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Energy Justice Framework for Marine Energy

Considerations from PacWave

May 2023

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U.S. DEPARTMENT OF ENERGY

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Executive Summary

Accelerating the just energy transition requires new energy infrastructure to provide direct benefits to communities and ensure that these benefits remain in the community. This necessitates the development of new framework templates that communities and developers will need to build and assess their plans.

Marine energy resources, such as wave, tidal, and ocean current, have the potential to support energy security and infrastructure in coastal communities while addressing environmental impacts. However, despite their promising potential to counteract the severe impacts of climate change and to bring tangible benefits to local communities, there exists a considerable knowledge gap in how to integrate dimensions of justice into marine energy development. This gap inadvertently hampers our ability to properly position marine energy as a significant component of a just energy transition.

This report aims to develop a conceptual energy justice (EJ) framework that can serve as a foundation for developing a data collection template encompassing various demographic, socioeconomic, and environmental data. It aims to help communities understand how such data can support more just and equitable outcomes in marine energy development. The framework focuses on three tenets of EJ: **distributional justice** (concerning the fair distribution of benefits and costs), **procedural justice** (ensuring the inclusive decision-making and equitable engagement), and **recognition justice** (addressing the recognition and incorporation of diverse values, needs, and perspectives). Case studies of renewable energy projects from various countries are reviewed, and metrics used around these three tenets are analyzed.

The framework conducts a thorough examination of activities that may transpire across the multiple stages of a project, including community engagement, pre-project analysis, siting, construction, project execution/operation, and post-project (Figure ES-1).

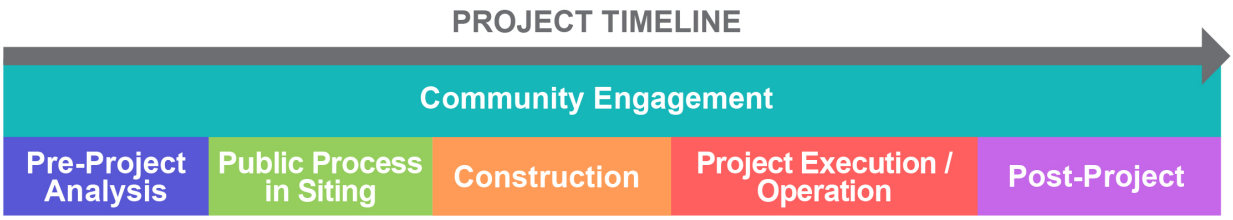

Figure ES-1. Project timeline and stages.

Community engagement involves ongoing interaction between developers and the community, and activities in this stage relate to all three tenets of EJ. Various pre-project analyses are conducted by the developer before project design or siting, with activities related to recognition and distributional justice. The public process in siting involves promoting a comprehensive and transparent process, mainly associated with procedural justice. Construction involves activities related to recognition and distributional justice, while project execution/operation includes activities primarily related to recognition and distributional justice, with some activities associated solely with distributional justice. Finally, the post-project stage involves activities associated with distributional justice, such as decommissioning equipment and adaptive management for future projects. Each respective activity is intrinsically linked to one or more tenets of EJ (Figure ES-2).

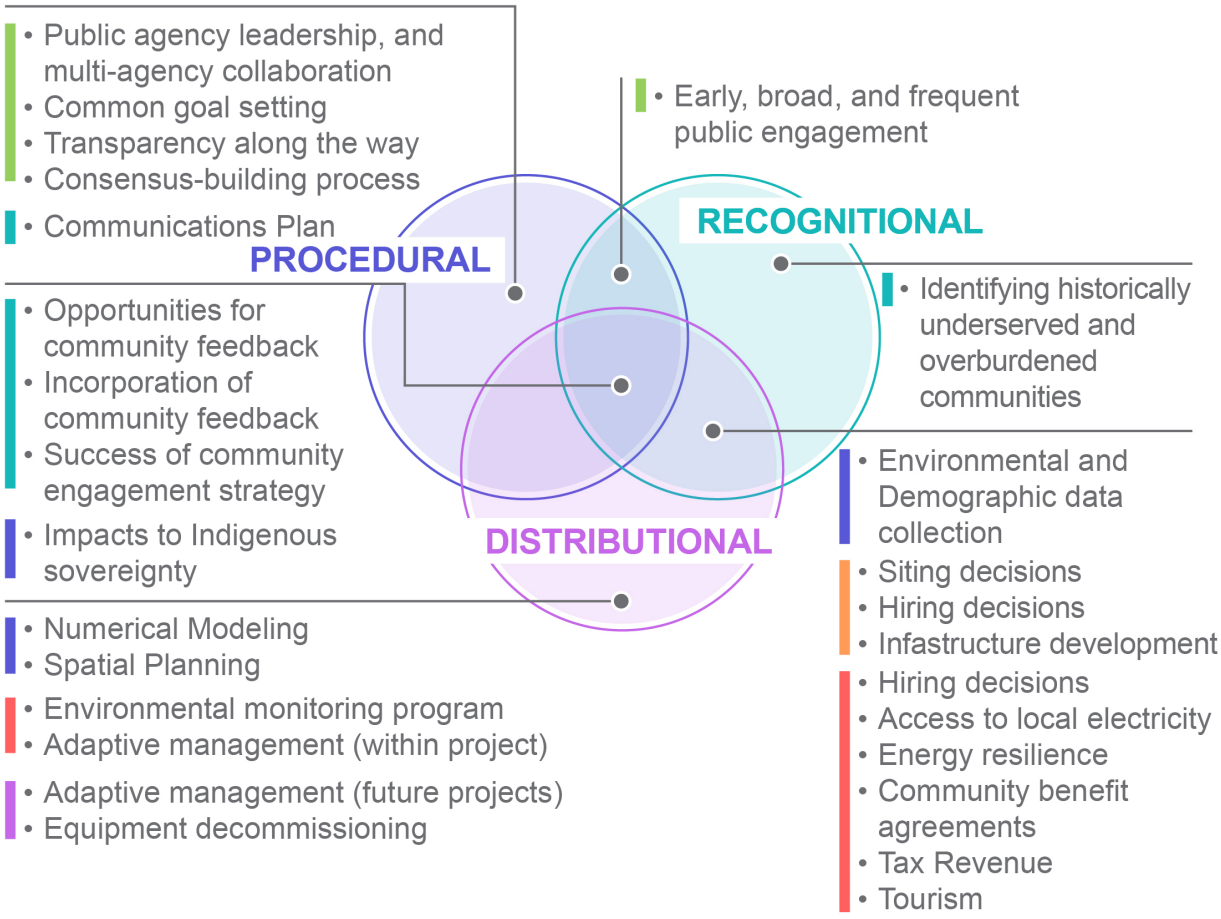

Figure ES-2. Activities comprising each project stage.

(Note: The colors next to the bullets link to the project stages in Figure ES-1)

The data collection template elaborates on each stage along with associated activities, relevant EJ tenets, EJ impacts, data type, potential metrics, data collection methods, and sources (Table 1). To assess each activity's contribution to EJ, a diverse range of data sources is required, including local and project records, spatial data, questionnaires, focus groups, developer's websites, associated documents, and project-specific research data (Appendix A).

Drawing on the EJ conceptual framework and the data collection template, this report delves into the development process at PacWave. Located off the coast of Oregon, this wave energy testing facility serves as a valuable example for understanding the integration of EJ in marine energy. Established by Oregon State University (OSU) in collaboration with the Department of Energy, PacWave expedites the progress of wave energy technologies while offering a range of services and acting as a focal point for research, education, and workforce development. For this report, Pacific Northwest National Laboratory researchers interviewed key PacWave staff to understand OSU's project development approach, with a particular emphasis on community engagement. The findings reveal that OSU developed the PacWave project through open and collaborative means, going beyond minimum requirements. Collaboration with the fishing industry was important, and suitable offshore areas were identified. Thorough public engagement was beneficial, but may be challenging for developers on tight timelines. OSU did

not develop specific economic benefit models for the project due to uncertainty about future utilization levels as a test facility. The development process at PacWave is evaluated against our EJ framework, thus offering unique insights into the practical application of EJ considerations in marine energy development.

In conclusion, this report aims to promote the adoption of marine energy technology by developing an EJ framework that facilitates data collection for assessing and valuing marine energy's impact. The literature review and case studies, further enhanced by the considerations from PacWave, emphasize the need for further research and practice, particularly in data collection to support procedural and recognition justice.

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Acronyms and Abbreviations

BIPOC	Black, Indigenous, and other people of color
CBA	community benefit agreement
DOE	Department of Energy
EJ	energy justice
FERC	Federal Energy Regulatory Commission
FINE	Fisherman Involved In Natural Energy
MSP	marine spatial planning
OSU	Oregon State University
RE	renewable energy

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1.0 Introduction

In response to the unprecedented climate crisis, the Biden administration has set a target of achieving 100% carbon-free electricity by 2030, with a minimum of 50% of this energy being supplied by local clean sources to satisfy round-the-clock demand (The White House 2021). Over the past decade, land use conflicts and community opposition have been two of the many challenges to attaining this goal. To accelerate the energy transition while addressing these challenges, federal policies and incentives require that new energy infrastructure provide direct benefits to communities and ensure that these benefits remain in the community (Mohtat 2021; Manasseh et al. 2017; O'Neil et al. 2022). The recent Justice40 Initiative, for example, highlights the Biden administration's commitment to addressing a just energy transition by requiring 40% of benefits from certain federal investments go to disadvantaged communities. The emerging objectives around energy justice (EJ) for renewable energy (RE) infrastructure necessitate the development of new framework templates that communities and developers will need to build and assess their plans.

Among the various types of RE resources and technologies, marine energy, including wave, tidal, and ocean current, is rapidly emerging and has the potential to support energy security and infrastructure in coastal communities while addressing environmental impacts (Copping et al. 2020). However, despite its promising potential to mitigate the worst impacts of climate change and benefit local communities, full-scale implementation of marine energy has not yet accelerated due to a host of technological, environmental, and social challenges. Among these is a limited understanding of the social and economic risks and benefits that marine energy brings to communities.

The literature surrounding marine energy emphasizes the importance of understanding the human dimensions of these projects to accelerate their full-scale development (Conway et al. 2010; Garrett et al. 2022; Boudet et al. 2020). Previous studies have also highlighted the need to minimize the burdens on community stakeholders, including those within the industry, fishing, cultural/historical resources, and natural resources/wildlife, and to co-develop projects to capitalize on potential benefits that are meaningful to the community, such as disaster resilience, local generation, freshwater supply, jobs, tourism, and infrastructure (Nelson et al. 2008; Manasseh et al. 2017; Garrett et al. 2022). Coastal communities are often small, vulnerable to high energy costs and the impacts of climate change, and require a more community-based approach to transition justly (O'Neil et al. 2021). Special emphasis should be placed on frontline communities, which traditionally have been marginalized in decision-making processes and have borne the brunt of negative project impacts disproportionately.

Given the various levels of commercial maturity and widespread deployment of many marine energy technologies, there is an opportunity to approach marine energy development in a different way, with a goal to integrate dimensions of justice into development. Therefore, the objective of this project is to develop a framework for collecting various demographic, socioeconomic, and environmental data and supporting communities in understanding how such data can support more just and equitable outcomes.

Specifically, this report addresses two research questions:

1. How can EJ be incorporated into the marine energy project life cycle?
2. What social and economic data are needed to assess how marine energy development supports EJ?

