Title
Reconsidering barriers to wind power projects: community engagement, developer transparency and place

Journal
Journal of Environmental Policy and Planning, 20(3)

ISSN
1523-908X

Authors
Firestone, J
Hoen, B
Rand, J
et al.

Publication Date
2018-05-04

DOI
10.1080/1523908X.2017.1418656

Peer reviewed

Electricity Markets and Policy Group
Energy Analysis and Environmental Impacts Division
Lawrence Berkeley National Laboratory

Reconsidering barriers to wind power projects: Community engagement, developer transparency and place

Jeremy Firestone[a], Ben Hoen[b], Joseph Rand[b], Debi Elliott[c], Gundula Hübner[d,e], Johannes Pohl[d,e]

[a] College of Earth, Ocean, and Environment, University of Delaware, Newark, DE, USA
[b] Lawrence Berkeley National Laboratory, Berkeley, CA, USA
[c] Regional Research Institute for Human Services (RRI), Portland State University, Portland, OR, USA
[d] Institute of Psychology, Martin-Luther-University Halle-Wittenberg, Halle (Saale), Germany
[e] Department of Psychology, MSH Medical School Hamburg, University of Applied Science and Medical University, Hamburg, Germany

December 2017

Published in *Journal of Environmental Policy & Planning*
DOI: https://doi.org/10.1080/1523908X.2017.1418656

This work was supported by the Wind Energy Technologies Office of the DOE's Office of Energy Efficiency and Renewable Energy under Lawrence Berkeley National Laboratory Contract No. DE-AC02-05CH11231.

JOURNAL OF ENVIRONMENTAL POLICY & PLANNING, 2018
VOL. 20, NO. 3, 370–386
https://doi.org/10.1080/1523908X.2017.1418656

Routledge
Taylor & Francis Group

Reconsidering barriers to wind power projects: community engagement, developer transparency and place

Jeremy Firestone[a], Ben Hoen[b], Joseph Rand[c], Debi Elliott[d], Gundula Hübner[e,f] and Johannes Pohl[e]

[a]College of Earth, Ocean, and Environment, University of Delaware, Newark, DE, USA; [b]Lawrence Berkeley National Laboratory, Milan, NY, USA; [c]Lawrence Berkeley National Laboratory, Arcata, CA, USA; [d]Survey Research Lab, Portland State University, Portland, OR, USA; [e]Institute of Psychology, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), Germany; [f]Department of Psychology, MSH Medical School Hamburg, University of Applied Science and Medical University, Hamburg, Germany

ABSTRACT
In 2016, we undertook a nationally representative wind power perceptions survey of individuals living within 8 km of over 600 projects in the United States, generating 1705 telephone, web, and mail responses. We sought information on a variety of topics, including procedural fairness and its relationship to project attitude, the foci of the present analysis. We present a series of descriptive statistics and regression results, emphasizing those residents who were aware of their local project prior to construction. Sample weighting is employed to account for stratification and non-response. We find that a developer being open and transparent, a community being able to influence the outcome, and having a say in the planning process are all statistically significant predictors of a process perceived as being 'fair,' with an open and transparent developer having the largest effect. We also find developer transparency and ability to influence outcomes to have statistically significant relationships to a more positive attitude, with those findings holding when aesthetics, landscape, and wind turbine sound considerations are controlled for. The results indicate that jurisdictions might consider developing procedures, which ensure citizens are consulted and heard, and benchmarks or best practices for developer interaction with communities and citizens.

ARTICLE HISTORY
Received 4 August 2017
Accepted 11 December 2017

KEYWORDS
Wind power; fair process; public attitudes; transparency; public perceptions

Introduction

Nations have typically promoted wind power because of its economic development, energy independence, and environmental benefits. Although economic benefits also flow from wind power projects to localities in which they are situated, negative effects to landscape, place, and wildlife are felt more deeply at the local level (Khan, 2003). Consequently, researchers have found that public opinion regarding some local wind projects is fundamentally different from that of wind power in general (Wolsink, 2007a), the so-called individual gap (Bell, Gray, & Haggett, 2005).

Yet, researchers have not always been careful with language in studies of renewable energy technologies (RETs). Batel, Devine-Wright, and Tangeland (2013) draw attention to use of community and social 'acceptance' of RETs in discourse (Wüstenhagen, Wolsink, & Bürer, 2007; Upham, Oltra, & Boso, 2015). While the literature often refers to 'acceptance,' RET perception studies have more typically inquired into 'support' and 'opposition' (e.g. Firestone & Kempton, 2007) or attitudes (positive/negative). Both have merit, with support/opposition being closer to a 'vote' than attitude, and presumably, more appropriate to measure opinion of hypothetical projects or prior to project approval or construction or slightly thereafter with attitude measuring experience.

CONTACT Jeremy Firestone jf@udel.edu College of Earth, Ocean, and Environment, University of Delaware, 221 Academy Street, 373 Harker ISE Lab, Newark, 19716 DE, USA

The decision to eschew inquiry into 'acceptance' is understandable given that survey respondents or interviewees might find it awkward to answer a question about whether or not they 'accept' a project. As well, 'acceptance' includes notions of tolerance and resignation – that is, feelings that a project is 'barely satisfactory or adequate' while 'support' has a more affirmative quality of 'upholding or defending as valid or right' or voting for (Merriam-Webster 2017). 'Attitudes,' which are 'feelings or emotions toward a fact or state,' (Merriam-Webster 2017) are broad enough to encompass 'acceptance' and 'support.'

