Wave energy communication and social opposition: can we improve perception of ocean energy development projects?

Maria C. Uyarra, Iratxe Menchaca, Sarai Pouso, Laura Zubiate, Dorleta Marina, Enored le Bourhis, Thomas Soulard, Sandrine Jamet, Niall Dunphy, Janete Gonçalves, Erica Cruz and Juan Bald

Abstract—**Despite the benefits of marine renewable energies (MRE) to the decarbonisation, public opposition has often been posed to MRE projects. This opposition may slow down Europe´s energy transition towards clean energies. In the context of European SAFEWAVE project (https://www.safewave-project.eu/), we aim to understand the causes that trigger opposition to wave energy projects and identify how communication could improve the perception and attitudes towards MRE projects. To achieve this aim, a systematic review of ongoing wave energy projects, scientific bibliography and social media has been carried out. Outputs of this research indicate that opposition to wave energy is rather limited and primarily posed by national and local communities, as well as NGOs. Opposition emerges after envisaging negative affection on i) economy, ii) social aspects, and iii) the environment. Despite much of the wave energy information available on the media is produced and communicated by scientists and engineers (which should be considered a reliable sources of information), most of the communicated content focus on the drivers, the technological developments and benefits. Limited information on potential impacts of wave energy projects is shared. A holistic communication approach, in which both expected benefits and impacts are communicated may reduce opposition and help society to become more marine energy-literate, allowing for informed decisions and responsible behaviours/attitudes. Availability of official documents, participatory approaches, and transparency are crucial for improving the perception of future wave energy projects.**

Keywords—**Attitudes, marine renewable energies, perception.**

I. INTRODUCTION

THE world population is continuously increasing and the energy consumption demand with it. This demand is further exacerbated in developed countries, where supporting high living standards requires high levels of energy supply. Renewable energy alternatives are being investigated as means to cover this increasing demand, but also, to counteract the negative effect of the resulting CO_2 emissions derived from fossil fuel combustion [1].

Indeed, at global level, there are continues negotiations to set up objectives to reduce CO_2 emissions, such us the Net Zero Coalition that calls the Paris agreement [2], that claims a 45% CO_2 reduction by 2030 and reach net zero by 2050, to keep the temperature increase at 1.5ºC. However, not all countries are willing to agree upon these objectives and those willing to do so, are far from achieving them. At the European level, the commitment is to reduce CO_2 emissions by 55% below 1990, by 2030 [3]. To achieve this aim, the EC requires to double the renewable energy production to 65% by 2030, which is requiring high economic investments on renewable energy research, including Marine Renewable Energies (MRE).

MRE research is far behind that of terrestrial renewable energies. From all MRE (i.e., current, tidal, wave, offshore), offshore wind energy is the one furthest developed. High economic cost, technical difficulties, and environmental impact uncertainty are some of the limiting barriers affecting a faster development of other alternatives.

In the case of wave energy, there is only one wave energy production farm (i.e., Mutriku (Spain)) operating in

This work was part of the SafeWAVE Project co-funded by the by the European Climate, Infrastructure and Environment Executive Agency (CINEA), Call for Proposals EMFF-2019-1.2.1.1 - Environmental monitoring of ocean energy devices.

Maria C. Uyarra, Iratxe Menchaca, Sarai Pouso and Juan Bald are at AZTI, Herrera Kaia, Portualdea z/g, 20110 Pasaia (Gipuzkoa), Spain (email. mcuyarra@azti.es)

Laura Zubiate and Dorleta Marina are at BiMEP Atalaia 2, bajo. 48620 Armintza, (Bizkaia), Spain (email. lzubiate@bimep.es)

Enored Le Bourhis, Thomas Soulard and Sandrine Jamet are at the Ecole de Centrale de Nantes / SEM-REV, 1 Rue de la Noe, 44321 Nantes Cedex 3, France (email: enored.le-bourhis@ec-nantes.fr).

Niall Dunphy is at the Environmental Research Institute, University College Cork, Ireland (email: n.dunphy@ucc.ie).

Janete Goncalves is at WavEc Edifício Diogo Cão, Doca de Alcântara Norte, 1350-352 Lisbon, Portugal (email: janete.goncalves@wavec.org).