To answer these questions, this project conducted a structured literature review centering around three tenets of EJ considerations: distributional, procedural, and recognition. According to McCauley et al. (2013), Jenkins et al. (2017), and Walker (2009), the three tenets of EJ can be understood as follows:

1. **Distributional justice** focuses on the uneven allocation of socioeconomic and environmental benefits and risks, including the unequal distribution of burdens associated with energy infrastructure siting and access to energy services.
2. **Procedural justice** pertains to access to equitable decision-making processes that engage all stakeholders in a non-discriminatory way.
3. **Recognition justice** centers on the need for a system and a process that represent individuals fairly with complete and equal rights, free from threats. It also emphasizes the importance of acknowledging the divergent perspectives rooted in social, cultural, ethnic, racial, and gender differences.

These three tenets are deeply intertwined, each reinforcing the others. For instance, when the benefits of energy production and use are equitably distributed, it reduces conflict and fosters societal stability. Likewise, if decision-making processes are fair and inclusive, it cultivates trust and reinforces the legitimacy of government institutions. Lastly, acknowledging the rights and needs of all individuals prevents discrimination and marginalization. Each of these components plays a crucial role in promoting a just and inclusive energy transition.

Building on this understanding, this project turns its attention to case studies of RE projects from British Columbia, United Kingdom, Rhode Island, Germany, New Zealand, and Oregon, and metrics used around these three tenets are reviewed. The three tenets serve as the primary structure for EJ framework. Using this structure, a data collection template is developed, focusing on the types of demographic, social, economic, and environmental data that could be gathered. The objective is to promote EJ throughout the entire life cycle of a marine energy project, encompassing phases of siting, construction, execution, operation, and even the pre- and post-analysis of impact assessments and valuations. This project underscores the importance of continuous community engagement throughout the lifecycle of a renewable energy project.

PacWave is a wave energy testing facility located on the central Oregon Coast. Based on our literature review, the EJ conceptual framework, and the associated data collection template, a review of the development process at PacWave is employed to draw more specific implications for how EJ can be integrated into marine energy. PacWave represents a flagship investment by Oregon State University (OSU), the State of Oregon, and the Department of Energy (DOE). The facility is situated in Lincoln County, which is home to the Confederated Tribes of Siletz Indians and family-scale fishing enterprises. PacWave has strong community support as a marine energy testing site and holds potential to provide valuable lessons for other communities.

The following sections present various case studies from other RE projects through the lens of distributional, procedural, and recognition justice; develop a conceptual EJ framework; and propose a data collection template for real-world application. This approach is tested in relation to the development process at PacWave, offering unique insights into the practical application of EJ in marine energy development. This project helps to pave the way for more just and equitable marine energy practices, where there is significant untapped potential.

2.0 Literature Review

A comprehensive review of the existing literature on the three tenets of EJ and their relevance to RE developments was conducted. Considering the scarcity of EJ literature specifically focused on marine energy, this review incorporates literature related to various types of RE developments, including marine energy, from locations around the world. This approach was adopted due to the longer history of development and the wealth of information available for these other RE cases. Furthermore, valuable lessons learned from these instances can be applied across various development types and regions.

The review is organized into three distinct sections, each dedicated to one of the core EJ tenets. This structure is intended to support the formation of the EJ framework, as discussed in Section 3.0. In each section, literature is scrutinized conceptually to establish its association with marine energy development, followed by a discussion of pertinent metrics. The insights derived from these findings pave the way forward by suggesting potential metrics for the data collection template.

2.1 Distributional Justice

Distributional justice, concerning the equitable distribution of benefits and burdens within the energy system, is a crucial consideration for marine energy development. The siting of marine energy installations can potentially transform local landscapes, affecting energy prices, commerce, and other activities. Ensuring a fair distribution of these effects among the local community is essential for achieving just outcomes. In this section, we investigate existing mechanisms for distributing benefits to local communities and address the uneven allocation of burdens on end users within the energy system.

2.1.1 Benefit Schemes

Numerous studies on RE, particularly wind development, underscore pertinent themes regarding the distributional impacts of energy-infrastructure development. A common theme in the literature is the necessity of ensuring local residents benefit from the energy infrastructure situated in their communities. Development projects can yield various benefits, such as jobs and additional tax revenue for the area. However, residents may harbor skepticism about the scope of these benefits due to uncertainties surrounding the allocation of tax revenue and the potential for local job creation (Stier and Wallimann 2019; Cowell et al. 2012). To enhance distributive justice for the communities involved, benefit schemes for local communities are often integrated into development projects. These schemes may encompass financial compensation for community members through direct payments to individuals, municipalities, or local organizations; reduced energy bills for residents; investment opportunities for community members to purchase shares in the project; or even non-monetary benefits such as educational presentations at local schools and infrastructure improvements like parks and playgrounds (Stier and Wallimann 2019; Cowell et al. 2012; Kallis et al. 2021; Walker and Baxter 2017).

The implementation of these benefit schemes can influence community support. A study examining residents near wind developments in three European communities (two in Germany and one in Sweden) found that the majority of participants preferred that project benefits remain local (Stier and Wallimann 2019). Nevertheless, concerns persist that the primary benefits from these development projects are realized elsewhere. Some individuals perceive these projects as being developed for global climate benefits associated with RE while burdening the local

community with housing the infrastructure (Walker and Baxter 2017; Stier and Wallimann 2019). Additionally, concerns have been raised that the majority of financial benefits go toward outside developers, not the local community, even for projects attempting to incorporate local investment opportunities (Walker and Baxter 2017; Stier and Wallimann 2019).

Despite the existence of benefit schemes, concerns remain that few residents actually use them, as doing so may require additional knowledge, effort, and time. This is especially true for cases involving investment and those necessitating concrete actions, such as switching energy providers to reduce electricity bills (Stier and Wallimann 2019; Walker and Baxter 2017). Many residents in these communities have also expressed frustration when financial benefits are exclusively directed toward landowners of the turbines through lease payments, while models providing financial benefits to residents on adjacent lands were perceived as fairer (Stier and Wallimann 2019). This observation underscores the importance of financial benefits for local communities in the context of marine energy, even when development is likely to occur on public rather than private lands.

2.1.2 Social Acceptance

Social acceptance refers to the manner in which a community responds to the development of a RE project, with an accepting community welcoming development and an unaccepting community resisting it. Stier and Wallimann (2019) argue that social acceptance is closely tied to EJ and should be discussed concurrently. However, concerns have been raised in the literature about linking social acceptance to benefit schemes, including apprehension that financial compensation might be perceived as an attempt to purchase public acceptance while silencing opposition (Stier and Wallimann 2019; Cowell et al. 2012). Cowell et al. (2012) contend that perceived social acceptance should not be directly associated with benefit schemes for development projects, as disadvantaged communities possess less power and are less likely to actively oppose development.

Furthermore, connecting social acceptance and benefit schemes could potentially diminish benefits for impoverished communities due to the perception of greater social acceptance among these groups. Instead, Cowell et al. (2012) advocate for offering compensation to affected communities regardless of the perceived acceptance within the community. Despite the ongoing debate, ensuring that benefit schemes are equitable and just for each community, irrespective of their initial perceived acceptance of the project, remains crucial for all energy developments, including marine energy.

2.1.3 Spatial Impacts

Another essential component of distributional justice is the siting of projects and the stakeholders affected by these decisions. An inclusive siting process can involve stakeholders at an early stage, addressing their social, cultural, economic, and environmental concerns by identifying areas with conflicting uses and promoting open dialog (Ko et al. 2022). Numerous studies demonstrate the wide-ranging applications of spatial analysis and planning in utility-scale RE siting (Brewer et al. 2015; Stoms et al. 2013; Watson and Hudson 2015). Employing geographic information science, these studies use land suitability mapping with the analytical hierarchy process and multi-criteria decision-making to allocate factor weights based on expert opinion (Charabi and Gastli 2011; Kaya and Kahraman 2011), or apply game theory to balance the interests of various stakeholders in the decision-making process (Almutairi et al. 2022; Asakereh et al. 2017). These spatial tools are valuable for coarse-level screening using

scientific knowledge and spatial data; recent research has sought to incorporate community input and EJ considerations into the spatial planning process (Wang et al. 2022).

For marine energy, marine spatial planning (MSP) is a common tool employed to make informed siting decisions at sea, taking into account various human activities to create a plan for the spatial and temporal distribution of marine resources, ensuring that ecological, economic, and social needs are considered (García et al. 2019; European MSP Platform n.d.; MSPglobal n.d.). Implementing this process for marine energy development has great potential to help minimize conflicts between the project and other marine uses, such as fishing and ecological preservation, by mapping out what areas of the sea are currently being used for other purposes and using this information to determine appropriate sites for marine energy projects. While the majority of MSP practices have primarily concentrated on tackling environmental and economic concerns rather than social or cultural ones (Tissière and Trouillet 2022), adopting an inclusive approach could improve distributional justice by ensuring that stakeholders involved in other marine activities do not face substantial negative consequences. Additionally, certain MSP tools provide relevant data to support communities in the planning process, making these tools accessible not only to governments and developers but also to local community members.

Case Study 1

First Nations in the Northern Shelf Bioregion of the British Columbia began multi-scale MSP in 2007 to integrate aboriginal values and rights into federal marine planning initiatives. When federal MSP was halted, they collaborated with the British Columbia provincial government, resulting in a co-governance model that respects Indigenous authority and incorporates Indigenous knowledge. A critical “step zero” pre-planning phase ensures the values, aspirations, and rights of Indigenous peoples are respected and supported by the institutional framework responsible for MSP. First Nations territory-level planning starts at the appropriate scale of First Nations governance, includes Indigenous knowledge, protects cultural values, and resolves traditional ecological knowledge integration issues (Diggon et al. 2021).

A nested approach to MSP balances bottom-up planning with top-down guidance and integration. This approach links territorial marine use plans to First Nations and collaborative sub-regional plans and a regional action framework through the Marine Plan Partnership. It enables First Nations to build planning capacity, create robust spatial databases, identify common conservation priorities, drive sub-regional marine planning, link goals and objectives to regional implementation structures, secure access to vital resources, and protect areas from external stressors. This concentric and collaborative planning structure underpins co-governance and co-management of marine areas in the Northern Shelf Bioregion, supporting collaboration while ensuring that First Nations’ rights, values, knowledge, and governance structures shape MSP at all levels (Diggon et al. 2021).

These collective efforts provide a prime example of distributional justice intertwined with recognition and procedural justice as their MSP approach ensures that the First Nations’ rights, values, knowledge, and governance structures are not only respected, but also integrated into the MSP at all levels. It supports their access to vital resources and protects them from bearing disproportionate burdens.

2.1.4 Metrics

Numerous existing distributional justice metrics focus on the benefits and burdens imposed on end users in the energy system. Understanding local demographics can aid in evaluating the distribution of benefits and burdens for current and future RE developments in many of these metrics. For instance, several studies that analyzed solar and wind siting patterns in the United States employed demographic information to demonstrate distributional inequities, such as injustices toward rural and low-income communities (O'Shaughnessy et al. 2022; Mueller and Brooks 2020). By leveraging MSP, this methodology for identifying distributional inequities in potential siting patterns could be applied to marine energy, assessing whether favorable or likely development locations would result in an equitable distribution of potential benefits and burdens on local communities.

Another metric used to measure the impact on end users is the energy burden, defined as the percentage of income an individual pays for their energy (Energy Equity Report 2022; Barlow et al. 2022; Cong et al. 2022). A person's energy burden can be exacerbated in various ways, including poor insulation and inefficient heaters commonly found in lower-income homes or the necessity for the elderly and individuals with certain chronic illnesses to maintain warmer homes (Cong et al. 2022; Middlemiss et al. 2019). The Energy Equity Report (2022), a study conducted by a team of researchers at the University of Michigan, also examines the energy burden through a demographic lens by incorporating a metric for the average energy burden among low-income households, BIPOC (Black, Indigenous, and other people of color) households, and other groups. Investigating how marine energy developments affect the energy burdens placed on various members of the local community is essential to ensuring that these developments do not exacerbate, but rather mitigate, existing distributional inequities and prevent future ones.