Batel et al. (2013, p. 2) contend that 'acceptance' implies non-agency, with communities receiving RETs without 'contestation.' However, individuals may come to terms with a local RET – that is, 'accept it,' because they consider the process by which it was approved to be legitimate. Alternatively, they may accept an RET given concerns regarding climate change or health of citizens that live near conventional power plants or as a result of accommodations to its existence given the passage of time even though their 'attitude' remains negative, neutral, or apathetic, or they remain 'opposed' to the earlier decision to approve.

Whether the decision to build a local wind project is considered 'fair' by local community members is influenced by both the outcome (distributive justice) – the wind project itself and how its effects are distributed – and the process (procedural justice) – the extent and depth of public participation and decision-making processes – that is, its legitimacy (Gross, 2007). Attitudes toward a local wind project are typically shaped not only by distributive effects, but also by fairness of the decision-making processes leading to approval (Aitken, 2010; Firestone, Kempton, Lilley, & Samoteskul, 2012a; Ricci, Bellaby, & Flynn, 2010; Walker, Devine-Wright, Hunter, High, & Evans, 2010; Wolsink, 2007a). Public participation can take a variety of forms (Rowe & Frewer, 2000). The International Association of Public Participation (IAP^2, 2014) provides a way of thinking about public participation, with processes running from those that seek to 'inform,' to obtain feedback ('consult'), to reflect community concerns and aspirations ('involve'), to engage citizens as partners ('collaborate'), to those that seek to give the public the final decision ('empower').

Local citizens who perceive a decision-making process as fair may more be likely to 'accept' the substantive outcome even if it does not fully satisfy their concerns (Aitken, 2010; Frey, Benz, & Stutzer, 2004; Gallagher, Ferreira, & Convery, 2008; Skitka, Winquist, & Hutchinson, 2003). Turning the inquiry around, if community members do not have a voice in the decision-making process, those who were leaning toward support could become opponents (Wolsink, 2007b), or at the very least, more likely annoyed by an operating RET (Pohl, Hübner, & Mohs, 2012).

The question becomes what makes a process fair or legitimate? Dietz and Stern (2008) provide a comprehensive assessment of public participation in *environmental* decision-making; much less is known about the relationship between fair procedures and attitudes toward RET outcomes. Firestone et al. (2012a) argue that perception of fairness is dependent not only on the procedures enshrined in law, but also on a developer's ability to cultivate an open and transparent relationship with the community, while Frey et al. (2004, p. 381) suggest that procedural fairness requires giving 'voice' to individuals. In short, to be considered fair, community engagement has to be more than 'dog and pony shows' (Walker, Baxter, & Ouellette, 2014, p. 737) or a *fait accompli* (Haggett, 2008, p. 300), with developers tightly controlling information flow (Aitken, Haggett, & Rudolph, 2016). Rather, it is important for developers to walk on the right side of the line between their commercial sensitivities and open communication (Howard, 2015). At the end, it becomes a question of the extent to which the public is allocated decision-making authority (Bidwell, 2016).

There is a wealth of literature on public perceptions of wind energy projects (e.g. Ellis & Ferraro, 2016; Rand & Hoen, 2017; Wiersma & Devine-Wright, 2014). Existing approaches, while providing invaluable insights, are nevertheless incomplete. First, many analyses use case studies, whose basis for selection can lead to bias. Cases have been selected at least in part because they were subject to public controversy (e.g. Firestone & Kempton, 2007; Groth and Vogt, 2014; Jami & Walsh, 2016), highlight best practices (Aitken et al., 2016), for their geographies or place-based attributes (e.g. Phadke, 2011), and/or out of convenience to the researcher (e.g. Howard, 2015). Are these cases typical or extraordinary? For example, while Devine-Wright (2009) makes the cogent argument that many individuals opposed to wind projects are undertaking place-protective actions rather than engaging in NIMBY behavior, does place attachment resonate at wind projects in general or only those subject to controversy, those which have been abandoned or denied approval or which have unique place-based geographies? Second, many analyses are undertaken without regard to survey sample weighting to account for non-response and stratification while others do not base insights on supplemental regression analysis leading to potentially misleading conclusions. Likewise, how generalizable are important insights regarding the relationship among landscapes (e.g. permanence), culture, and attitudes toward wind projects? (Pasqualetti, 2011; Wolsink, 2007b). Third, studies have not been careful to account for Tiebout (1956) sorting and other factors, although it is likely important to distinguish between residents who moved-in prior to construction from those who moved in after and between residents who were aware of a project prior to the commencement of construction from those who were unaware.

Finally, it should be noted that in the United States – our locus of inquiry – wind siting and planning processes fit within a backdrop of federal, state, and/or local regulations and procedures. The federal government may play a role in wind power project siting for a number of reasons, most of which, however, are not common for terrestrial installations. They include: if the project was sited on federal lands[1]; if the project required a federal permit, such as for alteration of a wetland; or if the federal government developed the project itself or provided a federal grant. Thus, most wind power siting decisions in the United States have been made under a combination of only state law and local planning and zoning regulations (NCSL, 2016; Stanton, 2012). The details of these laws and regulations are too many and too varied to categorize here, but in many cases they include some requirement for community input into the process, including environmental assessment, notice, public comment, and public hearings (Stanton, 2012), although some states have limited public participation mandates (Geißler, Köppel, & Gunther, 2013).

