# Public perceptions of tidal energy: can you predict social acceptability across coastal communities in England?

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## Abstract

Early consideration of potential societal issues faced by the nascent tidal industry is important to facilitate public engagement and potentially avoid levels of conflict that have arisen within other renewable energy sectors; general expressions of public support (as reported in national-scale attitude surveys) do not always translate into approval for local developments. It is a very appealing idea that the likely response of different types of communities to marine energy developments can be mapped and used to support planning. This study examined the attitudes of 963 people in South West England to hypothetical local tidal energy projects, analysing the results both by geographic location and according to the coastal community typology developed for England by the Marine Management Organisation. With the exception of age, demographic variables had little influence on the level of opposition to tidal energy, which instead was affected more by factors such as attitudes towards tidal energy in general (in particular its likely environmental impact), activities undertaken at the coast, and place attachment. These significant factors are typically not captured by the national census data used to determine community types. Any predictions about the acceptability of energy projects made as a result of community mapping based on demographic variables will not be a substitute for thorough public engagement and consultation, which should centre on the implications of tidal developments for the environment.

## 1. Introduction

As the tidal energy sector continues its progress towards commercialisation, with particular success in the UK and Canada, (Ren21, 2019), it is important to consider potential societal issues while the industry is nascent. This will facilitate public engagement and potentially avoid levels of conflict that have arisen within other renewable energy sectors. For example, despite the technological maturity and low cost of onshore wind energy generation, England has seen low rates of windfarm planning approval resulting from public objections to developments (Harper et al., 2019). The marine energy industry has recognised the importance of public acceptability: "e*nsuring regional support and community endorsement is critical to the long-term aspirations of ocean energy and to maximising Blue Growth for Europe*" (Ocean Energy Forum, 2016, p39).

Public acceptance of marine renewable energy, in general, is reported to be high. For example, a survey in the Canadian province of Nova Scotia, which sampled preferentially among those communities in closest proximity to potential developments, suggested that over 80% of respondents completely or mostly supported tidal energy demonstration projects (Marine Renewables Canada,

2018). In the UK, the Public Attitudes Tracker survey published by the Department for Business, Energy and Industrial Strategy reported that 82% of respondents support or strongly support wave and tidal energy (BEIS, 2019). However, this same survey also reports that 80% of respondents support or strongly support onshore wind, illustrating that general expressions of public support do not always translate into approval for local developments, and suggesting that tidal energy developments are not guaranteed public backing.

As has been shown with onshore wind: "*It is one of the most common mistakes in facility siting to take general support for granted and to expect people to welcome developments they claim to support*" (Wolsink, 2000). The high degree of public inertia in the planning process has long been documented (Hoinville and Jowell, 1972), and so organised groups who do take a strong position can have a significant influence through increasing the level of interaction on one particular side of the debate (Toke, 2005; Loring, 2007). Such groups have already organised to oppose tidal turbine projects in Kaipura Harbour, New Zealand (RNZ, 2010) and Canada's Bay of Fundy (Global News, 2017). There is evidence from the development of offshore wind that levels of opposition are influenced by demographic factors such as age (Ladenburg and Dubgaard, 2007; Firestone and Kempton, 2007; Krueger et al., 2011), but also that the same development can provoke very different responses from the residents of the different coastal towns affected (Devine-Wright and Howes, 2010).

There is a need to better understand public perceptions of, and concerns regarding, tidal energy, to determine the likely responses of local people to individual projects and so reduce risks within the consents process and support marine renewable energy policy more widely. This study uses a case study of three communities in South West England to examine the factors that affect the likelihood that people will oppose local tidal energy developments. The research also explores whether attitudes vary according to composite indicators of demographic characteristics, and hence the potential for mapping the types of community that may be particularly resistant to tidal energy developments.