In addition to focusing solely on energy burden, Cong et al. (2022) explore a metric they term the Energy Equity Gap. This metric measures the difference in inflection temperature, or the temperature at which a resident activates heating or cooling, between high- and low-income residents. This allows researchers to consider behavioral patterns as well, as an individual may not be classified as energy poor based on their heating and cooling expenses, despite maintaining their home at uncomfortable temperatures to keep their energy burden low (Cong et al. 2022). Metrics evaluating the distributional impacts of marine energy siting on local energy prices and burdens could be valuable in identifying potential benefits that communities may derive from such projects.

2.2 Procedural Justice

Procedural justice, which addresses the inclusion of all actors and community members into all decision-making processes, is another key consideration for marine energy developments. Assuring that everyone is given a voice in the marine energy siting process can prevent various problems, such as conflicts between the project and the community and conflicts with other maritime uses. This section addresses important aspects of communication between project leaders and other actors, as well as the importance of community influence in the siting process.

2.2.1 Communication

Communication between project leaders, often developers, and communities is frequently cited as a critical component in determining whether communities perceive development processes as fair, offering valuable insights into existing approaches to procedural justice. Numerous studies suggest that earlier and more frequent information dissemination can enhance

relationships between project leaders and communities (Stier and Wallimann 2019; de Groot and Bailey 2016; Kallis et al. 2021; Johnson et al. 2015; Wang et al. 2022; Ko et al. 2022). Enhanced relationships between project leaders and communities typically result in communities feeling respected in the development process, thereby fostering trust in the mutual benefits. Project leaders can actively participate in this process by maintaining transparency with community members throughout the project and sharing high-quality information via well-established communication channels (Simcock 2016; Stier and Wallimann 2019).

Case Study 2

In a case study examining the efforts to install wind turbines in South Yorkshire, United Kingdom, the developer (Origin) perceived their project website and a distributed booklet as the primary sources of information for the community, considering them adequate for providing project details. However, when project progress faltered, Origin received negative feedback on the booklet, which they attributed to the information being too difficult to understand. Conversely, community members argued that it lacked detailed information, such as the area's wind power feasibility, project financing, and Origin's company background. Community members also expressed a preference for face-to-face discussions and Q&A sessions as communication methods (Simcock 2016). This disagreement between Origin and the South Yorkshire community also highlights another crucial aspect of communication: aligning expectations between project leaders and communities to ensure both parties are satisfied with the outcome. While Origin believed they were providing sufficient information and engagement through the booklet and website, community members felt it was inadequate, as evidenced by continued project resistance (Simcock 2016).

All aspects of communication that contribute to robust relationships between communities and developers also influence trust, a vital element in a procedurally just development process (Stier and Wallimann 2019; Dwyer and Bidwell 2019; Kallis et al. 2021). Trust building can manifest in various ways, with severe mistrust arising when developers make decisions without consulting the public (Simcock 2016; Stier and Wallimann 2019). Dwyer and Bidwell (2019) underscore the significance of informal actions, or actions not mandated by policy and occurring outside formal settings, in building trust, noting that community members have cited these activities as their reasons for accepting development decisions. These actions might include one-on-one meetings with stakeholders or hiring intermediary actors to engage with the community; however, their informal nature can make them challenging to incorporate into frameworks or formal data collection processes.

Case Study 3

In the Block Island Wind Farm, a state-sponsored offshore wind turbine project off the coast of Rhode Island, concerns arose regarding the turbines' potential impact on local fishermen. The state's Coastal Resources Management Council, responsible for regulating potential ocean uses, employed informal actions to engage with fishermen, ensuring their concerns were heard and reaching an acceptable outcome. These actions included Coastal Resources Management Council members holding one-on-one meetings with fishermen regarding potential turbine effects on fishing rules and hiring a community member with experience in the fishing industry to act as an intermediary, listening to fishermen's concerns in informal settings. The "chain of trust" concept elucidates the progressive establishment of stakeholder trust, ultimately culminating in the acceptance of a particular outcome.

2.2.2 Community Influence

In addition to trust-building between project leaders and communities, the tangible influence communities exert on project development is crucial for facilitating a procedurally just development process. A study comparing residents' perceptions of wind development in top-down developments in Ontario and community-based developments in Nova Scotia found that the ability to affect outcomes in the development process was a strong predictor of approval from residents for both types of local developments (Walker and Baxter 2017).

The community's ability to influence outcomes can manifest differently for each type of development. In traditional top-down developments, the extent to which communities can impact outcomes often depends on the developer's discretion. One approach to addressing this power imbalance is by allowing the community to participate in decisions regarding the location and type of RE technology developed (Simcock 2016). For marine energy projects, this could involve public opinion surveys to assess whether the community believes marine energy is more suitable for the community than other RE types. It could also involve questionnaires with a visual choice experiment featuring clear benefits and trade-offs to ensure the most appropriate RE technology and siting location are selected for the community, similar to the method employed by Mostegl et al. (2017). Communities typically have more power in community-led developments, which are becoming increasingly common.

Case Study 4

Crafting publicly acceptable, feasible, and environmentally sound solutions requires careful consideration of various factors. Balancing public and private interests, like preserving landscapes and biodiversity versus low energy costs, is primarily a communal task due to its localized impact. RE systems and their placement have various visual and trade-off impacts, necessitating a deep understanding of their environmental and economic consequences. A case study from Bavaria, Germany, explores strategies to enhance public participation and examines the trade-offs within climate change adaptation planning processes (Mostegl et al. 2017).

In Langquaid, a community in Bavaria, participants in a choice experiment were presented with two hypothetical scenarios for RE developments to be sited in their community. Each scenario contained six attributes of the hypothetical development, including the location, number of wind turbines or photovoltaics, and household savings from the project's revenue. A total of 64 scenarios were created, and each participant evaluated six randomly chosen scenarios. This method allowed participants to repeatedly choose their preferred scenario, thus revealing which attributes they valued most (Mostegl et al. 2017). Employing this process for marine energy siting may be beneficial in ensuring that the community's voices are heard in the decision-making process.

2.2.3 Metrics

Existing metrics for procedural justice in relation to RE developments are currently limited. The Energy Equity Report (2022) presents several relevant metrics, such as those related to the ease of community participation. However, the report primarily concentrates on identifying metrics that can be implemented immediately. Due to gaps in the national-level data, these metrics couldn't be integrated into the report (Energy Equity Report 2022). Yet, it may be feasible to employ these metrics in targeted case studies involving local communities. This

could be achieved by conducting surveys among community members and analyzing responses in light of various factors, including demographics.

In a parallel vein, Barlow et al. (2022) propose energy equity metrics, including one related to participation rates in community-owned projects. This metric could be expanded to examine participation in the development process and potentially survey the community to determine if specific aspects of participation led to increased perceptions of fairness and community influence.

Although the literature lacks public surveys used to analyze procedural justice for energy developments, some inspiration can be drawn from surveys of public opinion on RE standards. For example, Stokes and Warshaw (2017) employed public survey opinions regarding renewable portfolio standards to examine how policy framing and potential financial impacts of these policies affected support for renewable portfolio standards. For marine energy developments, this could potentially involve public opinion surveys assessing how certain procedures, benefits, or burdens influence the sense of fairness and support from community members.

Finally, each of the case studies described above outlines the procedures of specific RE developments and the successes and failures of these processes in terms of community involvement. However, there does not appear to be a uniform approach that any specific development or developer attempts to use to ensure that the community has an appropriate voice in the process. This report aims to provide a guideline that could lay the groundwork for future marine energy developments.

2.3 Recognition Justice

Recognition justice, which involves ensuring that voices from diverse communities and backgrounds are heard, is a crucial aspect to consider in marine energy developments. Overlooking this aspect may exacerbate existing inequities within the energy system. Therefore, recognizing and addressing these factors is essential for achieving justice. This section first discusses the acknowledgment of local community and place values, followed by the consideration of traditional and Indigenous values, and concludes by exploring the mechanisms used to ensure recognition across various demographic backgrounds.

2.3.1 Place-Based Values

The significance of place-based values in local communities is a crucial component of recognition justice for marine energy projects. Place-based values refer to the values individuals or groups associate with their surrounding physical environment (Devine-Wright 2011). One manifestation of such values is place attachment, a positive bond with the physical environment, which often develops over time due to various behavioral and cognitive factors (Devine-Wright 2011). Consequently, local communities may be reluctant to support proposals conflicting with their place-based values. Ensuring that these values are acknowledged and integrated into marine energy developments is vital for achieving recognition justice (de Groot and Bailey 2016).

In coastal communities, place-based values frequently revolve around the ocean's significance as a public space (Jenkins et al. 2018). One such value is the community's commitment to preserving the natural environment, encompassing aspects like landscape views and wildlife protection (de Groot and Bailey 2016). A study examining the perspectives of residents from

three UK island communities concerning marine energy developments revealed concerns about the potential harm to aquatic wildlife due to marine energy devices and visual impacts, with many residents expressing preference for wave and tidal energy over offshore wind (de Groot and Bailey 2016). Additionally, there is apprehension that alterations to the natural landscape might negatively affect tourism and the local economy (Sayan 2019). These findings suggest that considering environmental impacts is essential, not only for the environment but also for the well-being of community members (Sayan 2019; Copping et al. 2020).

Other place-based values in coastal communities pertain to residents' direct interaction with the sea, including commercial relationships. Many coastal communities maintain strong economic connections to the ocean through activities like fishing and aquaculture. Interference with these commercial pursuits may result in economic difficulties, increased disapproval, and potential economic collapse if communities primarily depend on such activities for sustenance (de Groot and Bailey 2016). Furthermore, communities might be more likely to support marine energy projects if their effects on the labor market and local economy are generally positive (de Groot and Bailey 2016; Kallis et al. 2021).

Alongside commercial relationships, numerous coastal communities possess traditional and cultural values connected to the sea (Kerr et al. 2015; Kallis et al. 2021). This is particularly relevant for Indigenous communities, and acknowledging their values and involving them in the development process is essential for achieving recognition and procedural justice. Neglecting these values can result in conflicts, as demonstrated in Washington state, where the Tulalip Tribes contested permits for tidal energy generators due to concerns over ecological impacts and damage to cultural resources (Kerr et al. 2015). Additionally, addressing historical injustices faced by Indigenous communities concerning development on or near their land is crucial when considering new projects (Castillo and McLean 2012).

Case Study 5

A notable example of conflict arising from overlooking the values of Indigenous communities is the Crest Energy tidal power project case study in New Zealand. Although the project received legal approval, Crest was not obligated to consult local stakeholders, leading to resistance from the Māori, New Zealand's Indigenous people. Following unsuccessful legal battles concerning Crest's right to develop on the land, the Māori's representative group issued an aukati, a traditional ban, asserting their authority under the Resource Management Act of 1991 to prohibit Crest from accessing the land. Crest planned to disregard the ban, citing their rights under the same legislation, which prompted the community to threaten further action against Crest (Kerr et al. 2015).

In contrast, the Australian company Tenax demonstrated the benefits of engaging with Indigenous communities in their two tidal energy developments. By focusing on consultation, Tenax received approval for the projects, including support from a small Indigenous community known as "sea people" with strong maritime traditions (Kerr et al. 2015). These case studies involving Indigenous communities not only underscore the importance of acknowledging traditional and cultural values related to the sea, but also highlight the interdependence of EJ principles. Recognizing these values and integrating them into the development process is essential for achieving procedural justice.