In 2016, we undertook a nationally representative survey of individuals living near wind projects in the United States, addressing each of the aforementioned considerations. We sought information on a variety of topics, including procedural fairness and its relationship to project attitude – the foci of the present analysis. We were motivated by:

- When during the development cycle do projects become known to communities?
- How do individuals participate in planning processes?
- What role does the relationship of a wind project (e.g. distance to, size of) to a local citizen, general wind power attitudes, and demographic factors play in fair process perceptions?
- How are developer transparency and opportunities to participate related to perceptions of fairness and attitudes toward a wind power project?

Methods

We first determined the relevant community to sample. To the extent all citizens of a jurisdiction are asked to finance an RET at above market rates (e.g. Maryland's Offshore Energy Act), understanding the opinions of that larger public makes sense. However, in many cases, for the reasons mentioned, attention is focused at the local level. Researchers have used distance as a proxy for view-shed (Graham, Stephenson, & Smith, 2009), audible range (Walker et al., 2014), and without regard to view/sound (e.g. Jacquet, 2015; Swofford & Slattery, 2010) or taken a 'sitings' approach based on social links and local jurisdictional decision-making (e.g. Firestone, Bates, & Knapp, 2015; Nadaï, 2007). Batel and Devine-Wright (2015) suggest that even a sitings approach may be too narrow as an RET may affect multiple communities, each with its distinctive characteristics shaping people–place interactions. Given a central focus here – the effect of emissions (e.g. sound) on annoyance and wind turbine view on attitude is facilitated by emphasizing near-turbine residents and sampling across some 600 projects renders a sitings or placed-based approach impractical, distance (within 8 km) is used to demarcate 'local.'

The sample frame comprises 2015 US single-family residences, condos, duplexes, and apartments with complete addresses obtained from CoreLogic within 8 km of a 'utility-scale' wind turbine – defined by us as greater than 111 m to a blade tip at its apex and a nameplate capacity of 1.5 MW or greater installed through 2014 (LBNL, 2015). There were 29,848 wind turbines at 604 projects, with a cumulative installed capacity of 50 gigawatts (GW), and 1.29 million homes meeting these criteria, making this survey of attitudes the largest in terms of the number of projects anywhere in the world of which we are aware.

Given possible related acoustic modeling at a few locations, we oversampled households in the vicinity of 15 projects, which were selected to capture a diversity of turbine manufacturers, geographies, project sizes, background sound levels, population densities, and topographies. As for the remaining projects, we found that four small projects dominated the sample of homes in one of the four distance strata (discussed below). To ensure the sample included a sufficient dispersion of homes across the country, we under-sampled those four projects. The sample also was stratified by project size (greater or less than or equal to 10 turbines) and, as noted, distance a home was from a wind turbine (0–0.8 km, 0.8–1.6 km, 1.6–4.8 km, and 4.8-8 km) to facilitate the oversampling of homes located nearby wind turbines and the analysis of the effects of sound and shadow-flicker.[2]

Based on our prior research (e.g. Firestone et al., 2012a; Pohl et al., 2012) and a review of the literature (Rand & Hoen, 2017), we crafted a series of research questions (including those noted above). The research questions animated survey questions, with the survey going through more than 20 iterations. After receiving human subjects review and approval by Institutional Review Boards at Portland State University (PSU) and University of Delaware, PSU's Survey Research Lab conducted telephone surveys, followed by Internet (using Qualtrics software). The survey was piloted by telephone in December 2015 to ensure it was understandable and of appropriate length, after which it was modified and shortened, with the final survey administration occurring March to July 2016. The survey sought information regarding respondents' participation in and perceived fairness of the public process, relationship to the local wind project (e.g. turbines on property, compensation, see it, hear it), attitude regarding the project and perceptions of and reactions to it (appearance, landscape effect, annoyance by sound, shadow-flicker, lighting) as well as general attitudes toward sources of electricity and climate change, background information (e.g. length of residence, place attachment, noise sensitivity, acute and chronic stress), and demographics.

We drew an initial random, stratified probability sample of 43,041 homes. We then verified the location of each using two data geocoding services (Google and Melissa), keeping only those residences with close locational agreement (within 0.4 km), resulting in 26,848 residences. We matched phone numbers to these homes using MSG Data resulting in 15,455 homes. We drew a series (six in total) of random samples in each stratum, with the objective of loading only as much of the sample as was necessary to reach our phone survey goal of 900 responses, resulting in a total of 7845 loaded records.

We sampled an additional 6000 homes by mail/Internet. This sample comprises 750 phone non-responding homes and 5250 from records that did not have a phone number, were associated with a non-working phone number or that were earlier screened out because they could not be geocoded with Google, although ultimately they were geocoded using Melissa alone. The mail/Internet survey generally followed (Dillman, Smyth, & Christian, 2014), with an introductory letter, which included a web address and unique web PIN, a second mailing with a paper survey, and a reminder postcard.

The three surveys (phone/Internet/mail) were identical other than changes necessitated by mode differences. Individuals who completed the survey had their name entered into a random drawing for four $500 gift cards. We received a total of 875 phone responses out of 3114 resolved (not to be called back because e.g. they completed the survey or asked to never be called back or refused to take part) and 6332 eligible (resolved plus, e.g. reached voice mail or was asked to call back) phone numbers, for a resolved response rate of 28.1% and an eligible response rate of 13.8%. We also received 483 web and 347 mail responses out of a total of 4637 eligible addresses (accounting for undeliverable mail, etc.), an effective response rate of 17.9%, for a grand total of 1705[3] responses.