Erica Cruz was at WavEc and is currently at BlueOasis at Rua Prudêncio Franco da Trindade 4,2655-344 Ericeira, Portugal (email. erica@blueoasis.pt)

Digital Object Identifier: https://doi.org/10.36688/ewtec-2023-436

Europe. Other developments are still in the pilot/prototype phase. Considering that wave energy will eventually overcome the above-mentioned barriers, and then, it will have the potential to quickly develop and expand, it is important to understand potential opposition that wave energy developments may receive in future.

Despite the clear need for Renewable Energies and its many benefits, some sources of renewable energies have evoked opposition within intended host communities, even leading to social mobilisation against deployments. To avoid this, it is important to identify where opposition sources may arise, to tackle those from the start and promote a transparent communication, that promotes public engagement and minimizes its opposition.

To this end, in the context of the EU funded project SAFEWAVE (www.safewave.eu), we first analysed scientific evidence suggesting potential impacts and sources of opposition to wave energy. Secondly, we analysed different media sources of information (e.g., Youtube, Twitter) as means to identify what type of information people have access to and identify gaps. Outputs of this research highlights where communication efforts should be placed to increase "ocean energy literacy" as means to increased informed-public opinion.

II. METHODS

The study has been structured into two parts, according to sources of information. First, a systematic literature review was carried out to identify reported evidence of opposition in scientific and technical publications on wave energy. The sources of information used within this part are: i) Web of Science scientific publications, and ii) technical documents available in Tethys platform. Secondly, a systematic review of information communicated on different media types that may be more frequently used by citizens (i.e., Google, YouTube, Facebook, Twitter), was carried out as means to better understand which messages are communicated.

A. Opposition to wave energy: scientific and technical literature review

To facilitate the systematic review of Web of Science and Tethys references, a guidance document for the online searches and an excel file data collection were created. This excel file facilitated the extraction of the following information: general information (e.g., Identification Code, Source, Title, Year, etc.), key words, type (e.g., social, environmental, economic) and subtype (pre-defined fields) of opposition, actor presenting the opposition, process at which opposition was presented (e.g., scoping, planning, consultation, consenting, etc.), offered solutions, and duration of consultation process if information provided [4].

B. Social media analysis on wave energy

Wave energy content from Google, YouTube, Twitter and Facebook was analysed. Protocols developed in the context of the H2020 ResponSEAble project on ocean literacy [5] were adapted and used to develop a guidance document that would facilitate the wave energy media analysis. The guidance document is a step-by-step document that indicates how to perform the search within each media platform to ensure harmonized and useful outputs. This guidance document included limiting factors for the searches: years, language, countries, keyword strings, number of retrievals, etc. This document would allow output harmonization across different researchers that review media content in different languages (i.e., English, French, Spanish, Portuguese).

This guidance document also included an excel file to retrieve key information on the following topics: general information (i.e. identification code, source, title, URL, reference, language, year), content communicated, type of content communicated, communicator, target audience keywords and additional comments.

The type of content communicated included a drop-down menu of options, which followed the "DAPSI(W)R(M)" (Drivers-Activities-Pressures-State-Impact-(Welfare)-Response (measures)) causal model [6]. This allow identifying where the focus of communication is within the different media types.

For each source of information (i.e., Google, YouTube, Facebook and Twitter), and for each language, the first 30 retrievals obtained, were included in the excel files, whenever the retrievals comply with the guidelines provided in the guidance document.

III. RESULTS

Outputs of this research are structured according to the scientific / technical literature review and the media analysis.

A. Opposition to wave energy: scientific and technical evidence

Despite the many existing references in Tethys (N = 894) and Web of Science (N = 256) in the topic of "Wave energies", only 12 documents from each source were classified of interest in relation to opposition to wave energy. The analysis of these 24 references shows that opposition mainly related to economic (77%), social (35%) and environmental (61%) aspects. In addition, 14% of the main opposition topics related to safety for navigation.

The main subtopics to which opposition related to economic issues were the affection to existing uses (e.g., fisheries) (65%), followed by employment issues (8%), and spatial (user) conflicts (4%). On the social side, 23% of the references referred the opposition to the affection to local communities, followed by the visual impacts (11.5%) and the effect on traditions and socializing patterns (4%). Finally, environmental opposition mainly related to the noise (11%) and affection to different ecosystem

components (20%), such as birds, fish (8%) or habitats. It was mainly NGOs, surfers, and national and local communities who posed opposition.