## 2. Methods

### *2.1 Site selection*

This study focuses on communities bordering the Bristol Channel, which has the largest tidal energy potential in the UK and so is an appropriate location for research into public perceptions and attitudes. There has been significant activity around the development and deployment of tidal power initiatives on the Welsh coast (such as proposals for tidal lagoons in Swansea Bay and Cardiff as well as tidal current devices in Pembrokeshire). This study focuses instead on the English coast, where project proposals have not yet reached an advanced stage and there has been little public interaction, in order to avoid participants being unduly influenced by any consultations or outreach connected to a specific scheme. Three case study sites along the coasts of North Devon and Somerset were chosen: (i) the area around the Taw Torridge estuary; (ii) Minehead and Watchet (hereafter Minehead/Watchet); and (iii) Weston-super-Mare and Burnham-on-Sea (Weston/Burnham) (Figure 1). Although there was no particular activity around tidal energy at these sites during the study period, the

potential of all three areas has previously been documented (Binnie and Partners, 1989; DECC, 2010; National Infrastructure Planning Inspectorate, 2014). Each of the case studies is spatially distinct, allowing for comparisons to be made between the sites to determine whether attitudes to tidal energy vary by location as well as by demographic characteristics.

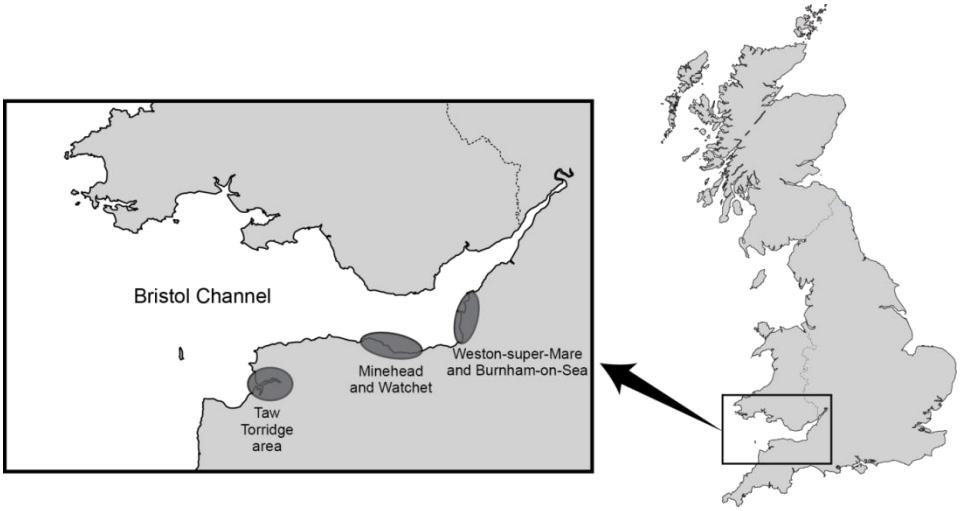


**Figure 1.** The location of the study site

The Marine Management Organisation (MMO) has created a typology to describe all coastal communities in England (but not Wales or Scotland) as a means of grouping areas with similar characteristics to help marine planners understand local socio-economic conditions and provide a strategic overview to inform planning discussions and stakeholder engagement (OCSI and Roger Tym & Partners, 2011). This typology is being used in marine plans to suggest community types that might be more amenable to energy developments (MMO, 2020). This study therefore also provides the opportunity to test that assertion (which has not previously been evaluated empirically), and hence whether maps produced from social, economic and demographic variables collected in national census data can be used to predict communities that are more, or less, likely to favour tidal energy developments in their local area. The experimental design of this research therefore also incorporates four of the MMO typology classes (Table 1). Respondents from each of the target typologies were identified by overlaying the shapefile of the coastal typologies onto an OpenStreetMap shapefile within QGIS to provide the appropriate street addresses for researchers to target.