We prepared sample weights given over- and under-sampling and differential response rates by stratum, gender, age, and education using American Community Survey (2014) census tract level household and demographic data. Because the sampling frame (homes within 8 km of a wind turbine) did not align with census tract boundaries, we estimated the percentage of homes in a given census included within our sampling frame. Weighting followed the method known as 'iterative raking' or 'sample balancing' (Battaglia, Izrael, Hoaglin, & Frankel, 2009; Deming, 1943).

To address concerns regarding Tiebout sorting and more specifically that those who moved in after wind project construction may have different attitudes toward the project and are unlikely to have had a realistic opportunity to participate in the public participation processes, the results reported here are confined to those individuals who moved into their homes prior to construction, with particular attention paid to those who were aware of their local project prior to construction given the focus on procedural fairness. Descriptive statistics reported are weighted while regression analysis is un-weighted (Solon, Haider, & Wooldridge, 2015) with dummy variables controlling for oversampling and differential rates of response.

We compared phone respondents to the subset of online and mail respondents who were phone non-responders to examine non-response bias and to the online and mail respondents more generally. When we include dummy variables for these factors in the regression where the dependent variable is fairness we find that those who responded by phone were less likely to indicate that the process was fair and those who were 'late' responders (responded by web or mail after having an opportunity to respond by phone), were less likely still, which is suggestive of a mode effect and that there may be some non-response bias. However, these same effects were not observed when we included fairness measures in the regression where the dependent variable is present attitude toward the project. Consequently, we chose to analyze the data without regard to any potential effect on fairness – that is, we did not include those dummy variables in the final regressions that we report. All statistics were analyzed using Stata 14.

We present a series of descriptive statistics on fairness and attitude, summary statistics related to the multivariate analysis, and then the regression results. Regression analysis employed two dependent variables. First, 'overall fairness' (0–8), which is a composite variable that combines the answer to the questions: 'To what extent do you believe the planning process was fair?' and 'To what extent did you feel annoyed by the planning and construction process?' Each question had a five-level rating, 'not at all' to 'very' ('don't know' was treated as missing).[4] The second dependent variable – attitude – a five-level rating variable, 'very negative' to 'very positive' (with 'don't know' treated as missing) was the answer to the question: 'What is your attitude toward the local project *now*?' We inquired into attitude rather than project support/opposition given that the mean installation year was 2010.

We ran models using only observations that had no missing values for any variable in the regression, followed by models where missing entries were imputed based on the observed data given concerns that missing data may not be random (e.g. if males are more likely to skip questions). To do so, we used Stata's multiple imputation functionality, pooling 10 imputed datasets in each regression. The models generated consistent intuitions. Non-imputed models were run as both ordered logit and linear regression and performed similarly; to simplify, we present only linear regression results.

Results

Table 1 provides information on the answer to the question: "When did the wind project become known to you?" Some 70% of those who moved into their home before construction were aware of the project, with an additional 20% becoming aware before project operation, 7.5% after the project began operating and 2.2% were unsure.

We then asked respondents who were aware pre-construction whether they agreed or disagreed with four propositions: whether they had a say in the local planning process, the community had a say, the developer

Table 1. Project awareness among respondents who moved into their home prior to construction.

Aware of project ($n = 1246$)	Percent
Before first public announcement	21.8
At time of first public announcement	34.7
After first public announcement	13.5
When construction began	20.3
After operation commenced	7.5
Don't know	2.2

was open and transparent, and the community was able to influence the outcome. For the latter, we stated 'For example, the location or number of turbines.' Almost a quarter (23.4%) agreed or strongly agreed that the community had been able to influence the outcome (which might be akin to 'consult' under the IAP^2), with a still larger percent (34.5%) indicating the community had a say in the planning process (Table 2). Only 13.3% thought they as individuals had a say, suggesting strength in numbers. If we analyze these three metrics together, more than one in seven (14.9%) indicates that they had little say in the planning process and influence over the outcome (disgree or strongly disgree). That figure rises to more than half (57.4%) if 'neither agree nor disagree' or 'don't know' is included. Thus, in the best light, a substantial minority view public participation processes as falling near the bottom IAP^2 rung – 'inform.' More encouragingly, almost half (47.7%) agreed with the characterization that the local developer was being open and transparent compared to less than 17.8% who disagreed.

We next asked respondents: 'To what extent do you believe the planning process was fair?' and whether they felt 'annoyed by the planning and construction process.' Just over 25% did not know, while approximately 41% thought the planning process was moderately or very fair compared to 21.6% who thought it either not at all fair or only slightly fair and another 12.5% somewhat fair (Table 3). Much smaller percentages found the process to be annoying to any degree. The fact that only a quarter of individuals who were aware of the project pre-construction did not have an opinion on fairness of the process suggests communities were relatively engaged.

We presented findings on whether citizens influenced the process above; we now consider the reverse effect: whether the planning process affected respondents' opinion of their local project. Approximately 2/3 are either the same or 'don't know,' while 20% are much or somewhat more positive compared to 13% much or somewhat more negative, with more individuals 'much more negative' (7.6%) than 'much more positive' (4.3%).

