hurdles but on creating a positive environment for effective communication through broad-based participation.

Identifying all the best practices developers have used in other RE projects is a difficult process, and besides, those identified may even be subject to debate, particularly when applied to the WE sector [8].

Methodologically, we provide case studies of WE developments that not only illustrate the applicability of the best practices concept but also explain its rationale. The case studies are selected based on three criteria:

- They examine distinct issues and look at best practices from different angles.
- They are geographically diverse.
- They are recent.

2. EIA

The questions raised in this paper (i.e. whom, when and how the public should be involved in WE projects) stem from legislative and permitting requirements. The Environmental Impact Assessment (EIA) is the tool used for examining the impacts of a project on the environment and on the socio-economic system. The first two steps of an EIA are the screening and the scoping process. Ideally, the screening is conducted by the competent authorities when a developer applies for a site permit [9]. Nevertheless, screening is not widely found [10].

In the European context, Directive 85/337/EEC defines the EIA process [11] and it is in accordance with the Aarhus Convention, thus, establishing public participation as an important part of the EIA [12].

According to this Directive, WE projects may be subject to an EIA depending on their nature (i.e. demonstration or commercial project), size and location. Thus, WE projects may undergo screening to assess whether the project has a significant EI or not. If the impact is relevant, a scoping document is prepared, which clearly states what the EIA will examine and at what level of detail, and comments can be received upon it from all stakeholders and the public [13]. Ultimately, the obligation to carry an EIA depends on each country's legislation, which determines the manner and opportunities for involvement in the decision making process.

So far, European WE demonstration projects have not been subject to a full EIA, but sometimes to an Environmental Impact Statement (EIS). For the latter, developers need to demonstrate awareness of the EIs of the project [14]. Commercial WE projects, however, are expected to be subject to a full EIA process.

In the US, public participation occurs mostly as part of the EIA process, in the framework of the National Environmental Policy Act (NEPA) of 1969. According to NEPA, federal agencies authorizing or funding a project are responsible for performing environmental reviews of the project. The Federal Energy Regulatory Commission (FERC) licensing procedure is an extensive technical process, in which the developer prepares a NEPA document (either an environmental assessment (EA) or an EIS) [15]. However, FERC establishes a preliminary permit or a "temporal exemption" for demonstration projects. This allows developers to experiment with the technology, as long as the project does not have commercial purposes [11].

In both Europe and the US, the extent of the EIA process depends on whether it consists of a demonstration or a commercial WE project. A lengthy EIA process can become a regulatory barrier to the sector's development and to its financial status.

Likewise, the questions addressed in the following section have to be considered along with the project's nature. The recommendations generally apply to commercial projects, although demonstration projects can eventually benefit from them. Then, the case studies show the importance of the EIA in the development process and the positive and negative effects it may have on the projects.

3. Wave Energy and Public Acceptability

Public acceptability of RE projects is influenced by factors such as scale, location and key characteristics of the project development [16]. Ongoing research suggests there are certain misconceptions about offshore RE projects coming from the lack of understanding of the technology and scientific findings [17-18]. Particularly, Sarmento et al. [19] comment that public acceptability of WE projects depends on a mixture of social aspects and competences over the project location. Devine-Wright [20] adds that local opposition is a form of place-protective action related to pre-existing emotional attachments and place-related identity processes.

According to the wide variety of stakeholder's and local communities' reasons involved in supporting or opposing a project [21] hereunder follows a discussion on: Who are the stakeholders? When is the best time for developers to approach them? What is the most effective way to approach?

3.1 Whom should developers address?

Since the public differs from project to project and from site to site, it is recommended to first conduct a critical and relevant stakeholder analysis and second, to identify the issues relevant to that stakeholder or target group [7, 22].

Generally, the target groups who require notable attention are: i) tourism businesses, ii) surfing groups and iii) local, professional and recreational fishermen (this analysis does not consider stakeholders related to sectors imposing "no-go areas", i.e. navigation).