**Table 1.** Descriptions of the coastal typology classes used (from Roger Tym & Partners and OCSI, 2011)

| Code | Name | Overview |
|---|---|---|
| A1 | Coastal retreats: Silver seaside | Retirement areas primarily located in smaller, less developed resorts. |
| B1 | Coastal challenges: Structural shifters | Towns and cities which have lost their primary markets, and are facing the challenge to find new ones. This group includes a range of single industry coastal towns, including seaside resorts, mining areas, industrial heartlands and former agricultural centres. |
| C1 | Cosmopolitan coast: Reinventing resorts | Primarily tourist economies with high levels of deprivation, but diversifying to attract a more highly skilled population. |
| D2 | Coastal fringe: Working hard | Towns characterised by high levels of employment typically in industrial sectors, and a stable population. |

### *2.2 Survey*

Data were collected through a face-to-face survey with members of the general public during March and April 2018. The survey design was influenced by the research on offshore wind which has shown that demographic factors including age, gender, income and education can affect responses to developments (Ladenburg and Dubgaard, 2007; Firestone and Kempton, 2007; Krueger et al., 2011; Tiesl et al., 2015). Furthermore, it is well recognised that people have emotional connections to particular places, as these settings can provide them with general meaning and purpose in life or link to specific activities, and such bonds are created in response to both the natural environment and social attachments (Brehm et al., 2006; Brown and Raymond, 2007). Place attachment[1] has been shown to be a significant factor in people's responses to proposed energy developments (Devine-Wright, 2011a,b; Vorkinn and Riese, 2001), and the possible disruption of existing attachments can induce negative emotional responses, with the potential for this to lead to place-protective behaviour (Devine-Wright, 2009; Stedman, 2002), and so it is particularly pertinent to examine place attachment in the context of possible actions in response to local tidal development.

Participants were asked initially about their general use and perceptions of their local coastal areas, including the frequency with which they undertook particular coastal leisure activities and their views on tourism and the local economy. Participants were also asked to rate the importance to them of seven specific features of the local coastal environment: marine mammals, birds, fish, sandy beaches, other shoreline habitats (saltmarsh, mudflats), peace and tranquillity, and the view. These features were selected as those most at risk from the environmental impacts of tidal energy, which include presenting a collision risk to mobile and migratory marine species, noise, electromagnetic fields, loss of habitat, change in sediment distribution, and reducing visual amenity (Bonar et al., 2015; Hooper and Austen, 2013; Garcia-Oliva et al., 2017; Nash et al., 2014). The question was asked in general terms, without reference to the potential impacts of tidal energy. To conclude this section, participants were asked to rate the importance of certain social and environmental aspects in their choice of where to live on a scale of one (not at all important) to seven (extremely important) in order to assess the key factors that shape their place attachment (after Brehm et al., 2006).

The second part of the questionnaire focussed specifically on tidal energy for electricity generation. Participants were asked how well informed they considered themselves to be and their general attitude to the challenges and opportunities of tidal energy development in the UK. This section also included an Analytic Hierarchy Process exercise, to determine the relative importance to respondents of four characteristics of tidal energy: the local environmental impact, local job creation, reliability and cost of energy. These characteristics were selected based on previous focus groups that had highlighted key areas of concern or interest for marine energy. Following descriptions of the characteristics participants were asked to make pairwise comparisons, rating the relative importance

[1] There are a range of concepts and typologies related to understanding the connections between people and places that have developed from the psychology and human geography perspectives including sense of place, community attachment and place dependence (Hernandez et al., 2014; Brown and Raymond, 2007). We follow the method of Brehm (2006) to assess a particular aspect of this phenomenon, and so similarly adopt her use of the term place attachment.

on a scale of one (attributes are of equal importance) to nine (the chosen attribute is very much more important than the other) (Saaty, 1980). Part Three of the survey concerned hypothetical tidal energy developments within the respondents' local area, and whether they were likely to support or oppose such a development. The survey concluded with the collection of standard demographic information.