2.3.2 Demographics

Socioeconomic factors affecting the community need to be considered, particularly those related to demographics. Demographic considerations were previously mentioned in relation to distributive justice, but it is important to note that demographic data itself is a piece of recognition justice, as it identifies what kind of groups make up various local communities and allows developers to identify the different voices that should be accounted for (Energy Equity Report 2022). Identifying communities that, either historically or currently, have an oversized share of the burden from the energy system is critical to assuring recognition justice occurs, as not only can attempts be made to alleviate these excessive burdens in future energy developments and policies, but once these communities are recognized, these efforts can be accomplished through incorporating insights from their experiences, concerns, and history.

Socioeconomic factors impacting communities must also be taken into account, particularly those related to demographics. This data identifies the diverse groups comprising local communities, allowing developers to account for various perspectives that should be considered (Energy Equity Report 2022). Identifying communities that have historically or currently borne a disproportionate share of the energy system's burden is crucial for ensuring recognition justice. By acknowledging these communities, efforts can be made to alleviate these excessive burdens in future energy developments and policies, incorporating insights from their experiences, concerns, and history.

Case Study 6

Given the interconnected nature of stakeholder needs and concerns, employing a systems thinking approach can help identify and analyze these complex relationships (Daniels and Walker 2001). Fitzpatrick (2021) used the systems thinking mapping approach to examine the priority values and concerns of each stakeholder involved in offshore wind development in Coos Bay, Oregon, based on stakeholder interviews (Figure 1). This approach facilitates the visualization of individual stakeholder perspectives in an interconnected map, revealing how the goals of one stakeholder group align with those of another. Importantly, recognizing and incorporating the perspectives of historically marginalized communities that have been disproportionately burdened by the energy system and related developments can enrich the understanding of diverse stakeholder priorities. This understanding can then be used as evidence to develop multifunctional design solutions that address the concerns and priorities of various groups, ultimately promoting more equitable and inclusive energy developments and policy actions.

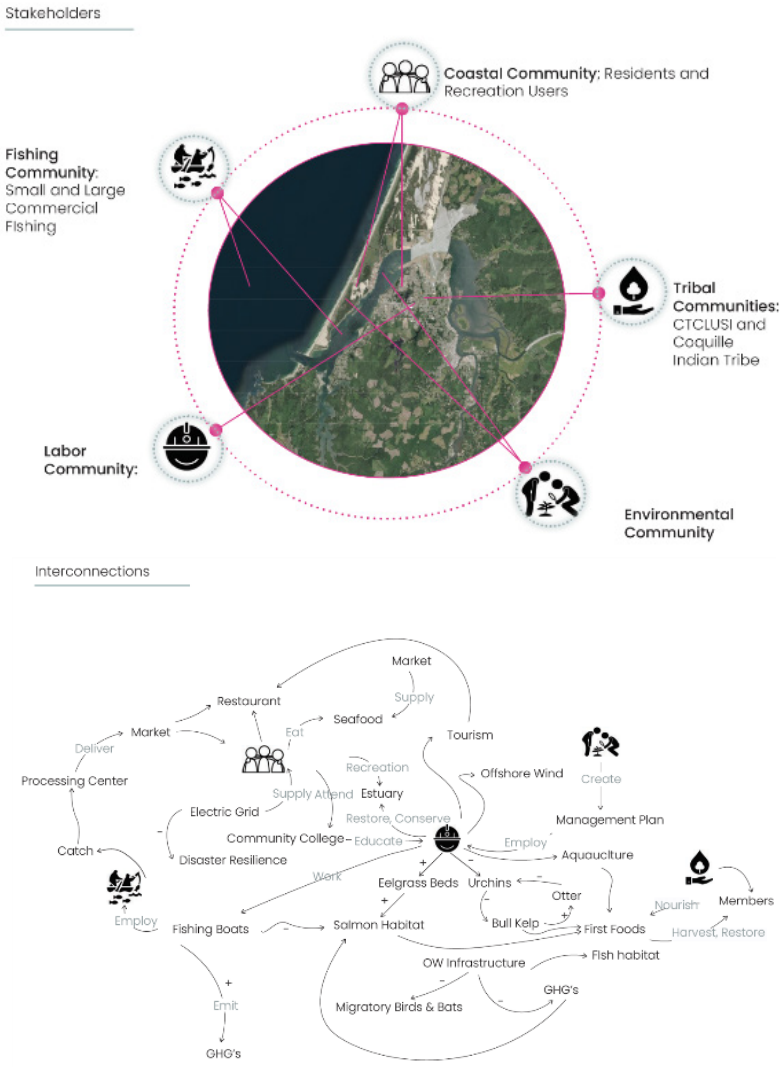

Figure 1. System thinking mapping to analyze stakeholder values and priorities (Fitzpatrick 2021).

2.3.3 Metrics

To identify overburdened communities, it is essential to have accessible metrics applicable to local contexts. The Energy Equity Report contributes to this need by incorporating 22 demographic metrics that can be measured at the national level, making them available for communities (Energy Equity Report 2022). Included metrics are poverty rate, percentage of BIPOC population, housing burden, and various climate vulnerability indicators (Energy Equity Report 2022). These measures can be employed in the context of marine energy communities to ensure fair recognition of all groups during the development process and provide more equitable treatment for overburdened communities. Such strategies may include using marine energy to power local and remote communities that have historically relied on costly diesel imports for electricity (Garrett et al. 2022).

3.0 Framework

Drawing from the literature review presented in the preceding section, an EJ framework has been developed, mirroring the structure of the review centered around three key EJ tenets. The EJ framework is meant to complement other frameworks related to energy transitions, such as DOE's Energy Transitions Playbook, the DOE Water Power Technologies Office Deployment Readiness Framework, and the DOE Office of Indian Energy Strategic Energy Planning Process and Project Development Strategy (Energy Transitions Initiative 2021; Arkema et al. 2022; Dane and Doris 2014; DOE Office of Indian Energy 2018).

The framework conducts a thorough examination of activities that may transpire across the multiple stages of a project. The project's life cycle used in the framework encompasses six stages: community engagement, pre-project analysis, siting, construction, project execution/operation, and post-project. These stages align with the RE development phases outlined in the RE planning framework by Ko et al. (2022). Figure 2 visually delineates the varying stages of the project, while Figure 3 elaborates on the array of activities within each stage and their correspondence to one or more of the three EJ tenets.

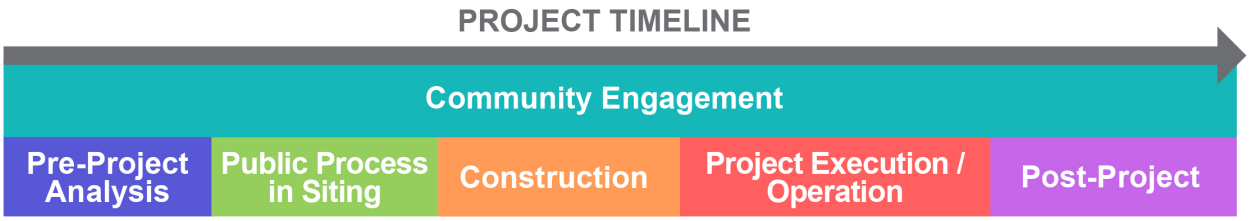

Figure 2. Project timeline and stages.

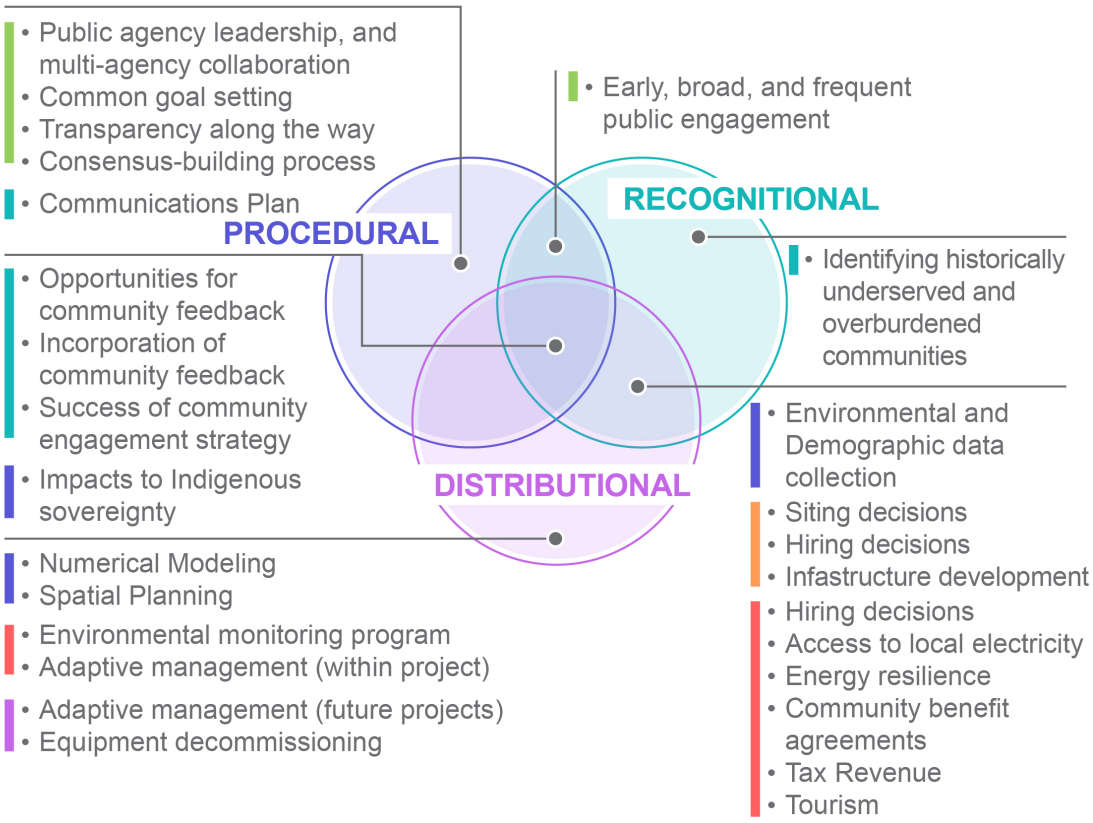

Figure 3. Activities to advance EJ in each project stage.

Each respective activity is intrinsically linked to one or more tenets of EJ, including distributional, procedural, and recognition justice. We assigned these linkages based on how well each activity corresponds to each tenet. We acknowledge the subjective nature of this kind of association, given the many definitions and interpretations of the three EJ tenets. As such, these categorizations are not meant to be prescriptive, but rather are meant to highlight the multifaceted ways that activities related to marine energy development can impact EJ.

3.1 Community Engagement

Community engagement involves the ongoing interaction between developers and the community throughout the project. It encompasses communication plans, opportunities for community input, integration of community feedback, identifying and providing outreach to historically underserved and overburdened communities, and evaluating the effectiveness of the community engagement strategy. All activities within this stage relate to all three tenets, except for the communication plan, which is associated solely with procedural justice.

3.2 Pre-project Analysis

Pre-project analysis refers to the various analyses conducted by the developer before the project's design or siting. It may involve collecting environmental and demographic data, performing numerical modeling of energy resources, assessing environmental impacts and economic factors, conducting spatial planning, and evaluating potential effects on Indigenous sovereignty. In this stage, environmental and demographic data collection relates to both

recognition and distributional justice, while numerical modeling and spatial planning are tied to distributional justice, and impacts on Indigenous sovereignty are linked to all three tenets.