First, areas with consolidated tourism tend to perceive RE technologies as damage to the tourist potential of their sites due to an environment disruption [23]. The discussions with local tourism businesses and tourists' demands should review the EIs of the project, particularly noise and visual impact (note these mainly depend on the device location with respect to shore), as well as the experience of other regions developing WECs and their impact on tourism. Current European WE pilot plants, as well as some offshore wind energy farms, are attracting an unexpected tourism flow in the area [24].

Second, surfing communities worry about possible modifications of the near-shore wave regime and alteration of coastal processes. So far, studies [10, 25] examining these impacts have not shown negative results. What is more, since surfing waves are created not only by wind waves but also by steep changes in the bathymetry, precisely where is worst to install WECs, device deployments are expected to have a minor effect on surfing.

Third, fishing communities may be particularly affected when traditional fishing methods (i.e. trawling) are prohibited due to the underwater cables around the projects [26-27]. This can be seen as a positive impact, regarding past predatory exploitation activities carried by fishermen [28]. Moreover, the experience of the offshore wind sector shows that compensatory fees for loss of fishing grounds are generally available [29].

3.2 When should they be addressed?

Early public involvement is identified as a key element for the successful implementation of RE projects [30-31]. Early communication can mitigate potential threats before a more general protest is formed that could turn later into unexpected opposition [32]. It can also avoid misinformation by media or rumors that may likely misrepresent important facts of the project. Moreover, the earlier developers learn about any potential changes in the project the better, since working in the ocean environment makes unexpected changes much more expensive than onshore.

While the public is involved in the scoping process in the US, in some European countries the granting authority decides whether the public should be involved early on in the process or not at all [30]. The latter approach can save time initially but may lead to many problems in the long run, as case study 1 shows.

3.2 How should they be addressed?

Oftentimes public acceptability of RE projects increases when familiarity with the technology rises and observations of similar projects are possible [32-33]. Hansen et al. [34] comment that WE can possibly become more popular than wind energy because of the minimized visual and noise impact. However, it is a big challenge due to the "low public knowledge" on WE. It is therefore important to be aware of the level of WE understanding in selecting the most appropriate tools for addressing stakeholders.

Essentially, there are three ways for involvement: through passive information, planning participation and financial participation [16, 26, 35-36]. In general, the former is regarded as a bad practice if there is a lack of WE knowledge or no previous related activity in the area. Likewise the latter option is not considered since WE has not yet become financially attractive [28].

The recommended strategy, namely planning participation, directly involves stakeholders in the planning phase through two-way communication techniques, incorporates negotiated changes into the project, provides motivation for the public, generates interest in the project and other energy related issues and can deal earlier with misconceived threats [28].

Nevertheless, this strategy may carry some drawbacks related to fulfilling public demands and the time required for that. As a result, it is becoming common to hold a communication process managed by an independently appointed party. This method assures that the public and stakeholders' views are fairly represented in the process. It has proved effective in Belgium with several wind projects as well [37].

4. Case studies

4.1 SSG Kvitsøy pilot project, Norway

The Norwegian based company Wave Energy AS (WEAS) develops the technology Seawave Slot-Cone Generator (SSG), a WEC of the overtopping type. The 150 kW pilot project [38] comprises of a 10x17x6m (width-length-height) concrete civil structure module to be built on a rocky shoreline (Fig.1). WEAS was not obliged to carry an EIA nor an EIS for the pilot project. The project had none of them, but obtained the construction permit.

Figure 1: SSG pilot plant in Kvitsøy island, Norway [39].

***Location*:** It is located in Kvitsøy island, west coast of Norway. The island has a high tourist value due to its natural resources, particularly for the greenstone rock. The location was chosen for its WE resource (i.e. the near-shore average WE power is estimated at 19.6 kW/m [39]) and for its remote characteristics. There was no particular competence in the deployment site besides some possible interference with kayaking and canoeing activities.

Engagement strategies: Generally, public engagement practices were very few and there were neither specific awareness campaigns nor public exhibitions or other relevant engagement strategies.