### *2.3 Data analysis*

Exploratory Factor analysis (performed in STATA/SE 12) was used to determine patterns of responses in participants' use of their local coastal environment and in the social and environmental attributes potentially influencing their place attachment. In each case, a polychoric correlation matrix was generated (to account for categorical and non-normal data), a Kaiser-Meyer-Olkin measure of sampling adequacy was performed, and Obliman oblique rotation was used to allow for correlations between variables (after Brehm et al., 2006). Calculation of the attribute weights from the Analytic Hierarchy Process (AHP) was carried out using an eigenvalue calculation tool within R. The individual attribute weights were aggregated for each sample using the geometric mean, as the arithmetic mean is considered less consistent with the underlying axioms of AHP (Forman and Peniwati, 1998). Further details of the processes involved in calculating AHP weights can be found in Saaty (1980, 1990, 2008) and Duke and Aull-Hyde (2002). Logistic regression (again performed using STATA/SE 12) was used to model the contribution of different variables to the likelihood that respondents would oppose a local tidal development. Further, the ANOSIM function in Primer-E v6 was used for multivariate analysis of the explanatory variables associated with opposition to tidal development to determine how these varied between case study sites and typologies.

## 3. Results

Predominantly, results presented in the following sections describe findings for the full sample of respondents. More detailed breakdowns of survey responses (and other results) by case study and typology class are contained within the Supplementary Material (SM).

### *3.1 Characteristics of the sample populations*

A total of 963 completed questionnaires were returned, with approximately 320 responses per case study and at least 200 per typology class, with representatives from each typology class across at least two case studies (see Table SM1, and also Table SM2 for the demographic characteristics of each sample). A large proportion of respondents reported that features of their local coastal environment were very important to them: at least 74% across all the environmental categories for the full sample (Table SM3). The different features were rated broadly equally, with no clear trends that certain attributes were considered more important by a higher proportion of respondents. The most common leisure activities undertaken by participants were enjoying the scenery and walking/running/cycling on beaches and coastal paths. Rates of regular participation in watersports, angling/crabbing and wildfowling were low, with no more than 6% of the total sample taking part in any one activity at least once per month (Table SM4). The natural landscapes, seascapes and views (mean score 5.9) was the most important factor in respondents' decision to live in the current location,

while local culture and tradition (5.2) and opportunities for community activities (4.8) scored lowest on average across the sample (Table SM5).

The data sets on the coastal leisure activities undertaken by respondents' and the factors contributing to their place attachment produced Kaiser-Mayer-Olkin measures of 0.82 and 0.89 respectively, and were therefore adequate for conducting factor analysis. Responses on use of the coastal environment grouped according to three factors: (i) watersports (snorkelling, powered and non-powered watersports); (ii) beach activities (relaxing, playing with children); (iii) wildlife and bird watching (Table SM6). Two factors explained the relationship between place attachment attributes: (i) the presence of friends and family; and (ii) wider characteristics of the area, both social and environmental (Table SM7). The factor analysis was used to derive composite variables to summarise respondents' participation in key coastal activities and their place attachment for use in subsequent modelling.

### *3.2 General perceptions of tidal energy*

Overall, 58% of respondents described themselves as being not at all or not very well informed about tidal energy although they had broadly positive opinions about the sector in general (Table SM8). There were very high levels of agreement that the UK should continue to have a leading global role in tidal energy research and development (89% across the full sample), and that the UK government should invest more in tidal energy (85%). Conversely only about 15% of respondents agreed that (i) the engineering challenges were too difficult to overcome; or that (ii) tidal energy would never contribute significantly to the UK's electricity supply.

The previous data on respondents' high level of regard for nature (Section 3.1) was reinforced by the results of the Analytic Hierarchy Process (AHP). Across the sample as a whole, the local environmental impact of a tidal development was most important to respondents, and cost of energy the least (Figure 2), a pattern that was repeated when the samples were split by both site and typology class (Figure SM1).

