



Original research article

Changing Tides: Acceptability, support, and perceptions of tidal energy in the United States



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ABSTRACT

Tidal energy is a renewable energy source that could be used to help mitigate climate change. Tidal energy technology is in the early stages of development and views towards this technology and energy source are not well understood. Through a representative mail survey of Washington State residents, we assessed attitudes and behaviors related to tidal energy, perceived benefits and risks, and climate change beliefs. Higher levels of perceived benefits and climate change beliefs were associated with increased acceptability of and support for tidal energy whereas greater perceived risks were associated with decreased acceptability and support (acceptability being an attitudinal construct, support a behavioral construct). Coastal residents reported higher levels of acceptability and support than non-coastal residents. Pulling from innovation theory, we show that levels of support depended upon the development lifecycle stage of the technology. Support declined once the project moved into the water from the lab, however, grid-connected pilot projects were more likely to be supported than those without grid-connection. Policies developed to encourage the development of tidal energy may be more accepted and supported if they include incentives for pilot phases with grid-connection.

1. Introduction

Increasingly, attention has been paid toward how social science can contribute to understanding and reducing global climate change. One promising research direction within social science, especially for environmental psychology, is a focus on behavioral drivers of climate change and mitigation responses [1,2]. The International Social Science Council has also highlighted responses, such as mitigation and adaptation, as an area for social scientists to contribute to the forthcoming 1.5 °C Special Report of the Intergovernmental Panel on Climate Change [3]. Mitigation with regard to climate change is “any human action that reduces the sources of or enhances the sinks of greenhouse gases” [2, p. 104] and includes contributions from renewable energy technology and policy. Furthermore, the methods used in environmental psychology are well-suited to study perceptions of renewable energy and policy [4]. Here, we use survey research to better understand perceptions of tidal current energy. This research aligns with the agenda for social studies research in marine renewable energy (MRE) [5].

Tidal current energy, also known as in-stream tidal energy, is one type of MRE that can help reduce greenhouse gas emissions, increase

energy security, and help meet renewable energy goals. It is created when differentials between high and low tides create strong currents that can be harnessed for electricity production.¹ Hereafter, we refer to tidal current energy as tidal energy. This study focuses on WA State, where there is high tidal energy resource potential in Puget Sound and the possibility to meet a large part of local electricity demands [6] (see Fig. 1).

The Federal Energy Regulatory Commission (FERC) issued a federal license for a pilot tidal energy project in Admiralty Inlet within Puget Sound, WA in 2014. However, the project did not advance due to cost increases during the planning stage [7]. Given the high resource potential, it is likely that tidal developers may look to Puget Sound again in the future. Therefore, it is important and timely to better understand WA residents’ views towards the development of tidal energy and how different stages of development may impact those views. This is the first study to address this need with a mail survey of a random sample of WA residents. This study adds to the literature on climate change mitigation through renewable energy by focusing on attitudes and behaviors related to the development of tidal energy and its associated technology.

In the following sections, we introduce the lifecycle stages of

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¹ Tidal current energy is a different energy source than tidal barrages, wave energy, and hydropower.



Fig. 1. Tidal resources in Puget Sound, WA. Map credit: Craig Hill, University of Washington.

development for MRE and then offer a brief overview of the state of tidal energy technology development. This is followed by a discussion of the investment in MRE by the United States and then we review the literature on views towards MRE focusing on acceptability, acceptance, and support. Our methods and results follow. We then discuss our findings in light of the literature and offer our conclusions.

1.1. Lifecycle development stages for MRE

Technology progresses through development stages to reach maturity. Specifically for MRE, these development stages are identified as R&D, scale prototype, full-scale prototype (pre-commercial), first farms (niche markets), and fully commercial [8]. These stages are not always distinct and some would consider R&D to also incorporate scale prototypes. Movement through these stages of development is also known as moving along the innovation chain [9].

Past research has used a techno-economic framework to investigate investor preferences for investing and supporting new renewable energy technology development through the lifecycle stages of the technology [8,9]. High risks are associated with investing in early stages of MRE development, specifically for UK investors, thus making it difficult to secure funding [8]. The challenges of securing funding during this phase of development are not unique to tidal energy or MRE in general, as investors perceive large risks associated with investment at the stages before commercialization commonly coined, “the valley of death” [8,9].

If lessons from the UK are applied to the United States, it is likely that public sector investment and support of tidal energy will have a strong influence over the advancement of the technology through the early stages of development, because the private sector may be hesitant to invest due to perceived risks [10]. One of these perceived risks is uncertainty around public acceptance of the technology [10]. Additionally, although some MRE technologies may be viewed positively in early stages in the innovation chain, attitudes towards the technology may change as development is scaled up [11]. No previous studies have assessed views towards MRE technology at different stages along the innovation chain. The present study addresses this research gap by investigating public support for tidal energy technology across the development lifecycle stages.

1.2. State of tidal energy technology development

The development of tidal energy technology is currently underway in multiple countries. Looking at the industry from a lifecycle stages of technology framework, the industry has not yet reached commercialization. Pilot projects such as individual full-scale prototypes have been developed and the industry is moving towards multiple device pilot projects, also known as small arrays or farms. Scholars have suggested the use of pilot projects and gradually scaling up projects as the appropriate innovation pathway for MRE from a technical and economic standpoint [12]. Scaling up and not skipping steps in the development process is important for long-term success for the technical and

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