The project consortium included the Municipality of Kvitsøy as "a key to […] ensuring […] cooperation with the island inhabitants". The Municipality only planned to involve the locals with the construction of a local museum dedicated to WE and the particular SSG project. Nevertheless, the museum was never realized.

Besides radio programs, TV programs and newspapers gave relevant project information, which mainly focused on the SSG pilot project and WEAS locally-based company. No general WE information was provided. Additionally, a project website was established.

Public opinion: There was very high project acceptance among the local inhabitants. The highlighted benefits of the project were added tourist value to the area and to some extent new RE sources as an alternative to existing diesel generators.

The opposition to the project came from only one individual who had a summer house in the island. He had had related activities with EIAs and his main complaint was the lack of an EIA for the project. His opposition campaign involved contacting most of the responsible authorities behind the project, at the local, national and EU level, and writing in local newspapers.

He wrote objection letters and delivered an official complaint to Kvitsøy municipality against the construction approval. This objection was denied twice by the Municipality but was taken further to a regional commissioner. The latter also denied the objection, but then it was delivered together with the objection against the above decision to the Norwegian Department of Environment and Energy.

In addition to this, he found two unknown issues related to WEAS and the project. First, that WEAS did not have the money required for the decommissioning phase, approximately in ten years time. And second, that it planned to blast rocks for the construction works.

The opposition campaign resulted into additional project delays and increased public opposition. As a result, the project consortium decided to stop the project and choose a different location, even before the last objection was solved.

4.2 Wave Dragon Pembrokeshire pilot project

Wave Dragon (WD) Pembrokeshire project consists of the deployment of a 7 MW demonstrator, off Southwest Wales, UK. The device will be tested for 3-5 years, whereupon it will be removed from the temporary deployment zone to a final one 40-45 km further offshore, with 21-25 kW/m WE potential.

Location: The demonstration site was selected due to a predominant wind and wave direction and good WE potential (i.e. up to 15 kW/m), proximity to grid connection points and proximity to land, including a major port. The site is also away from commercial shipping interests and outside of military firing ranges.

These criteria defined a site surrounded by ecologically sensitive areas (i.e. it is within Pembrokeshire Coast National Park), which, in spite of this, was pointed by the Countryside Council for Wales as the most suitable location. The area is also characterized by tourism, associated service industries and potting activities for lobsters fishing [10].

Engagement strategies: The developer made substantial efforts to engage stakeholders, local organizations and the public from the earliest stages [40] in order to share their plans and gain feedback. This engagement was coordinated by an offshore wind energy consultant. There were a series of one to one discussions with relevant stakeholders, a formal project briefing, with 40 people representing 25 organizations, and a public exhibition. The later gathered over 200 people. The project also launched a website giving access to the most important documents (www.wavedragon.co.uk).

Public opinion: The major concerns varied significantly among the target groups. While statutory stakeholders (i.e. Milford Haven Port Authority, Maritime and Coastal, Guarding, Department of Trade and Industry, etc) were interested in navigational safety issues, non-statutory stakeholders like local groups and individuals were concerned about WD intrusion (i.e. visual impact, impact on local beaches, sensitivity of the local marine environment and effects on tourism) and the precedent an initial demonstrator project could set for a larger one [40].

To face the wide variety of concerns WD carried several studies: geophysical, benthic and archeological records studies, navigation surveys, and studies on fisheries, coastal processes, birds, subsea noise and ecology, among others. Particularly, WD produced theoretical visibility mapping to predict the visual influence of the WEC (Fig.2). This proved to be highly enlightening for stakeholders and allayed many concerns about the proximity of the device to the coast and the effects on tourism [10].

The local fishing community highly supported the project once initial concerns over loss of sea space for potting were allayed. Moreover, the Marine Fisheries Agency repeated their overwhelming position of support and strongly commended WD communication and engagement with local fisheries [10]. In addition, WD is considering allowing local fishermen to drop mussel ropes off the device and harvest the catch.

Figure 2: WD photomontage from Pembrokeshire Coast Path at Hooper´s Point (250 mm viewing distance) [10].