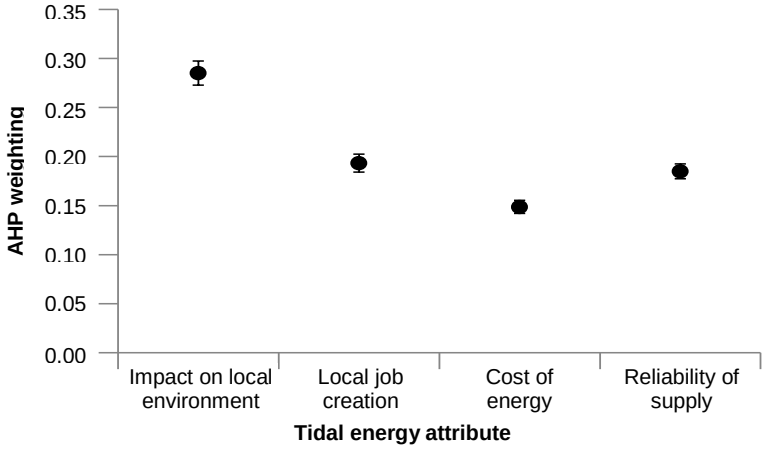


**Figure 2.** The relative Analytic Hierarchy Process (AHP) weightings for four tidal energy attributes (with error bars indicating the 95% confidence interval).

### *3.3 Key variations across case studies and typologies*

Broadly, the fewest significant differences in participant responses were found between A1 and B1 typology classes, while C1 differed from at least one other typology class across all the variables for which pairwise comparisons were undertaken. The Taw Torridge area and Minehead/Watchet were the most similar case study sites. Of 25 variables considered as potentially influencing attitudes to tidal developments, there were no differences between the subsamples (by case study site or typology class) in terms of gender, age, households with children, employment rates, income, or the AHP scores for the importance of environmental impact and local job creation as attributes of tidal energy schemes.

There were differences by both case study site and typology class for the AHP score for cost (which had a higher relative weighting in Weston/Burnham and in the C1 and D2 areas), and whether respondents were long term residents (which varied in some way across most pairwise comparisons). There were further differences by both site and typology class in the frequency with which activities on the coast were undertaken, and in the importance of both local environmental attributes and the factors contributing to sense of place. Typically, rates of participation and importance scores were lowest in Weston/Burnham and in the C1 and D2 classes.

Those in Minehead/Watchet felt they were less well informed about tidal energy than at the other sites, while those in Weston/Burnham were more likely to agree that it was important that the UK continues to increase the production of electricity from renewable sources. However, compared to those in Minehead/Watchet, Weston/Burnham residents were also more likely to agree that there are too many engineering challenges for tidal energy to ever really take off. Those in the D2 typology class were also more likely to hold this view of engineering challenges, and to agree that tidal energy will never make a significant contribution to UK electricity supply.

### *3.4 Attitudes to local tidal energy developments*

*3.3.1 Level of opposition to local developments*

Across the full sample, 78% of respondents would support or strongly support a tidal energy development in their area, and 4% would oppose or strongly oppose any such project (Figure SM2). Differences in the frequency of responses were not significant between case study sites. However, there was one significant pairwise comparison between typologies: rates of opposition to tidal developments were higher amongst residents in A1 than D2 typology classes, at 6.4% and 1.8% respectively.

The factors that may influence respondents' opposition to a local tidal energy development were modelled using logistic regression. The variables used in the models are given in Table 2. Two versions of the model are included. Model 1 includes all respondents, while in Model 2 those who responded that they "*would not have a view one way or another*" about a local tidal development were excluded. This was because the 'no opinion' option may be used where the respondent does not know (Sturgis et al., 2014). Therefore, those who expressed no firm opinion could be considered as

undecided, rather than holding a truly neutral position. Income was not included as a variable as this reduced the full sample size from 955 to 335; all questions in the survey were optional, and (as often occurs in such cases) many respondents refused to disclose their household income. Also, income was not significant when tested in an early version of the model. The models were created using backward elimination from the full suite of appropriate variables (Table SM9, with the full model including these variables in Table SM10).