We also asked respondents about their attitude toward the project prior to construction and their present attitude. First, comparing pre-construction to present attitudes among those individuals who were aware pre-construction, individuals have moved from having neutral attitudes to having either a positive or negative attitude toward their local project. Although this result has to be interpreted with caution as the prior attitude was assessed post hoc, this change could be the result of the distribution of costs and benefits of the outcome (e.g. whether sound can be heard in the home from the project and individual compensation) or more general attitude changes regarding wind power. In the last column of Table 4, we include present attitudinal data of the residents who moved into their home prior to construction but who were unaware of the project before construction commenced. They are less polarized than the 'aware' residents, suggesting that perceptions of the process may have had an effect on present attitudes; alternatively, unaware residents may be different from aware residents, being less engaged and less affected one way or the other by a project. Finally, we find that the present attitude (mean) of residents who moved in since construction commenced (3.90) is significantly greater ($p = .046$) than that of residents who moved in prior (3.55).

We also inquired into whether or not those who were aware of the project pre-construction took *any* of the following actions during the planning process: meeting attendance, spoke at a meeting, contributed to a webpage, put up a sign, or wrote a letter to the editor (Table 5). Slightly more than one-fifth took some action, including 17.2% who attended a meeting, with smaller percentages taking the other actions. Of those individuals who undertook some action, 84.5% took action in only one category, 11% taking action in two categories, and 4.3% in three.

Of those who took action, almost 72% characterized their actions as either solely supportive or opposing, with 16.8% neither in support nor in opposition and 5.7% in both support and opposition, and 5.8% did

Table 2. Factors informing planning process fairness for respondents aware of project prior to construction.

n	Individual say 904	Community say 908	Developer open/transparent 907	Community influence outcome 907
Strongly disagree	32.5%	11.8%	7.3%	17.5%
Disagree	35.1%	16.2%	10.5%	17.9%
Neither agree nor disagree or don't know	19.1%	37.5%	34.6%	41.2%
Agree	9.4%	28.3%	42.0%	18.5%
Strongly agree	3.9%	6.2%	5.7%	4.9%

Table 3. Planning process fairness.

n	Process fair 915	Process annoying 917
Don't know	25.2%	4.5%
Not at all	11.3%	60.5%
Slightly	10.3%	7.1%
Somewhat	12.5%	8.3%
Moderately	26.0%	7.1%
Very	14.6%	7.0%

Table 4. Pre-construction and present attitude.

	Attitude prior to construction	Attitude at present	
	Aware residents	Aware residents	Other pre-construction residents
n	921	924	366
Don't know	5.1%	2.7%	5.6%
Very negative	1.9%	7.2%	4.6%
Negative	5.7%	4.8%	5.7%
Neutral	41.0%	27.8%	43.2%
Positive	30.4%	39.8%	20.0%
Very positive	15.9%	17.8%	20.8%
Mean (SE)[a]	**3.56 (.08)**	**3.58 (.10)**	**3.50 (.13)**

[a]Excludes Don't know.

not know. Table 6 presents respondents' supportive and opposing actions relevant to one another and to support and opposition. Many more actions were supportive (63%) as opposing (37%), primarily on the strength of meeting attendance. Given that almost six times as many individuals report having positive or very positive attitudes compared to negative or very negative, a given opponent was slightly more than three times as likely to attend a meeting as a given supporter. Moreover, despite being outnumbered at meetings, opponents were more likely to speak (compare relative percentages, 6.3–5.4%), while supporters as a group were more active on the web. Given that the sampling frame is households near built projects, these percentages may well be different from those that were not built.

Multivariate statistical analysis

In order to shed additional light on process fairness perceptions and relationship to attitude, we undertook multivariate statistical analysis. The definitions and descriptions of variables and their weighted means or proportions, as appropriate, are in Table 7. Fairness and attitude base models are similar with the exception that the attitude model includes overall fairness as an independent rather than a dependent variable.

The second group of independent variables includes measures of the effect of a respondent's relationship to a wind project such as the year the nearest turbine was installed, its height and distance to respondent's residence,

Table 5. Actions taken by respondents who were aware of the project pre-construction.

Action (highest to lowest)	Aware pre-construction ($n = 909$)
Took none of specified actions	78.7%
Took one or more specified actions	21.3%
Attended meeting	17.2%
Spoke at meeting	3.5%
Contributed to webpage	2.4%
Put up sign	1.6%
Letter to editor	0.8%
Don't know	0.1%

Table 6. Supportive and opposing actions relative to one another and to support and opposition.

Action type	Supportive	Opposing
Attended meeting	42.5%	22.9%
Spoke at meeting	5.4%	6.3%
Contributed to webpage	10.3%	2.5%
Put up sign	2.8%	3.0%
Letter to editor	2.0%	2.1%
Total	**63.0%**	**37.0%**

whether it is located on respondent's property, whether turbine(s) are visible from home or property, and the number of turbines and installed capacity of the local project.[5] The second group also includes stratification variables, some of which (e.g. distance) already have been mentioned, to control for sampling. The third group, demographic variables – age, education level, gender, ln(income), race (white or not), and variables related to respondent's home (own/rent, primary/secondary residence and year moved in – are included to control for stratum non-response differences and because they may be correlated with dependent variables. Finally, there are variables related to a project's' effect on aesthetics (see from home, appearance and landscape fit[6]), place attachment, and sound and related annoyance.