3.3 Public Process in Siting

Public process in siting encompasses activities that promote a comprehensive and transparent public process concerning project siting. These activities include early, extensive, and regular public engagement; leadership from public agencies and collaboration between multiple agencies; setting shared goals; maintaining transparency throughout the process; and fostering consensus-building. Most activities in this stage are primarily associated with procedural justice, though early, extensive, and regular public engagement relates to both procedural and recognition justice.

3.4 Construction

The construction stage covers activities that could affect or benefit the partner community, such as construction-related impacts on fisheries; cultural, historical, and natural resources; freshwater supply, potential benefits from construction job opportunities, and effects on infrastructure development. All activities in this stage are connected to recognition and distributional justice.

3.5 Project Execution/Operation

The project execution/operation stage refers to activities occurring between the project's construction and decommissioning phases. These activities include hiring decisions for operations and maintenance jobs, access to local electricity generation and energy resilience, consequences for tourism and tax revenue, community benefit agreements (CBAs) and the ease of accessing those benefits, environmental monitoring, and adaptive management resulting from monitoring. Most of these activities are linked to recognition and distributional justice, while environmental monitoring and adaptive management are solely associated with distributional justice.

3.6 Post-project

The post-project stage involves activities that occur at the end of the project's lifetime, including equipment decommissioning and adaptive management for future projects. Both of these activities are associated with distributional justice.

It is important to acknowledge that the list of stages and activities is not all-encompassing, and many activities may be applicable to more than one project stage. Furthermore, the association of a particular activity with one or more EJ tenets is inherently subjective – many activities do not clearly fit within a singular EJ tenet. These categorizations should not be perceived as prescriptive or immutable; rather, they serve to establish a framework that can be adapted, reconsidered, and redefined to suit the specific requirements of individual projects.

4.0 Data Collection Template

Drawing on the conceptual framework rooted in the three tenets of EJ, a practical data collection template for real-world applications was developed. This template is designed to enhance compliance with EJ objectives. The metrics discussed in the literature review guided the creation of the template, designed to assess the socio-economic impacts and opportunities stemming from a variety of marine energy projects. This framework is designed to accommodate a diverse range of stakeholders, such as project developers, community members, researchers, policymakers, and other interested parties.

Table 1 provides a concise summary of each stage along with associated activities. The template addresses the impact of undertaking these activities in advancing EJ, as well as measurement metrics, potential data sources, data collection methodologies, and diverse data types (tabular, qualitative, spatial).

Detailed descriptions of each stage and activity, along with relevant questions to assess each activity, are available in Appendix A.

Table 1. List of data types in the data collection template.

Project Stage	Activities	EJ Tenet	Impact of Undertaking the Activity to Advance EJ	Type of Data (qualitative, tabular, spatial)	Potential Metrics	Data Collection Methods	Existing Data Sources
Community Engagement	Communications plan	Procedural	Increased trust and knowledge of the project	Qualitative	Publicly available communications plan; types of communication and materials; methods of distribution	Questionnaires/ Focus groups	
Community Engagement	Opportunities for community feedback	Procedural; Recognitional; Distributional	Increased trust; community empowerment	Qualitative	Extent to which project developer provides opportunities for community feedback; types of feedback; accessibility of providing feedback (e.g., if community meeting, is it scheduled at a time when only certain segments of the community can attend? Is childcare available? Are meals provided?)	Questionnaires/ Focus groups	
Community Engagement	Incorporation of community feedback	Procedural; Recognitional; Distributional	Increased trust; community empowerment; incorporation of community goals/ feedback	Tabular; Qualitative	Mechanisms for incorporating feedback; extent to which the incorporation process is transparent; extent to which feedback is incorporated in decision-making; are there specific segments of the community whose incorporated feedback is over/under-incorporated?	Questionnaires/ Focus groups	
Community Engagement	Success of community engagement strategy	Procedural; Recognitional; Distributional	Increased trust; community approval of marine energy development	Qualitative	Extent to which the community feels heard/involved; extent of community feedback incorporated by developer; community stratification when it comes to levels of approval (who is for and who is against within the community?)	Questionnaires/ Focus groups	

Project Stage	Activities	EJ Tenet	Impact of Undertaking the Activity to Advance EJ	Type of Data (qualitative, tabular, spatial)	Potential Metrics	Data Collection Methods	Existing Data Sources
Community Engagement	Identifying historically underserved and overburdened communities, targeting them in outreach	Recognitional	Opportunity to engage with and provide outreach to historically underserved and overburdened communities; increasing trust within these communities	Tabular; Spatial; Qualitative	Extent to which historically underserved and over-burdened communities are targeted in outreach	Project-specific research	
Pre-project Analysis	Environmental data collection	Recognitional; Distributional	Understanding of the environmental/ cultural impacts; opportunity to participate in the siting process by incorporating local knowledge; increased trust	Tabular; Spatial; Qualitative	Environmental impact; geographical extent; species impacted; landscapes impacted; natural/cultural resources impacted	Project records	
Pre-project Analysis	Demographic data collection	Recognitional; Distributional	Understanding the makeup of the community; opportunity to revisit project development process if the impacts of the project as planned are shown to be unjust	Tabular; Spatial; Qualitative	Community demographics compared to national/ state/county demographics; extent to which marginalized groups within the community are impacted	Project-specific research	Environmental Protection Agency's Environmental Justice screening tool; DOE's Energy Justice Dashboard; Climate and Economic Justice Screening tool; American Community Survey
Pre-project Analysis	Numerical modeling of the energy resource, environmental impacts, and economic analysis	Distributional	Increased trust; opportunity to revisit project development process based on model outcomes	Tabular; Spatial; Qualitative	Description of energy resource, environmental impact, and economic analysis modeling studies (e.g., sites and interactions of habitats and species)	Project records	

Project Stage	Activities	EJ Tenet	Impact of Undertaking the Activity to Advance EJ	Type of Data (qualitative, tabular, spatial)	Potential Metrics	Data Collection Methods	Existing Data Sources
Pre-project Analysis	Spatial planning	Distributional	Increased trust; opportunity to revisit siting process; opportunity to solicit community input on locations with least conflicts	Spatial	Landscape/seascape-level spatial mapping and planning, focusing on overlayed zones to identify least conflict sites	Spatial records	MarineCadastre.gov; SeaSketch.org
Pre-project Analysis	Impacts to Indigenous sovereignty	Procedural; Recognitional; Distributional	Increased trust; opportunity to revisit siting process; opportunity to engage with local Tribes or Indigenous groups to incorporate feedback	Qualitative	Extent to which project development could affect Indigenous sovereignty (e.g., impacts to cultural/historical sites, traditional foods, treaty-protected rights and resources)	Questionnaires/ Focus groups	
Public Process in Siting	Early, broad, and frequent public engagement	Procedural; Recognitional	Increased trust; community empowerment	Tabular	Level of acceptance; degree to which community feedback is included in project siting; who in the community is able to participate in public engagement; extent to which public engagement goes beyond required measures and how far beyond these requirements they go (e.g., incorporation of “informal actions”)	Questionnaires/ Focus groups	
Public Process in Siting	Public agency leadership, and multi-agency collaboration	Procedural	Increased trust	Tabular	Degree to which agency involvement and roles are documented; degree to which officials and expert opinions are accessible to the public	Project records	
Public Process in Siting	Common goal setting	Procedural	Increased trust; incorporating community goals; expectation alignment	Tabular; Qualitative	Degree to which community goals are incorporated in common goal; description of goal setting process and involved stakeholders	Questionnaires/ Focus groups	

Project Stage	Activities	EJ Tenet	Impact of Undertaking the Activity to Advance EJ	Type of Data (qualitative, tabular, spatial)	Potential Metrics	Data Collection Methods	Existing Data Sources
Public Process in Siting	Transparency along the way	Procedural	Increased trust; increased knowledge of project impacts and outcomes	Tabular	Extent of publicly available information; ease of access to said information; quality of information	Project records	
Public Process in Siting	Consensus-building process	Procedural	Increased trust; incorporating community goals	Qualitative	Description of the consensus-building process; extent to which community views are incorporated	Questionnaires/ Focus groups	
Construction	Construction impacts (fisheries)	Recognitional; Distributional	Understand and mitigate potential impacts on fisheries (e.g., ecological impact of the project, available area for people to fish, fish mortality from marine energy); general ecological impacts (e.g., fish/mammal turbine collisions)	Tabular; Qualitative; Spatial	Extent to which fishing is impacted by project construction; extent to which specific people's access/yield from fishing is impacted; extent of ecological impacts	Project records	
Construction	Construction impacts (cultural/ historical/natural resources)	Recognitional; Distributional	Understanding and mitigating impacts on cultural/historical/ natural resources	Tabular; Qualitative; Spatial	Extent to which cultural/historical/natural resources are impacted by project siting	Project records	
Construction	Construction impacts (freshwater supply)	Recognitional; Distributional	Understanding and mitigating impacts on freshwater supply	Tabular; Qualitative; Spatial	Extent to which project impacts freshwater supply; whose water supply is being impacted	Project records	
Construction	Infrastructure development	Recognitional; Distributional	Understanding and mitigating infrastructure development impacts on natural/cultural resources, Tribal lands, fisheries, etc.	Spatial	Extent to which project-related infrastructure development infringes on natural/cultural resources, Tribal lands or fishing rights, fisheries	Project records	

Project Stage	Activities	EJ Tenet	Impact of Undertaking the Activity to Advance EJ	Type of Data (qualitative, tabular, spatial)	Potential Metrics	Data Collection Methods	Existing Data Sources
Construction	Hiring decisions (construction jobs)	Recognitional; Distributional	Local job creation; increasing local knowledge base (e.g., training a local as a technician rather than bringing in an outside expert); keeping monetary benefits within the community	Tabular; Qualitative	Extent to which construction creates local jobs; who the jobs go to; types of jobs; number of jobs; "quality" of jobs (e.g., seasonal, full-time, benefited); extent to which these jobs benefit the community as a whole (e.g., an electrician who works on the marine energy can also provide services to the community)	Questionnaires/ Focus groups	
Project Execution / Operation	Hiring decisions (operations and management jobs)	Recognitional; Distributional	Local job creation; increasing local knowledge base (e.g., training a local as a technician rather than bringing in an outside expert); keeping monetary benefits within the community	Tabular; Qualitative	Extent to which operations and management creates local jobs; who the jobs go to; types of jobs; number of jobs; "quality" of jobs (e.g., seasonal, full-time, benefited); extent to which these jobs benefit the community as a whole (e.g., an electrician who maintains the project can also provide services to the community)	Questionnaires/ Focus groups	
Project Execution / Operation	Community access to local electricity	Recognitional; Distributional	Access to local renewable electricity	Tabular; Qualitative; Spatial	Extent to which local generation is available to the community; price of this electricity	Project records	
Project Execution / Operation	Energy resilience through local electricity	Recognitional; Distributional	Ability for renewable energy to continue to power a community resilience hub in the event of a grid outage	Tabular; Qualitative; Spatial	Extent to which local generation can be used to meet resilience needs in the event of a blackout (e.g., by powering a single-building, "behind the meter" microgrid, or a "front of the meter" community microgrid, when combined with battery storage)	Project records	