In Tethys technical references it was found that almost half of the opposition was presented during the consultation process, in the context of the consenting phase of the project. However, 40% of the opposition was registered during public consultation (through workshops, questionnaires, etc.), and only one case was registered during the scoping phase of the project. In the case of Web of Science references, the opposition was mainly found through the research projects carried out over ongoing pilots.

TABLE 1.
SOLUTIONS IDENTIFIED TO AVOID, LIMIT OR OVERCOME SOCIAL OPPOSITION TO WAVE ENERGY PROJECTS.

Measures	Definition	WoS	Tethys	Media
Transparency	Ensure transparency through any wave energy development	x	x	
	Create documents/data repositories easily accessible to people			
	Simplify processes for wave energy development (clear actors involved)			
Engagement	Develop local strategies that ensure benefits to communities	x		
	Work to foster collaboration with local communities and local leaders	x		
	Establish additional steps at which stakeholders can present opinions/concerns			
	Use local knowledge to select best locations to deploy wave energy projects	x		
Science	Increase scientific knowledge in relation to environmental impact	x	x	
	Favour additional monitoring and surveys		x	
	Use and implement integrative (environmental, social and economic) models	x		
	Improve technological designs to reduce visual impacts (as well as other impacts)			
	Use and implement existing tools to identify locations where conflicts will be minimal			
	Use MSP and redesign projects according to different users' needs	x	x	
Measures	Establish a set of compensatory measures	x	x	
	Develop a monetary fund to use under different circumstances		x	
	Develop and share EIA and surveillance plans, which should also include funds/actions to overcome risks			
	Develop and share risk plans and emergency measures		x	
Communication	Grow and educate (ocean literacy promotion) for clean energy pride			
	Introduce uncertainty as in relation to impacts (and benefits) in the communication			x
	Use direct communication to communicate with local communities (e.g., brochures, meetings)	x		
	Better indicate limits of the wave energy development areas	x	x	

Transparency, social engagement, more science, additional measures, and better communication are the key solutions identified by authors of this article and in the reviewed documents as means to avoid, limit or overcome opposition to wave energy (Table 1).

B. Social media communication of wave energy

Of the potential 480 media items (i.e., 30 retrievals per language and media type), 473 were obtained and analysed. The media analysis shows that the content communicated on wave energy primarily focuses on the Activity itself; that is, in the wave energy production/development. In addition, the Drivers are also the focus for communication (e.g., need to combat climate change, consumers' demands) and the contribution of wave energy to Welfare (e.g., clean energy supply, employment, a less polluted planet, etc.). Therefore, the overall "wave energy message" in these specific four media sources is very positive. Indeed, not many media retrievals focused on the Pressures that the infrastructure deployment or the functioning itself may introduce into the environment, nor on the potential environmental impacts that wave energy projects may cause (Figure 1).

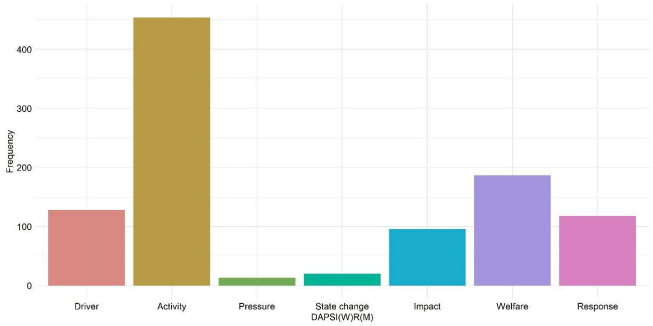

Fig. 1. Content type communicated through the 473 references (from Google, YouTube, Facebook and Twitter) analysed in this work. The content is organized around the wave energy DAPSI(W)RM framework (Driver – Activity – Pressure – State change – Impact (on the environment) – Welfare (impact on Welfare) - Response.

IV. DISCUSSION

This study reveals that so far opposition to wave energy is limited with few references found on this topic. However, such information is very valuable, especially in the context of potential development and expansion of wave energy projects, and MRE in general.