**Table 2.** Descriptions of the variables and models used in logistic regression (Table 3) to explore the effect of socio-demographic variables and attitudes on the likelihood that respondents would oppose a tidal energy development in their local area.

| Variable name | Type | Description |
|---|---|---|
| Typology | Categorical | The typology classification given to the participants location (B1, C1, D2), compared relative to the A1 category. |
| Age | Categorical | The respondents' age group, compared relative to the 18-24years group. |
| Placeattach_environ | Binary | Place attachment attributes related to the wider environment are more important than those for friends/family |
| Activity_Watersports | Binary | Watersports activities undertaken more often than beach-based or wildlife watching |
| Tidal_UKInvest | Binary | Strongly agree/agree that UK Government should invest more in tidal energy |
| Tidal_Contribution | Binary | Strongly agree/agree that tidal energy will never make a significant contribution to UK electricity supply |
| AHP_Environment | Continuous | The AHP score for the importance of the environmental impact of tidal projects |

**Table 3.** The outcome of logistic regression models to explore the effect of socio-demographic variables and attitudes on the likelihood that respondents would oppose a tidal energy development in their local area. Further details of the variables are given in Table 2

| | **Model 1** (full sample) | | | | **Model 2** (neutral responses removed) | | | |
|---|---|---|---|---|---|---|---|---|
| | *odds ratio* | *std. err.* | *z* | *p* | *odds ratio* | *std. err.* | *z* | *p* |
| Typology_d2 | 0.32 | 0.18 | -2.01 | 0.04 | 0.29 | 0.18 | -2.01 | 0.05 |
| Age_35-44yrs | 3.30 | 1.93 | 2.04 | 0.04 | 3.50 | 2.12 | 2.06 | 0.04 |
| Age_55-64yrs | 3.52 | 2.03 | 2.18 | 0.03 | 3.61 | 2.16 | 2.15 | 0.03 |
| Age_64+yrs | 3.11 | 1.60 | 2.21 | 0.03 | 2.92 | 1.54 | 2.04 | 0.04 |
| Placeattach_environ | 0.50 | 0.19 | 1.82 | 0.07 | 0.53 | 0.21 | 1.62 | 0.11 |
| Watersports | 0.31 | 0.16 | -2.24 | 0.03 | 0.39 | 0.21 | -1.75 | 0.08 |
| Tidal_UKInvest | 0.13 | 0.05 | -5.45 | <0.01 | 0.07 | 0.03 | -6.47 | <0.01 |
| Tidal_Contribution | 6.01 | 2.30 | 4.69 | <0.01 | 5.33 | 2.14 | 4.17 | <0.01 |
| AHP_environment | 12.20 | 10.02 | 3.04 | <0.01 | 11.79 | 10.25 | 2.84 | <0.01 |
| _cons | 0.04 | 0.02 | -5.30 | <0.01 | 0.07 | 0.05 | -4.02 | <0.01 |
| n | 955 | | | | 781 | | | |
| LR$\chi^2$ | 74.9 | | | | 83.8 | | | |
| p | <0.001 | | | | <0.001 | | | |
| Log likelihood | -128.6 | | | | -115.9 | | | |
| Pseudo $R^2$ | 0.23 | | | | 0.27 | | | |
| AIC | 277.3 | | | | 251.9 | | | |
| BIC | 325.9 | | | | 298.5 | | | |