According to an independent research activity [40], there is a significant degree of local support and no organized opposition to the project at this stage.

Timeline and EIA: The total process carried by WD can be divided into five distinct phases: i) scoping, ii) initial survey work, iii) discussion on initial survey results to inform full EIA surveys, iv) EIA surveys and v) discussion with survey results [10].

WD performed expensive and extensive EI studies even though it was only applying for permission to use the site as a test area. The reason may be explained as follows: On one hand, there was no clearly defined consent process for a WE demonstrator unit in the UK by the project time. The consent process was adapted from other contexts and authorities were not prepared

[28]. Therefore, it was WD's responsibility to decide what to include and how to approach the EIA process. On the other hand, WD had a deadline to use the project funding and was actually worried of having the project stopped due to lack of EI studies. Thus, the uncertainties in the licensing process along with WD´s fear of jeopardizing the project funding, led WD to carry out a full EIA. The process involved more than 13 authorities and including the feasibility assessment and consent, it lasted for four years (Fig.3).

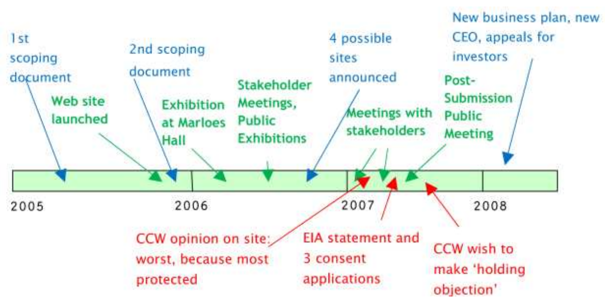

Figure 3: Wave Dragon application process timeline [40].

The project stalled after scoping studies, engagement and consent applications. Funding problems are cited as the main reason in addition to difficulties of the complex process [40]. The project is finally back on track (by 2010) with the final consent expected in 2011.

4.3 Ocean Test Berths scoping process

The Northwest National Marine Renewable Energy Center (NNMREC) is a partnership between Oregon State University (OSU) and the University of Washington (UW) sponsored by the Department of Energy (DOE) in the Pacific Northwest area of the US. OSU and UW collaborate toward WECs and tidal energy devices commercialization, inform decision makers and boost technology development.

NNMREC has proposed to construct, deploy and operate an Ocean Test Berth (OTB) about 2 km off Newport, Oregon, US. The OTB will be an integrated and standardized test center to test, develop and validate WECs. The first development of OTB is the Mobile Ocean Test Berths (MOTB), where WECs can be tested without grid connection.

Engagement strategies: DOE, as the funding agency of the project, has initiated the preparation of a draft EA of the MOTB, according to NEPA requirements. Its purpose is to i) identify any adverse environmental effects, ii) evaluate viable alternatives to the proposed action, iii) describe the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity, and iv) characterize any irreversible and irretrievable commitments of resources [41]. DOE also issued a Notice of Scoping for the MOTB. The Notice of Scoping provides details about the project and is publicly available in order to get input on issues that should be considered in the EA.

DOE held a meeting where the public could provide comments, tobe incorporated in the draft EA. After, the public will be notified and allowed to comment on the Draft. Subsequently, the public comments will be incorporated in the final EA. Then, DOE will either determine a Finding of No Significant Impact or proceed with a full EIS [42].

Public Opinion: About 25 people attended the DOE community scoping meeting. Most of them represented the general public, but there were also representatives of state agencies and local businesses and some commercial and recreational fishermen. Most of the questions raised focused on the test site location. It was suggested that the MOTB was in a very busy area for recreational fishermen. Several people asked about the total closure area and whether the MOTB could be moved within the test site. Some questions focused on the mooring design and the devices to be tested.

Newport community has seen plans for harnessing WE for several years ahead. By 2006, Oregon suitability for WE development was made public [43] and since 2004 there have been strong efforts to establish a NNMREC in Oregon [44]. Efforts included building strong support at the state and federal levels, collaboration with industries, utilities and the communities, and outreach to the fishermen and crabbers community. In addition, specialists and University professors have been informing coastal communities about WE development opportunities in Oregon [45].