Indeed, out of the many references obtained, only few (less than 3%) pointed out opposition issues with wave energy developments. This is not surprising since this type of developments are mostly in a pilot and small-scale phase. It is also not surprising that most opposition is presented during the consultation phase, which represents the moment at which the public has access to project details. Yet, it is worth noting that research papers also found opposition once the projects are ongoing and running. This may be related to the consultation process i) being too short to allow posing opposition, ii) not reaching all potentially affected sectors or iii) not providing comprehensive information.

Indeed, for some of the consultation documents reviewed (e.g., SEM-REV site), the consultation process lasted a month. This period may be enough for consulting the document, but not to raise concerns, to have the opportunity to consult experts, or to establish effective engagement with developers.

The hypothesis of opposition being a result from information not reaching all the required audiences is supported by the fact that highest opposition reported relates to economic (e.g., conflicts with existing uses, threat to current jobs…) and social issues (e.g., affection to local communities and traditions), which could be overcome with longer (i.e., from scoping to surveillance of scaled-up projects) and better engagement with all key local stakeholders [7].

Finally, we hypothesized the important role of adequate communication to avoid communication. As found through the media content analyses, it could be concluded that the message on wave energy transferred to the society is very positive and mostly focuses on its benefits. Although this could be the case, as so far, there is limited knowledge and high uncertainty regarding the environmental impacts of such projects, the fact that these

are rarely mentioned could raise scepticism, as if some knowledge was not being shared. Thus, integrating within the wave energy message a certain level of uncertainty associated with the impacts/benefits and recognizing that there is limited evidence suggesting negative impacts of wave energy would be beneficial to increase trust.

Fortunately, this potential lack of trust can be counteracted thanks to a large proportion of the media sources analysed being originated by the professional sector, which should be considered a reliable source of information. However, the risk associated with this is that sometimes bridging the gap between science and the society is a challenge.

The Laswell´s communication model formula "Who says What to Whom in Which channel and with Which effect" is often seen as the way for effective communication, which can result on increasing ocean energy literacy. Yet, this needs to be taken a step forward, and aim for public engagement throughout the entire process. Only by doing so, opposition can be prevented or managed [7].

Thus, preventing, limiting or overcoming opposition requires from a combination of several actions: i) communication of a more comprehensive and holistic wave energy message on the media that includes all existing scientific knowledge and uncertainties and that reaches in an adequate language different sectors of society, ii) further engagement with local communities from the start and throughout the entire process, iii) increasing transparency in the process by making information and documents easily and readily available and finally iv) adopting and implementing measures if necessary. These actions set up the framework for building trust in wave energy projects and ultimately, reduce the potential opposition to wave energy projects.

REFERENCES

[1] EC, 2019. Communication from the Commission – European Green Deal (COM(2019) 640 final): https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019DC0640

[2] UNCCC, 2015. Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104.

[3] EC, 2030. Communication from the Commission – Stepping up Europe's 2030 climate ambition Investing in a climate-neutral future for the benefit of our people (COM(2020) 562 final): https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0562

[4] M.C. Uyarra, I. Menchaca, S. Pouso, J. Bald, L. Zubiate, D. Marina, E. le Bourhis, T. Soulard, S. Jamet, N. Dunphy, J. Gonçalves and E. Cruz. "Deliverable 7.1 Societal response to marine renewable energy. Corporate deliverable of the SafeWAVE Project co-funded by the European Maritime and Fisheries Fund (EMFF) program of the European Union, Call for Proposals EMFF-2019-1.2.1.1 - Environmental monitoring of ocean energy devices". 80 pp. 2021.

[5] T. Fawzy, C. Quico, M. Verweij, M.C. Uyarra, S. Rees and H. Fammler. "The knowledge system of the Human-Ocean Relationship in Europe". *WP3 Deliverable 3.2 ResponSEAble EU funded project*, 2017

[6] M. Elliott, D. Burdon, J.P. Atkins, A. Borja, R. Cormier, V.N. de Jonge, and R.K. Turner. "And DPSIR begat DAPSI(W)R(M)!"—a unifying framework for marine environmental management. *Mar. Poll. Bull.*, 118(1–2):27–40, 2017.

[7] N.P. Dunphy, B. Lennon, A.L. Smith, M.C. Uyarra, J. Gonçalves, T. Soulard, and Zubiate, L. "Towards increased social acceptability of marine renewable energy", *Proc EWTEC, 2023*.