Looking at the weighted means, 1.2% have a wind turbine on their property; 5% receive compensation; just over half can see a wind turbine from their home or property; and on average individuals moved into their home in 1992, with 93% owned and 85% primary residences. Mean project capacity is just over 39 MW, on average turbines are 126 m tall and installed in 2010, and 1/3 of the projects have more than 10 turbines.

Table 8 sets forth fairness regressions of those who were aware pre-construction: Models 1 (un-imputed) and 2 (imputed). Not surprisingly, each process metric variable is significantly and positively related to the dependent variable, process fairness. What is interesting is that the coefficient on the developer being open and transparent is 2–3 times greater than that on the community being able to influence the outcome, 4–5 times greater than the coefficients on I and community had a say in the planning process, and greater than the sum of the three public participation coefficients. The effect is more dramatic when comparing the effect of size (variance explained), with partial ω^2 (.20, .03, .01, and .01, respectively). This suggests that perceptions of fairness are more driven by how developers approach communities than extent of participation provided.

Having a wind turbine on one's property is positively and significantly (or borderline significant, model dependent) related to process fairness, while when controlling for that fact, compensation is not statistically significant. Participating landowners may perceive the process as 'more fair' because they had more opportunities to participate and negotiate than others – so-called private participation (Jacquet, 2015). Individuals who live close to a wind turbine (<0.8 km) have a less favorable view of the process than others, which is consistent with the notion that they may have greater concerns while larger project size has either no or negative effect (model dependent) on fairness perceptions.

Demographic variables are for the most part insignificant, although home ownership is negatively related to a perception of fairness. Lastly, having a generally positive attitude toward wind power is significantly related to a perception of fairness.

Lastly, we use the fair process to predict attitude. Table 9 presents four attitude regressions for individuals who were aware of the project prior to construction: Models 3 (un-imputed) and 4 (imputed) each include a core set of independent variables, while Models 5 (un-imputed) and 6 (imputed) are expanded with visual and sound effect independent variables.[7] First, in addition to overall process fairness being significantly related to having a positive attitude toward one's local project, so is having a developer who is open and transparent and the community being able to influence the outcome, while merely having a say in the process is not.[8] This suggests that a more robust planning process, closer to IAP^2's 'consult,' can lead to positive attitudes toward project outcomes. Moreover, comparing more constrained regressions (3–4) to those taking account view, aesthetics, landscape fit, and sound (5–6), the coefficients on developer openness and being able to influence the outcome are robust (although the coefficient on overall process fairness decreases substantially), providing additional support for their importance in project attitude formation. As well, the sum of the significant process

Table 7. Variable descriptions, definitions, means/proportions if aware of project.

Variable	Variable Description/Definition	Weighted mean/proportion[a] (SE)
Dependent Variables		
Overall process fairness	9 category composite of 'planning process fairness' (not at all to very) (0–4) and 'process annoyance' (very to not at all) (0–4) variables (0–8)	5.49 (.28)
Present attitude toward project	5 category (very negative to very positive); don't know treated as missing (1–5)	3.58 (.10)
Independent Variables		
Process metrics		
Community had say in planning process	5 category (strongly disagree to strongly agree); with middle category comprised of 'neither agree nor disagree' and 'don't know' (1–5)	3.01 (.12)
I had say in planning process	(Same as above)	2.17 (.11)
Developer open and transparent	(Same as above)	3.28 (.10)
Community able to influence outcome	(Same as above)	2.75 (.12)
Relationship to wind project/ stratification variable		
Wind turbine on property	'1' if on respondent's property; '0' otherwise	0.012 (.01)
Family received compensation	'1' if family received compensation; '0' otherwise	0.051 (.01)
Year nearest turbine installed	Year installed (1997 treated as year 1)	2010 (.25 years)
Nearest turbine total height	Height to tip of a blade at its apex (meters)	126 (1.0)
Installed capacity of nearby project	Project megawatts (MW)	39.1 (3.0)
See turbine(s) from home/property	'1' if yes; '0' no	0.51 (.049)
[b]Nearby project >10 turbines	Large: greater than 10 turbines	0.34 (.029)
[b]Case study project	'1' if case study project; '0' if 'national' sample	0.12 (.012)
[b]Dominant project	'1' if under-sampled given nearby population; '0' otherwise	0.19 (.036)
[b]Live less than or equal to 0.8 km from nearest turbine	'1' if in specified distance range to nearest turbine; '0' otherwise (omitted category)	[a]0.018 (.001)
[b]Live 0.8–1.6 km from nearest turbine	'1' if in specified distance range to nearest turbine; '0' otherwise	[a]0.048 (.004)
[b]Live 1.6–4.8 km from nearest turbine	'1' if in specified distance range to nearest turbine; '0' otherwise	[a]0.33 (.037)
[b]Live 4.8–8 km from nearest turbine	'1' if in specified distance range to nearest turbine; '0' otherwise	[a]0.60 (.035)
Demographics		
Age	Age in years	55.6 (1.5)
Age squared	Square of age	
Education level	Elementary/middle school; some high school; HS graduate or GED; some college; associate degree; bachelors; graduate/professional degree (1–7)	Some college
Female	'1' if female; '0' male	0.55 (.06)
ln(income)	Natural log of median income of survey-selected census categories (7 categories: <$25,000 to >$250,000)	[c]$67,847 ($4060)
Children	'1' if a child/children living in household; 0' otherwise	0.27 (.05)
White	'1' if race is white; '0' otherwise	0.88 (.04)
Homeowner	'1' if own home; '0' otherwise	0.93 (.03)
Year moved in home	Year in home (1921 treated as year 1)	1992 (1.9 years)
Secondary residence	'1' if home a secondary residence; '0' otherwise (omitted category)	[a]0.063 (.02)
Primary residence	'1' if home primary residence; '0' otherwise	[a]0.85 (.03)
Residence status unknown	'1' if unknown; '0' otherwise	[a]0.086 (.03)
Landscape, sound, place/attitude		
General attitude toward wind power	Prohibited; not sure; in appropriate circumstances; encouraged and promoted (1-4)	3.40 (.07)
Place attachment/identity	9 category composite of 'Identity' and 'Regret' (2–10)	7.99 (.17)
Community is part of 'identity'	Strongly disagree to strongly agree (1–5)	3.99 (.10)
Would 'regret' having to move	Strongly disagree to strongly agree (1–5)	4.00 (.11)
Annoyed by wind project sound	Not at all to very (0–4)	0.30 (.11)
Do not like wind project look and does not fit landscape	'1' if don't like look and does not fit, '0' otherwise (omitted category)	[a]0.12 (.03)