FINE (Fishermen Involved in Natural Energy), the local community and representatives from federal and state resource agencies are now involved in the MOTB site selection. FINE was established in Newport as an advisory group, whose purpose is to represent the community interests, especially those of fishermen and crabbers, in making decisions about the actions taken in the County waters. The reason for its creation was the County's concern that WEC developers could obtain permits *without engaging the community*.

DOE decision as a result of the scoping process will probably be favorable. This is due to the early community involvement and the organized approach that puts local and fishermen interests on par with WE development.

Scoping is viewed as "the most important stage" for determining the quality of an EIA and as "the most problematic phase" [30]. This case study shows that with early stakeholder involvement, the second part of the definition might need to be changed.

5. Discussion

The presented case studies provide good baseline data to discuss the following questions:

- Are there differences in best practices for WE projects in comparison to developing other RE projects?

The inherent characteristics of WE makes the research and development stage more difficult than for other RE technologies in relation to technology testing. WE prototypes above a certain scale have to be tested in real seas and their size has to be adjusted to the sea states where are deployed. This makes WECs not only large in size but very expensive to test.

On top of this, WE developers may have to deal with regulatory hurdles, long and expensive EIAs, and an opposing public opinion to obtain permits to deploy demonstration projects.

Case study 2 describes one of the main barriers for WD development, the expensive and extensive EI studies that had to be performed [28], in spite of it being a demonstration project. WE pilot projects should be exempt from complex EIA processes that would represent a barrier for the development.

- Are best practices globally defined or site specific?

There are some universal best practices, such as early and local participation, and some site-specific issues, which depend on the community priorities. In different locations particular stakeholders might need to be stressed over others.

It could be inferred from Case study 1 that it should be the responsibility of the local authority to organize public acceptance campaigns and to collaborate with developers for their realization, since the local authority knows better the inhabitants, their culture as well as the community habits. Particularly, WEAS believes it should be the developer´s decision whether to carry public acceptance campaigns or not when deploying pilot projects, even though it should aim at. He should not be obliged by national or international laws, but by the local authority.

- Can we talk about best practices in Europe versus best practices in US or other regions and countries?

In the US [46], local communities form groups, such as FINE or FACT (Fisherman Advisory Committee for Tillamook), which represent the community interests. In their meetings anyone can express an opinion about an issue relevant to the local community. Eventually, these groups help coastal communities come out with a unified position and speak up their interests, when holding discussions on WECs siting, for example.

So far, European experience for WE does not reveal any organized groups as such to aid in reaching a common community decision. This is neither found in the wind energy sector, except for organized anti-wind farm groups.

6. Conclusions

Public involvement is considered positive in the long run despite the fact that it can extend the timeline for public approval almost indefinitely. In other words, as long as the public has any concerns about a proposed project, the project will not be implemented if those concerns are not addressed in a satisfactory manner.

For example, WD firmly believed in an early and open approach [35]. According to the high levels of public acceptability to the Wales project, this strategy has proved to bring direct benefits to the project [10]. Nevertheless, the experience has also shown that negotiations with stakeholders could last indefinitely and eventually result into a time consuming and expensive process.

Besides, it seems that RE projects are generally more penalized by the local communities and sometimes also by the authorities with regard to their EIs and the EIA process than non-RE ones.

Here, the authorities, particularly the local ones, play a major role. They should aid developers in addressing stakeholders and local communities. Moreover, strategic planning policies like Strategic Environmental Assessment along with Marine Spatial Planning, are desirable to avoid or minimize conflicts of WE with other sea uses or damage to visual, cultural or archaeological resources [47]; these usually being the origin of public opposition to WE projects [21].

The paper has proposed some recommendations for an effective public acceptability process. For further research and a better understanding of the difficulties for developers in achieving best practices, we recommend conducting further interviews with developers. Once commercial deployments take place we will see what is actually happening and how the reality fits with the anticipated positive and negative impacts of WE and their consequences on public opinion.

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