The only demographic variable that was significant in respondents' opposition to a local tidal development was age (with older respondents more likely to oppose tidal schemes) (Table 3). Those for whom place attachment attributes related to the local environment were more important than the presence of friends and family were also more likely to oppose tidal projects, although this was only significant at the 10% level in Model 1. Those who undertake watersports more regularly than other coastal activities were less likely to oppose developments, and the reduced likelihood that D2

residents would oppose tidal schemes compared to those in A1 areas was significant in the model. Attitudes to tidal energy in general were also significant in predicting responses to local schemes. Those who did not believe that tidal energy would make a significant contribution to UK energy and those for whom environmental impact was the most important attribute of tidal developments were more likely to oppose local projects. Conversely, those with a positive attitude to tidal energy (evidence by the belief that the UK Government should invest more in the sector) were less likely to oppose local tidal developments.

Multivariate analysis was used as an alternative approach to assess all the explanatory variables for likely tidal opposition in aggregate (using ANOSIM in Primer-E v6), which did not detect significant differences in the samples by either typology class or case study. This supports the finding from the model that there is no clear pattern of factors that can be attributed to geographical or socio-economic groupings in order to determine likely community response to tidal energy developments.

## 4. Discussion

In general, the high-level message from national attitude-tracking surveys that the general public supports tidal energy is substantiated by this study: 78% of respondents in this survey would support a development in their local area, only slightly lower than the 82% of national respondents who express support for tidal energy in general (BEIS, 2019). However, certain factors were shown to be significant in predicting likely opposition to local tidal energy schemes.

### *4.1 Demographic variables, community type and place attachment*

As has already been shown for offshore wind (by, for example, Ladenburg and Dubgaard, 2007; Firestone and Kempton, 2007; Krueger et al., 2011), age is a factor in explaining likely opposition to local tidal energy schemes. However, other characteristics that have been shown to affect people's response to proposed offshore wind projects such as gender, income and education (as reviewed in Tiesl et al., 2015) were not apparent in this study. There was some suggestion that the experiences and attitudes of residents of the Weston-super-Mare area (which represented the largest population centre) differed from the case studies further west, but this did not translate into clear trends that affected responses to tidal energy developments.

The limited influence of demographic variables on opposition to tidal energy suggest that it would be challenging to map likely attitudes spatially or to summarise them according to community classifications based on social or economic groupings. When the Marine Management Organisation's coastal community typology was developed, predictions were made as to how different communities might react to different planning issues. This suggested that B typology areas are most likely to be amenable to energy developments as their labour markets and infrastructure are likely to make the area attractive to investors (Roger Tym & Partners and OCSI, 2011). This assumption that B typology areas are a "*probable good fit for energy developments*" was repeated in the draft South West marine plan (MMO, 2020, p102). From the perspective of the attitude of residents, our research provides no

evidence to support this assertion that B areas differ from other typology classes. However, differences between typology classes in their likely negative response to tidal schemes were found (between A and D groups). This provides some evidence to suggest that a typology that encompasses a range of variables can better capture community responses than individual demographic characteristics. However, much more research is required to determine how communities will respond in different circumstances before any predictions should be included in statutory documents such as marine plans.

This study found two distinct elements of place attachment: (i) a connection to friends and family and (ii) a connection to the wider community and the natural environment. When wider social and environmental factors influenced place attachment more strongly, the likelihood of opposition to a tidal development increased. Environmental concerns connect to place attachment characteristics of natural landscapes, the presence of wildlife and opportunities for outdoor recreation, as there is the potential for these to be directly impacted by tidal energy developments. The social characteristics of the sense of place metric may link to environmental concern through perceptions of possible effects on cultural identity and heritage, or wider health and wellbeing of the community (Brehm et al., 2006). Conversely, when sense of belonging is shaped most strongly by particular people, and thus is unaffected by changes related to a new tidal energy scheme, there is a lower likelihood of objection. As place attachment represents a complex, multifaceted emotional connection, a comprehensive, participatory consultation process is required if the public acceptability of specific developments is to be properly understood. This can be a positive process, providing developers with the opportunity to frame their proposals in such a way as to emphasise the means by which their project will enhance, rather than threaten, the different components of place attachment (Devine-Wright, 2009; de Groot and Bailey, 2016).