(*Continued*)

Table 7. Continued.

Variable	Variable Description/Definition	Weighted mean/proportion[a] (SE)
Do not like wind project look, but fits landscape	'1' if don't like look, but fits; '0' otherwise	[a]0.042 (.026)
Neutral or no opinion on wind project look	'1' if neutral or no opinion on look; '0' otherwise	[a]0.18 (.04)
Like wind project look, but does not fit landscape	'1' if like look but does not fit; '0' otherwise	[a]0.34 (.06)
Like wind project look & fits landscape well	'1' if like look and fits landscape; '0' otherwise	[a]0.32 (.05)
Other		
Imputed		Model dependent

[a]Proportion rather than mean.
[b]Stratification variable.
[c]Income rather than ln(income).

variables' standardized coefficients (.458) is greater than that (.398) for having generally positive wind power attitudes (Model 3).

When view, perceptions of project appearance and landscape fit are controlled for, having a turbine on one's property is no longer statistically significant at 5%, while compensation is. However, when we include an interactive term between compensation and turbine hosting (regression not shown), the linear combination of the three terms is large and significant (coefficient = 0.419, $p < .001$). More recent projects engender less positive attitudes, which could be the result of Tiebout sorting, with those holding more negative attitudes having had more time to move from communities with longer standing wind projects.[9] Demographic variables for the most part appear to have little effect on project attitude, although white respondents have more negative attitudes toward local wind projects than others.

Our measure for place attachment is not significant in the models, although those that have lived in their homes longer have less positive attitudes toward their local project and place attachment is significantly, albeit weakly, correlated with taking opposing action (.166; $p < .01$). Interestingly, if anything, distance and attitude are connected negatively. This distance–attitude perception relationship finds support (e.g. Warren, Lumsden, O'Dowd, & Birnie, 2005), although runs counter to *economic preferences* (e.g. Knapp & Ladenburg, 2015).

Turning to the effect of local wind project appearance and its effect on landscape (Models 6 and 7), the results suggest that project appearance in general (its look) matters more than whether it fits the landscape. For example, in Model 5 when comparing coefficients on having a neutral opinion on appearance (.336) to liking the look (.725), the coefficient increases by .389 ($p = .000$), but by only .155 (=.036), when comparing coefficients on project landscape fit (.725) and lack of fit (.870) among respondents who like their project's look; the change is statistically insignificant ($p = .189$) in a similar fit/no fit comparison among those who do not like the way their project looks.[10]

Discussion

The United States and many countries around the world are presently in the midst of an energy transformation from central plants powered by fossil and nuclear fuels to wind and solar energy and other distributed renewable resources. As wind power projects become more prevalent – they already supply more than 25% of the electricity in the US states of Iowa, South Dakota, Kansas, and Oklahoma (US Department of Energy [USDOE], 2017), and the USDOE (2015) envisions installed capacity increasing from 61 GW in 2013 to 224 GW in 2030 and 404 GW in 2050 – citizens will increasingly cross paths with wind power projects.

Table 8. Linear regression models of process fairness (not at all fair and very annoyed to very fair and not annoyed).