Project Stage	Activities	EJ Tenet	Impact of Undertaking the Activity to Advance EJ	Type of Data (qualitative, tabular, spatial)	Potential Metrics	Data Collection Methods	Existing Data Sources
Project Execution / Operation	Tourism	Recognitional; Distributional	Reduced tourism (if impact on sightseeing) or increased tourism (if other co-benefits grow economy and increase size of tourist sector)	Tabular; Qualitative	Extent to which marine energy impacts tourism ($); what segments of the community are most impacted by changes in tourism related to the project	Local records	
Project Execution / Operation	Community Benefit Agreements	Recognitional; Distributional	Unique to each CBA: could include local hiring commitments, providing money to local funds, funding job training and educational services, financing community development projects, etc.	Tabular; Qualitative; Spatial	Is there a CBA? Composition of the community benefit group (e.g., neighborhood associations, faith-based orgs, unions, environmental groups); extent of CBA benefits; extent to which EJ principles are built into the CBA (e.g., 40% of benefits go toward communities of color, Indigenous peoples, low-income communities, and other marginalized groups). What percentage of the population is able to use or opt-in to benefits?	Project records	
Project Execution / Operation	Tax Revenue	Recognitional; Distributional	Increased tax revenue within the community; economic opportunities	Tabular	Extent to which increased tax revenue goes to the local community	Local records	
Project Execution / Operation	Environmental monitoring program	Distributional	Increased trust; mitigating project impacts	Tabular; Spatial	Scope and results of environmental monitoring program	Project records	
Project Execution / Operation	Adaptive management (within project)	Distributional	Increased trust; mitigating project impacts	Qualitative	Extent to which monitoring outcomes are used to improve on-site mitigation	Project records	
Post-project	Adaptive management (future projects)	Distributional	Increased trust; improving future projects	Qualitative	Extent to which modeling studies and monitoring outcomes are used to improve future project design	Project-specific research	

Project Stage	Activities	EJ Tenet	Impact of Undertaking the Activity to Advance EJ	Type of Data (qualitative, tabular, spatial)	Potential Metrics	Data Collection Methods	Existing Data Sources
Post-project	Equipment decommissioning	Distributional	Ensuring the community does not bear the burden of removing equipment and restoring the project location	Qualitative	Decommissioning plans, timeline, and budget	Project records	

5.0 PacWave Considerations

Drawing on the literature review, the EJ conceptual framework, and the corresponding data collection template, we examined the development process of PacWave, a wave energy testing facility located off the coast of Oregon. This wave energy testing facility serves as an ideal example for exploring more specific implications of integrating EJ into marine energy. Established by OSU in collaboration with DOE, the facility is designed to accelerate the development and deployment of wave energy technologies. PacWave offers services such as device testing, environmental monitoring, and data collection while serving as a hub for research, education, and workforce development in marine energy. With robust community backing, PacWave, as a marine energy testing site, holds considerable potential to impart valuable lessons for other communities.

This section describes the results of interviews with the key PacWave staff members conducted by researchers from Pacific Northwest National Laboratory to gain insights into OSU's approach to project development, particularly focusing on their efforts in community engagement. We also consider the experience at PacWave against the framework and provide unique insights into the practical incorporation of EJ consideration in marine energy development.

5.1 Overview

Construction on PacWave South began in 2021, following extensive planning, permitting, and stakeholder engagement (Freeman et al. 2022). Site selection considered factors like water depth, wave energy potential, distance from shore, and environmental impacts. The process required obtaining federal, state, and local permits, with close collaboration from regulatory agencies such as the Bureau of Ocean Energy Management, the Federal Energy Regulatory Commission, and the Oregon Department of State Lands (PacWave n.d.).

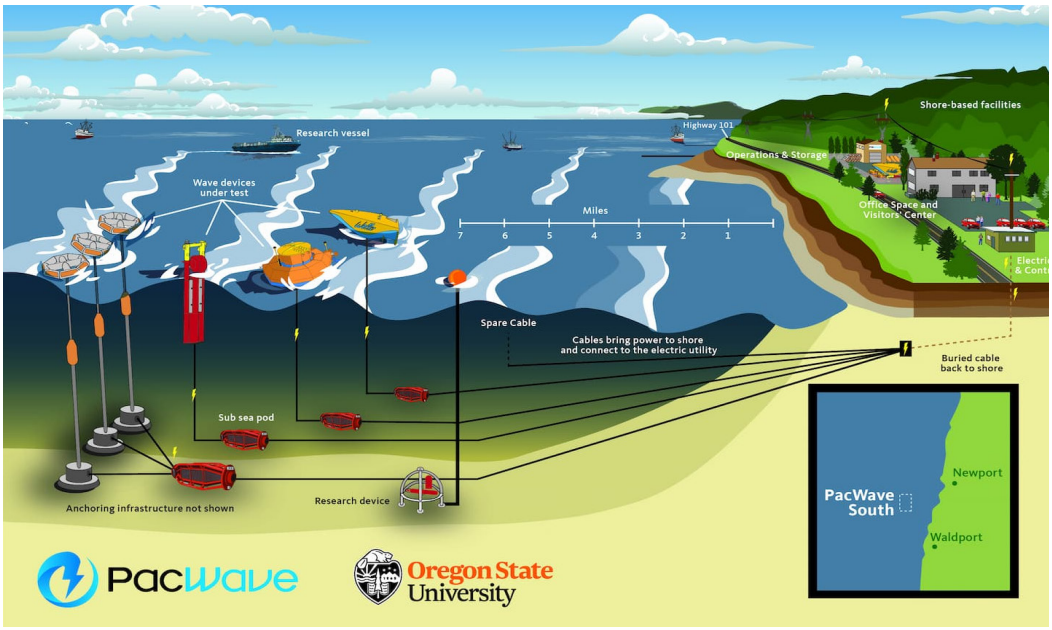

Figure 4. PacWave South Energy Test Site overview and site location (https://pacwaveenergy.org/south-test-site).

Community engagement was vital for PacWave's development. OSU and PacWave staff facilitated open dialog with stakeholders through public meetings, workshops, and webinars. They also established a stakeholder outreach program, engaging with groups like the fishing community, local Tribes, environmental organizations, and others. This approach addressed concerns and incorporated feedback, resulting in a well-received facility. More details about the project permitting process are well documented in Freeman et al. (2022).

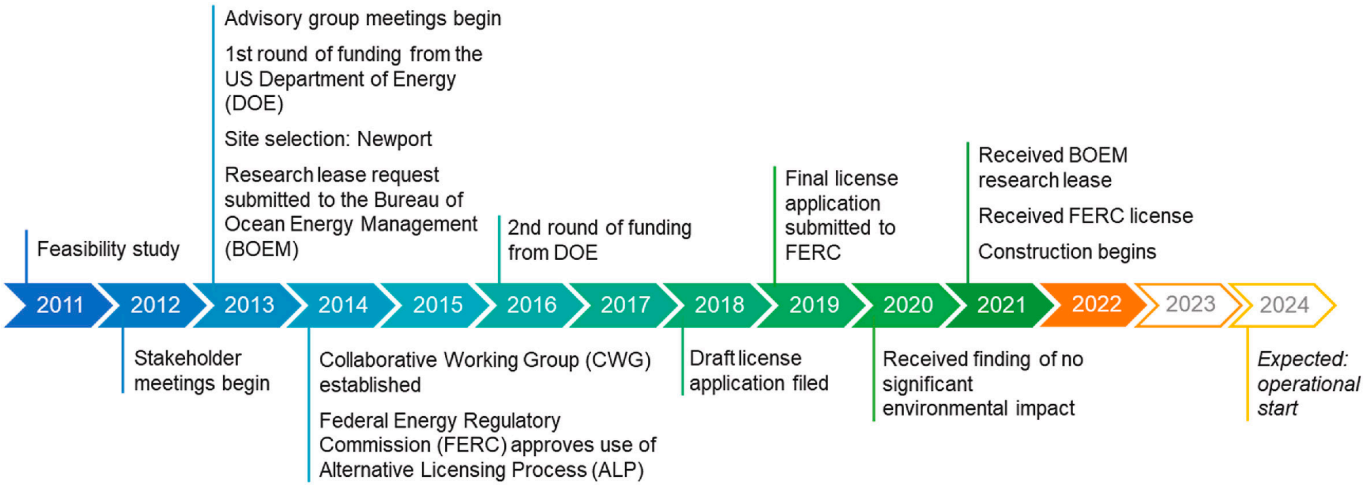

Figure 5. Timeline of PacWave development and permitting process (Freeman et al. 2022, with authors' permission).

5.2 Key Lessons on EJ Considerations

As part of this project, our team interviewed PacWave staff members Dan Hellin and Justin Klure, the co-authors of Freeman et al. (2022), to gain insights into OSU's approach to project development, particularly focusing on their efforts in community engagement. They also provided feedback on the data collection template developed through this project (Table 2). They agreed that establishing a framework and a data collection template is helpful due to the complex nature of such projects, but emphasized that a commitment to a collaborative, open process is more important than merely ticking off activities from a list.

The key findings from the interview are summarized below:

- OSU prioritized an open and collaborative process in the development of PacWave, which was crucial for effective community engagement. They exceeded minimum requirements and went beyond merely "checking the boxes."
- For site selection, OSU identified four coastal communities with suitable attributes for a successful marine energy test facility. Each community was informed about the potential project, including a public open house. Based on the feedback received, two of the communities (Reedsport and Newport) were invited to submit proposals to host PacWave. This approach fostered a level of community acceptance that would not have been achievable through a more traditional project development approach.
- The project benefited from having the outreach efforts led by a local community member, which enhanced the backing gained through extensive community engagement.

- OSU addressed potential conflicts with and impacts on the fishing industry through significant efforts to collaborate with the local fishing community, primarily via the Fisherman Involved In Natural Energy (FINE) group. This led to the identification of suitable offshore areas near Newport that met technical criteria and were acceptable from a fishing perspective.
- OSU committed to thorough engagement with the public and stakeholders from the outset. While this led to extensive public input and a lengthy response process, it ultimately paid off for the project and the industry. However, a project developer with pressures to develop on a certain timeline might have found the level of time and effort needed to be problematic.
- OSU did not develop specific economic benefit models or metrics, as they did not want to make promises beyond their control. As PacWave is a test facility with an uncertain number of future clients and utilization levels, OSU could not predict its economic impact on the Newport community.
- Other activities not used include examining the partner community's demographic makeup and creating a CBA. A CBA was not discussed since the project agreement and buy-in occurred a decade ago before CBAs became prevalent in RE development.

Table 2. PacWave approach in relation to EJ consideration.