### *4.2 Understanding of tidal energy and key issues of concern*

A further finding from this research is that general beliefs about the relevance of the tidal energy sector nationally have a significant influence on the likelihood of individuals opposing local developments. However, people generally report that they do not feel well informed about tidal energy. There is, therefore, a role for efforts to increase public awareness, which would need to include evidence that the sector is making progress and has the necessary political support. Nonetheless, it would be wrong to assume that all opposition to tidal power results from ignorance or that people's concerns can be removed by increased knowledge. This perspective that opposition to renewable energy is fundamentally wrong, and therefore opponents are misinformed and their view can be corrected, has resulted in a narrow framing of the public acceptability debate around other renewable technologies, particularly wind power, and a missed opportunity for a more positive, truly participatory discourse (Aitken, 2010).

Although it is well argued that typical planning consultations may lack required elements of a wholly participatory process (Aitken, 2010), outcomes for developers have been shown to improve when

they increase engagement with local communities (Toke, 2005; Loring, 2007). To support appropriate communication, developers need to understand the issues likely to be of most importance to the people affected by tidal energy schemes. Our findings suggest that some assumptions that have been made about public attitudes may not be entirely correct. It has previously been emphasised that "*the economic and social benefits of development should be highlighted and communicated at a local level to ensure community endorsement and support*" (Ocean Energy Forum, 2016). Our research demonstrates that local people are much more concerned about environmental impacts. The importance of job creation or other economic benefits is likely to be location specific; potential business and employment opportunities tend to be of higher importance in more isolated communities with limited alternatives for economic development (de Groot and Bailey, 2016).

Similarly, the UK government has repeatedly stated that keeping energy bills as low as possible is a national policy priority (DECC, 2015; HM Government, 2017; BEIS, 2018). However, this study demonstrates that members of the public may prioritise other aspects of tidal energy generation above cost. Previous research has already shown that the general public is willing to accept an increase in energy bills and contribute to the cost of the low-carbon transition, provided such increased costs are perceived as just and fair (Evensen et al., 2018). Therefore, while energy costs and economic benefits should not be ignored in engagement with the public, the environmental implications of potential developments should be central to the consultation process.

### *4.3 Limitations and future research*

This study considered a hypothetical tidal development rather than a live project in order to generate findings that were independent of the characteristics of a specific scheme. However, this is a limitation of the research; responses given to interviewers do not always reflect later behaviour as, for example, literature on stated versus actual contributions to conservation efforts has demonstrated (Christie, 2007). Opportunities for observation of public perceptions of, and subsequent responses to, tidal developments are limited due to the small number of active sites, but conducting such research as part of future initiatives would be of considerable value in building the knowledge base. In addition, while the case study sites were distinct areas within their region, they were all from one part of southwest England. A priority for future research is therefore to determine whether they key findings of this study are applicable to communities with significantly different social, cultural or demographic characteristics.

## 5. Conclusions

It is a very appealing idea that the likely response of different types of communities to marine energy infrastructure developments can be mapped and used to support planning in much the same way as sensitive habitats can be identified and avoided. However, the criteria used to produce such maps relies on data recorded regularly in national statistics, which tends to be demographic variables such as age, income, education, and employment status. With the exception of age, these have little influence on likely opposition to tidal energy developments, which instead was affected more by levels

of concern about environmental impacts and attitudes towards tidal energy in general. Therefore, any predictions made as a result of community mapping will not be a substitute for thorough public engagement and consultation.

The findings of this research also call into question the received wisdom that what matters most to members of the public is the cost of energy and the social and economic benefits that renewable energy developments could bring. Instead, local people are most concerned about the environmental consequences, which should therefore be central to the consultation process.

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