Project Stage	Activities	EJ Tenet	PacWave Approach
Community Engagement	Communications plan	Procedural	No publicly available communications plan at the outset; OSU had a presence in the community and had a mechanism for communication; **OSU had the commitment to an open, collaborative process**
Community Engagement	Opportunities for community feedback	Procedural; Recognitional; Distributional	OSU went to the communities, held open meetings; then asked for feedback in the form of proposals from communities (i.e., what are the impacts and benefits from the community); a lot of outreach through SeaGrant; gives a feeling for "the temperature" of the community for energy projects
Community Engagement	Incorporation of community feedback	Procedural; Recognitional; Distributional	Important to have a local champion; not sure about specific mechanism, OSU SeaGrant and OSU researchers were collecting data for social impacts research
Community Engagement	Success of community engagement strategy	Procedural; Recognitional; Distributional	
Community Engagement	Identifying historically underserved and overburdened communities, targeting them in outreach	Recognitional	
Pre-project Analysis	Environmental data collection	Recognitional; Distributional	Thoroughly examined
Pre-project Analysis	Demographic data collection	Recognitional; Distributional	Did not focus on demographic
Pre-project Analysis	Numerical modeling of the energy resource, environmental impacts, and economic analysis	Distributional	Thorough on technical, not as much on economic because PacWave is a test facility; created the technical requirements for the site based on the need in industry

Project Stage	Activities	EJ Tenet	PacWave Approach
Pre-project Analysis	Spatial planning	Distributional	The fishing community does not appreciate marine spatial planning because it implies they do not have legitimate commercial interest in some areas in the ocean, and could limit future fishing options; PacWave gave the fishing community criteria (distance from port, water depth); local group FINE identified areas that met criteria and were not objectionable; FINE was created by the County after Newport was selected by OSU
Pre-project Analysis	Impacts to Indigenous sovereignty	Procedural; Recognitional; Distributional	Did what was required under Federal Energy Regulatory Commission (FERC) process for consultation; no special meetings with the Tribes; FERC requires reaching out to Tribes and documenting the outreach; the Tribes did not engage very much but through Tracy Bailey, who is a local community member in Lincoln County and also a Tribal member with Siletz; Tracy has a role in energy; OSU reached out again later with offers for presentation, etc. – no interest
Public Process in Siting	Early, broad, and frequent public engagement	Procedural; Recognitional	OSU decided to engage with the public and all stakeholders on the front end; double-edged sword with lots of public input and a lengthy process to respond and corporate that input; ultimately worth it for the project and the industry
Public Process in Siting	Public agency leadership, and multi-agency collaboration	Procedural	FERC process – OSU opted for the “alternative” process, best fit with a lot of early engagement; Collaborative Working Group with over 20 agencies and local groups – met quarterly over a long period of time; formal communications plan to get the agency staff to speak freely; community groups in the Collaborative Working Group gave access to the public
Public Process in Siting	Common goal setting	Procedural	
Public Process in Siting	Transparency along the way	Procedural	
Public Process in Siting	Consensus-building process	Procedural	Used a professional facilitator, used a voting system “agree/I can live with it/don’t agree”
Construction	Construction impacts (fisheries)	Recognitional; Distributional	
Construction	Construction impacts (cultural/ historical/natural resources)	Recognitional; Distributional	Baseline is captured in the National Environmental Policy Act analysis, pre-construction investigations; FERC license outlines what to do with discoveries of impacts
Construction	Construction impacts (freshwater supply)	Recognitional; Distributional	PacWave shut down a state park for a year; stakeholders near Driftwood were regularly informed, had access to PacWave Deputy Director’s phone and email at all times; construction updates mailing list; special announcements for high-impact activities; construction updates on website
Construction	Infrastructure development	Recognitional; Distributional	
Construction	Hiring decisions (construction jobs)	Recognitional; Distributional	No particular strategy for local job creation; OSU procurement process doesn’t allow favoring local companies; PacWave suggested to contractors the use of local subs, since materials nearby are better for a variety of reasons
Project Execution / Operation	Hiring decisions (operations and management jobs)	Recognitional; Distributional	OSU has not suggested what the economic benefits may be; didn’t want to make promises that OSU can’t keep; some aspects of construction have clearly had impact: 25 staff living in Newport for 1 year +

Project Stage	Activities	EJ Tenet	PacWave Approach
Project Execution / Operation	Community access to local electricity	Recognitional; Distributional	Neighbors asked about free electricity – OSU can't do that!
Project Execution / Operation	Energy resilience through local electricity	Recognitional; Distributional	
Project Execution / Operation	Tourism	Recognitional; Distributional	
Project Execution/ Operation	Community Benefit Agreements	Recognitional; Distributional	No discussion currently at OSU for a CBA? Not currently, the agreement and buy-in happened 10 years in the past
Project Execution / Operation	Tax Revenue	Recognitional; Distributional	
Project Execution / Operation	Environmental monitoring program	Distributional	
Project Execution / Operation	Adaptive management (within project)	Distributional	
Post-project	Adaptive management (future projects)	Distributional	
Post-project	Equipment decommissioning	Distributional	In the FERC license and Bureau of Ocean Energy Management lease the decommissioning requirements are outlined

While PacWave's unique status as a testing site may limit the direct applicability of its lessons to other marine energy projects, its extensive siting, permitting, and community engagement efforts highlight the significance of collaboration and communication in new marine energy facility development. These processes ensured regulatory compliance, minimized potential environmental impacts, and fostered community ownership and support. As PacWave progresses, it will maintain stakeholder engagement and promote transparency, contributing to the responsible growth and development of the marine energy sector.

The engagement with PacWave in this project delves into the alignment of the framework and template with current industry initiatives by preliminarily validating both the framework and template. It identifies potential opportunities and challenges for template usage, and assesses its potential application in future endeavors.

5.3 Relevant Research

Over a decade, OSU not only fostered community engagement around PacWave, but also spearheaded significant research, highlighting the human elements in marine energy. Research methods around community engagement have primarily involved workshops, interviews, and surveys focusing on perceptions and potential risks to humans and marine life. Recognizing the importance of input from those directly connected to the infrastructure, objectives aim to identify potential impacts on the environment, ecosystems, and human dimensions, while ensuring compatibility with sensitive environments and existing users (Henkel and Hellin 2014). Workshops facilitate deeper understanding by bringing together smaller groups to discuss the issue (Boudet et al. 2020).

Research by OSU's Conway et al. (2010) and Boudet et al. (2020) reveals a generally positive perception of wave energy, especially among coastal residents and those in the Willamette Valley. However, many lack sufficient information to make informed decisions or take a stance. Trust in information sources varies, with academic sources, the DOE, utility companies, local government, and personal research considered more reliable (Boudet et al. 2020; Conway et al. 2010). Public knowledge is crucial for community members to grasp the benefits and burdens of marine energy and provide feedback (Conway et al. 2010; Garrett et al. 2022). Involving community members in decision-making and planning processes addresses concerns and increases acceptance (Boudet et al. 2020; Henkel and Hellin 2014).

In the Pacific Northwest, Oregon residents demonstrate the greatest knowledge of marine energy and favor wave energy development off their coast (Boudet et al. 2020). They appreciate the potential for reduced dependence on conventional energy, job creation, new businesses, and increased tax revenue (Nelson et al. 2008; Conway et al. 2010; Garrett et al. 2022). However, concerns exist about potential impacts on marine resources, both environmentally and economically, and conflicts related to marine energy project locations and permit acquisition (Conway et al. 2010). Energy equity is also a concern, with the hope that new technologies will address existing community equity issues and improve job opportunities, economic resilience, and workforce mobility (Boudet et al. 2020; Garrett et al. 2022). These findings offer essential insights for future marine energy development by identifying the place-based values, priorities, and concerns of communities, and ultimately contributing to the promotion of EJ.

6.0 Conclusion

This project aimed to promote the adoption of marine energy technology by developing an EJ framework that facilitates data collection for assessing and valuing the impact and benefits of marine energy. The literature review and case studies examined the current state of EJ considerations in various RE projects. A conceptual EJ framework, structured around three core EJ tenets and mirroring the review's structure, has been established. This framework provides a broad analysis of potential activities occurring throughout the various stages of a project.

Leveraging the conceptual EJ framework, a data collection template has been developed for real-world applications. This tool aims to enhance adherence to EJ goals and assess the socio-economic implications of various marine energy projects. Informed by a literature review, the template is meant for a wide array of stakeholders, including project developers, community members, researchers, and policymakers. However, it should be noted that the list of stages and activities is not exhaustive or rigid, and activities may span multiple project stages. Likewise, associating an activity with an EJ principle is subjective. These classifications are flexible, providing a framework that can be modified to meet the needs of individual projects.

As illustrated in Figure 3, the various stages and activities involved in marine energy project development can be linked to multiple EJ tenets. However, many of these activities are challenging to measure, and there is a scarcity of existing data sources. Although demographic information is easily accessible through sources like the American Community Survey, the Environmental Protection Agency's Environmental Justice Screening and Mapping Tool (EJScreen), the DOE Energy Justice Dashboard (beta), and the Climate and Economic Justice Screening Tool), most activities necessitate project-specific research. Therefore, to assess each activity's contribution to EJ, a diverse range of data sources is required, including local and project records, spatial data, questionnaires, focus groups, developer's websites, associated documents, and project-specific research data. The following three sections discuss the attributes and limitations of readily available data in the literature for the three fundamental EJ tenets.

1. **Distributional Justice** – Data on energy burden and demographic information by census tract are available (Energy Equity Report 2022), which can serve as a baseline for post-project analysis and monitoring before marine energy development enters local communities. Once marine energy development is underway or completed, new measurements can be compared to the baseline to evaluate marine energy's impact on the energy burden of various demographics within the community. The main data gap is obtaining updated measurements for communities after marine energy siting. Additionally, it would be advantageous to determine whether observed changes are indeed attributable to local marine energy development. As marine energy is an emerging technology, there are limited precedents to draw from.
2. **Procedural Justice** – A significant data gap exists in analyzing procedural justice due to the unique nature of each development process and the predominance of qualitative rather than quantitative measurement options. Consequently, existing data is typically available only at the local level through completed community surveys. This data can provide general insights into community preferences regarding development processes (e.g., participation methods or communication frequency), but it cannot replace input from the local community for each development. For marine energy projects, integrating feedback from local communities is crucial to achieving justice.

3. **Recognition Justice** – Demographic data can be easily obtained from various sources, such as the American Community Survey, the Environmental Protection Agency's Environmental Justice screening tool, the DOE Energy Justice Dashboard, and the Climate and Economic Justice Screening tool. This information can help identify the diverse characteristics of communities where marine energy projects are being developed. However, because marine energy is an emerging technology, significant gaps exist in analyzing demographics for marine energy projects. These gaps include recognizing the types of communities, such as those with varying racial, cultural, and economic backgrounds, where marine energy development is located. Additionally, data gaps persist in ensuring that Indigenous communities and local community values are acknowledged during the development process. Addressing these gaps may involve surveying communities to ensure their voices and needs are heard and considered.

The engagement with PacWave and considerations of the development process for the marine energy test facility explored the preliminary validation of the framework and template, assessing alignment with current industry initiatives. These highlighted potential opportunities and challenges for template usage, and its prospective application in future projects. While PacWave's role as a testing site may limit the direct transferability of its lessons to other full-scale marine energy projects, its comprehensive siting, permitting, and community engagement underscore the importance of collaboration and communication in marine energy development. The project outcomes emphasize that a commitment to a cooperative, transparent process outweighs simply checking off activities on a data collection list.

This report emphasizes the need for further research and practice, particularly in data collection to support procedural and recognition justice. Continuing these efforts by applying the framework to the rest of the PacWave project cycle and other marine energy initiatives at early phases with additional funding will enable the evaluation of the feasibility and limitations of this approach, thereby refining the details of data collection and contributing to its overall effectiveness.

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Appendix A – Descriptions of Project Stages and Activities

This appendix provides a brief overview of each stage of the project and its associated activities, as described in Table 1 of Section 4.0, Data Collection Template. It is important to acknowledge that the list of stages and activities is not comprehensive, and numerous activities could be applicable to more than one project stage. Furthermore, associating a specific activity with one or more energy justice tenets is inherently subjective – many of the activities do not distinctly align with a single energy justice tenet. These classifications are neither prescriptive nor immutable; they are intended to establish a basic structure and should be reevaluated and redefined for each individual project.

A.1 Community Engagement

This stage refers to the process by which developers engage with the community throughout all stages of the project. All activities within this stage are associated with all three tenets except for the communications plan, which is only associated with procedural justice.

A.1.1 Communications Plan

This activity describes the developer's communications plan. A good communications plan can increase knowledge and trust within the community with regards to the project. Questions that could be asked to evaluate this activity may include: How is information communicated, and what are the materials used? Who is/is not being targeted? Is information available in multiple languages? Formats?

A.1.2 Opportunities for Community Feedback

This activity describes the opportunities for community feedback provided by the developer. The ability to provide feedback can increase trust and provide a sense of community empowerment. Questions that could be asked to evaluate this activity may include: To what extent does the developer provide opportunities for community feedback? What types of feedback are available? How accessible are the opportunities to provide feedback? For example, if the opportunity for feedback is a community meeting, is it scheduled at a time when only certain segments of the community can attend? Is childcare available? Are meals provided?

A.1.3 Incorporation of Community Feedback

This activity describes how the developer incorporates community feedback. Depending on the process for incorporating feedback, outcomes include increased trust, community empowerment, and incorporation of community goals and feedback into the project development process. Questions that could be asked to evaluate this activity may include: What are the mechanisms for incorporating community feedback? To what extent is this process transparent? To what extent is this feedback incorporated in decision-making? Are there specific segments of the community whose feedback is incorporated more or less than other segments?

A.1.4 Success of Community Engagement Strategy

This activity describes how the community rates the success of the developer's community engagement strategy. A successful strategy can increase trust and improve community approval of the project. Questions that could be asked to evaluate this activity may include: To what extent to does the community feel heard or involved? Is community feedback being incorporated by the developer? Is the community stratified vis-a-vis levels of approval? Do some segments of the community feel like the strategy was unsuccessful?

A.1.5 Identifying Historically Underserved and Overburdened Communities, Targeting Them in Outreach

This activity describes how the developer identifies historically underserved and overburdened communities, and their process for providing outreach to these communities. A successful strategy can increase trust in the project within these communities. Questions that could be asked to evaluate this activity may include: What steps has the developer taken to identify historically underserved and overburdened communities? How is the developer providing outreach to these communities?

A.2 Pre-project Analysis

This stage refers to all analysis undertaken by the developer prior to designing or siting the project. This may include environmental and demographic data collection; numerical modeling of the energy resource, environmental impacts, and economic analysis; spatial planning; and assessing potential impacts on Indigenous sovereignty. In this stage, environmental and demographic data collection are associated with both recognition and distributional justice, numerical modeling and spatial planning are associated with distributional justice, and impacts to Indigenous sovereignty are associated with all three tenets.

A.2.1 Environmental Data Collection

This activity aims to understand the cultural and environmental impacts of the project. If presented transparently, results of this data collection can improve trust and provide an opportunity for the community to participate in the siting process by incorporating local knowledge of the area, such as suggesting alternative locations. Questions that could be asked to evaluate this activity may include: What are the environmental impacts, and to what geographical extent? Which species and landscapes might be impacted? What cultural or historical resources might be impacted?

A.2.2 Demographic Data Collection

This activity gathers information on the potentially impacted community. If presented transparently, results of this data collection provide an opportunity to revisit the project development process if the impacts of the project as planned are shown to be unjust. Questions that could be asked to evaluate this activity may include: What are the demographics of the community as compared to national/state/county demographics? To what extent are historically marginalized groups within the community impacted by the project? This data can come from a variety of sources, including the Environmental Protection Agency's Environmental Justice screening tool, the Department of Energy's Energy Justice Dashboard, the Climate and Economic Justice Screening tool, and the American Community Survey.

A.2.3 Numerical Modeling of the Energy Resource, Environmental Impacts, and Economic Analysis

This activity describes different outputs that might result from pre-project modeling, such as the extent of the energy resource, the environmental impacts or co-benefits of the project, and the economic ramifications of the project. Modeling results can be used to revisit the project development process based on unfavorable model outcomes.

A.2.4 Spatial Planning

This activity describes the kind of landscape/seascape spatial mapping the developer has undertaken, the results of which can be used to solicit community input on the locations with the least conflicts and revisit project development based on feedback. Questions that could be asked to evaluate this activity may include: What types of mapping were used? What are the sites with the least conflicts?

A.2.5 Impacts to Indigenous Sovereignty

This activity describes the extent to which the project could impact Indigenous sovereignty, such as through impacts to cultural/historical sites, traditional foods, or treaty-protected rights and resources. This provides an opportunity for the developer to engage with local Tribes or Indigenous groups to incorporate their feedback, and to revisit the project development process if project outcomes impact Indigenous sovereignty.

A.3 Public Process in Siting

This stage includes activities that can support a robust and transparent public process related to project siting. Activities in this stage of the process are mainly associated with procedural justice, although early, broad, and frequent public engagement is associated with procedural and recognition justice.

A.3.1 Early, Broad, and Frequent Public Engagement

This activity encompasses the degree to which the project developer engages with the community. This activity can increase trust and community empowerment. Questions that could be asked to evaluate this activity may include: Do they engage early in the process of development? How often does community engagement occur? What does this engagement look like (community meetings, flyers, etc.). To what extent does this engagement go beyond required measures, and how far beyond these requirements does it go?

A.3.2 Public Agency Leadership, and Multi-Agency Collaboration

This activity describes the degree to which multi-agency involvement and roles are documented, and the degree to which officials and expert opinions are accessible to the public. Understanding the relationships between agencies and being able to access these opinions can increase trust.

A.3.3 Common Goal Setting

This activity describes the extent to which community and developer goals are weighted and emphasized in the creation of a common goal. This can increase trust, ensure that community goals are incorporated, and ensure the expectations of various stakeholder groups are aligned. Questions that could be asked to evaluate this activity may include: Is there one goal that dominates? What is the goal setting process? Who is involved?

A.3.4 Transparency Along the Way

This activity describes the extent to which the developer provides publicly available and easily accessible information about the project, which can increase trust and education with regard to the project and its potential impacts and outcomes. Questions that could be asked to evaluate this activity may include: How easy is it to access this information? Is it accessible online, or is there the need to submit a written request? Is it formatted or available in data formats that are easily understood? What is the quality of this information?

A.3.5 Consensus-Building Process

This activity describes the process by which consensus is developed. A successful consensus-building process will increase trust and ensure community goals are incorporated. Questions that could be asked to evaluate this activity may include: What does consensus look like? Who are the involved stakeholders? Who is “at the table”? To what extent are community views and goals incorporated?

A.4 Construction

This stage includes activities that could impact or benefit the partner community, such as construction impacts related to fisheries; cultural, historical, and natural resources; freshwater supply; potential benefits related to construction jobs; and impacts related to infrastructure development. All of the activities in this stage are associated with recognition and distributional justice.

A.4.1 Construction Impacts (fisheries)

This activity describes the impacts of construction on fisheries, and provides an opportunity to understand and mitigate these impacts. Questions that could be asked to evaluate this activity may include: To what extent are fisheries impacted by project siting? What is the extent of the ecological impacts? To what extent is access to / yield from fishing impacted, and are some segments of the community impacted more than others?

A.4.2 Construction Impacts (cultural / historical / natural resources)

This activity describes the impacts of construction on cultural / historical / natural resources, and provides an opportunity to understand and mitigate these impacts. Questions that could be asked to evaluate this activity may include: To what extent are cultural / historical / natural resources impacted by project siting?

A.4.3 Construction Impacts (freshwater supply)

This activity describes the impacts of construction on the local freshwater supply, and provides an opportunity to understand and mitigate these impacts. Questions that could be asked to evaluate this activity may include: To what extent does project siting impact freshwater supply? Whose water supply is being impacted?

A.4.4 Infrastructure Development

This activity describes the extent of project-related infrastructure development impacts, such as impacts to natural/cultural resources, Tribal lands or fishing rights, or fisheries, and provides an opportunity to understand and mitigate these impacts. Questions that could be asked to evaluate this activity may include: What kind of infrastructure development is associated with the project (e.g., roads, transmission lines)? Where is this infrastructure development situated? Are any groups disproportionally impacted by this development?

A.4.5 Hiring Decisions (construction jobs)

This activity describes the extent to which project construction jobs benefit the community. This activity could create local jobs and build local knowledge and capacity, in addition to keeping job income within the community. Questions that could be asked to evaluate this activity may include: Are local jobs created? Who do the jobs go to? What are the job qualifications? Is job training provided to community members? What types of jobs are available? How many jobs? What is the “quality” of the jobs (e.g., seasonal, full-time, temporary / permanent, level of benefits). To what extent do these jobs benefit the community as a whole?

A.5 Project Execution/Operation

This stage refers to activities related to operations of the project between construction and decommissioning. Activities include hiring decisions for operations and maintenance jobs, access to local electricity generation and energy resilience, impacts to tourism and tax revenue, community benefit agreements and ease of access to those benefits, environmental monitoring, and adaptive management as a result of monitoring. The majority of these activities are associated with recognition and distributional justice, although environmental monitoring and adaptive management are associated solely with distributional justice.

A.5.1 Hiring Decisions (operations and management jobs)

This activity describes the extent to which project operations and management jobs benefit the community. This activity could create local jobs and build local knowledge and capacity, in addition to keeping job income within the community. Questions that could be asked to evaluate this activity may include: Are local jobs created? Who do the jobs go to? What are the job qualifications? Is job training provided to community members? What types of jobs are available? How many jobs? What is the “quality” of the jobs (e.g., seasonal, full-time, temporary/permanent, level of benefits). To what extent do these jobs benefit the community as a whole, such an electrician who maintains the project half-time and also provides services to the community?

A.5.2 Community Access to Local Electricity Generation

This activity describes the extent to which electricity generation from the project is available to the community. Local electricity could be provided at a more affordable rate than utility power, and could allow community members to access renewable energy. Questions that could be asked to evaluate this activity may include: How much does this electricity cost? Is it more/less expensive than utility power? Is the whole community able to access the electricity?

A.5.3 Energy Resilience through Local Generation

This activity describes the extent to which electricity generation from the project can be used to meet resilience needs in the event of a power blackout. For example, could this energy be used to power a single-building, “behind the meter” microgrid, or a “front of the meter” community microgrid (when combined with battery storage)?

A.5.4 Tourism

This activity describes the extent to which tourism is impacted by the project. Questions that could be asked to evaluate this activity may include: Does the project impact tourism, or income earned from tourism? Are some segments of the community more impacted than others by changes in tourism resulting from the project?

A.5.5 Community Benefit Agreements

This activity describes the community benefit agreement (if any) related to this project. Energy infrastructure projects can provide a wide range of benefits to a community, including but not limited to local hiring commitments, providing money to local funds, funding job training and educational services, and financing community development projects. Questions that could be asked to evaluate this activity may include: Is there a community benefit agreement? If so, what is the composition of the community benefit group (e.g., neighborhood associations, faith-based orgs, unions, environmental groups)? What is the extent of the benefits? What percentage of the population is able to use or opt-in to benefits? To what extent are energy justice principles built into the community benefit agreement (e.g., 40% of benefits go toward communities of color, Indigenous peoples, low-income communities, and other marginalized groups)?

A.5.6 Tax Revenue

This activity describes the extent of increased tax revenue resulting from the project flow to the local community. This tax revenue could provide economic opportunities to the community.

A.5.7 Environmental Monitoring Program

This activity describes the environmental monitoring program(s) (if any) related to this project. The results from these program(s) could be made publicly available to increase trust and provide an opportunity to mitigate project impacts. Questions that could be asked to evaluate this activity may include: What do the programs entail? What are the results of ongoing environmental monitoring programs?

A.5.8 Adaptive Management (within project)

This activity describes the extent to which monitoring outcomes are used to improve on-site mitigation.

A.6 Post-project

This stage refers to activities that occur at the end of the project lifetime, including equipment decommissioning and adaptive management for future projects. Both of these activities are associated with distributional justice.

A.6.1 Adaptive Management (future projects)

This activity describes the extent to which modeling studies and monitoring outcomes are used to improve future project design.

A.6.2 Equipment Decommissioning

This activity describes the developer's plan for equipment decommissioning at project end of life. This activity ensures the community does not bear the burden of removing equipment and restoring the project location.

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