Model	Aware (1)		Aware Imputed (2)	
n	619		926	
Adjusted *R*-Squared	.61		.56	
	Coeff.	*p* value	Coeff.	*p* value
Process metrics				
Community had say in planning process	0.205	.007***	0.182	.021***
I had say in planning process	0.204	.004***	0.145	.026**
Developer open and transparent	0.955	.000***	0.937	.000***
Community able to influence outcome	0.351	.000***	0.370	.000***
Relationship to wind project				
Wind turbine on property	0.642	.024**	0.486	.073*
Family received compensation	0.031	.880	0.199	.322
Year nearest turbine installed	−0.017	.677	−0.022	.577
Nearest turbine total height	−0.001	.568	−0.002	.374
Installed capacity of nearby project	−0.002	.087*	−0.002	.061*
[a]Nearby project >10 turbines	−0.293	.159	−0.336	.087*
[a]Case study project	0.103	.493	0.218	.131
[a]Dominant project	0.022	.951	0.199	.554
[a]Live 0.8–1.6 km from nearest turbine	0.554	.002***	0.536	.002***
[a]Live 1.6–4.8 km from nearest turbine	0.381	.083*	0.364	.075*
[a]Live 4.8–8 km from nearest turbine	0.788	.001***	0.622	.006***
Other				
General attitude toward wind power	0.602	.000***	0.696	.000***
Place attachment/identity	−0.056	.112	−0.067	.053*
Demographics				
Age	0.063	.102	0.031	.371
Age squared	−0.0004	.197	−0.0001	.663
Education level	0.052	.303	−0.002	.965
Female	0.152	.266	0.112	.426
Ln(income)	−0.021	.834	−0.024	.812
Children	0.202	.327	0.259	.178
White	−0.341	.238	0.001	.996
Own home	−0.847	.052*	−1.008	.006***
Year moved into home	0.002	.696	0.004	.442
Primary residence	0.514	.063*	0.331	.204
Residence status unknown	0.286	.414	0.225	.490
Constant	−2.71	.150	−1.43	.422

[a]Stratification variable.
****p* < .01; ***p* < .05; **p* < .10

How wind power developers and jurisdictions that have approval/disapproval authority act in response to this societal change may greatly influence the trajectory and path of the transformation.

In this first of its kind national survey of wind power perceptions, we reconsider barriers in two respects. First, while much attention is rightly focused on technological and economic barriers; here, we focus on what may be the largest barrier going forward – local public attitudes. Second, this national survey has allowed us to think anew about how public participation, developer transparency, and aesthetics might influence the energy transformation.

We have carefully distinguished between residents who lived near a project prior to its construction from those who move in after construction has commenced, recognizing the latter may have less of an aversion to wind turbine sound and aesthetics. Given our focus on process, the inquiry is necessarily on those individuals who were aware of a proposed project prior to its construction.

Although wind power project approval does not require local citizens to perceive decision-making processes as fair, the results underscore that it is an important determinant of local attitudes. More specifically, we find that when citizens who are ‘engaged’ to the point of being aware of a potential project feel they have been given more than a mere voice, and are actually heard, they are more likely to have a positive attitude toward a local

Table 9. Linear regression models of present attitude toward local wind project (very negative to very positive).

Model	Aware (3)		Aware Imputed (4)		Aware (land/sound) (5)		Aware Imputed (land/sound) (6)	
n	618		887		596		887	
Adjusted *R*-Squared	.70		.68		.75		.72	
	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value	Coeff.	*p* value
Process metrics								
Overall process fairness	0.251	.000***	0.239	.000***	0.137	.000***	0.141	.000***
Community had say in planning process	−0.00003	.999	0.015	.602	−0.007	.808	0.013	.622
I had say in planning process	0.027	.382	0.041	.122	0.013	.654	0.025	.302
Developer open and transparent	0.121	.001***	0.123	.000***	0.098	.005***	0.112	.000***
Community able to influence outcome	0.087	.009***	0.083	.005***	0.107	.000***	0.081	.003***
Relationship to wind project								
Wind turbine on property	0.338	.006***	0.318	.002***	0.164	.147	0.160	.098*
Family received compensation	0.185	.030**	0.139	.061*	0.213	.007***	0.145	.036**
Year nearest turbine installed	−0.029	.090*	−0.038	.014**	−0.025	.115	−0.038	.007***
Nearest turbine total height	0.0005	.638	−0.0003	.687	0.001	.240	0.0001	.854
Installed capacity of nearby project	0.001	.227	0.001	.142	0.001	.066*	0.001	.046**
See turbine(s) from home/property					−0.331	.002***	−0.250	.005***
[a]Nearby project >10 turbines	−0.140	.118	−0.160	.039**	−0.077	.356	−0.086	.244
[a]Case study project	0.107	.099*	0.099	.091*	0.014	.813	0.033	.525
[a]Dominant project	0.230	.140	0.181	.193	0.191	.190	0.140	.276
[a]Live 0.8–1.6 km from nearest turbine	0.074	.329	0.083	.196	0.005	.941	0.013	.827
[a]Live 1.6–4.8 km from nearest turbine	0.079	.406	0.127	.112	−0.178	.058*	−0.080	.316
[a]Live 4.8–8 km from nearest turbine	0.051	.611	0.007	.935	−0.281	.013**	−0.262	.007***
Landscape, sound, place, attitude								
General attitude toward wind power	0.398	.000***	0.389	.000***	0.267	.000***	0.266	.000***
Place attachment/identity	0.010	.519	0.010	.425	0.001	.971	0.009	.452
Do not like wind project look, but fits landscape					0.176	.189	0.158	.165
Neutral or no opinion on wind project look					0.336	.005***	0.291	.009***
Like wind project look, but does not fit landscape					0.725	.000***	0.655	.000***
Like wind project look & fits landscape					0.870	.000***	0.785	.000***
Annoyed by the sound of the wind project					−0.145	.000***	−0.131	.000***
Demographics								
Age	−0.006	.725	0.006	.665	0.004	.813	0.017	.194
Age squared	0.0001	.466	−0.00002	.891	0.00003	.833	−0.0001	.272
Education level	0.017	.429	0.023	.213	0.017	.394	0.024	.161
Female	0.023	.694	0.031	.554	−0.002	.974	0.006	.893
Ln(income)	−0.049	.266	−0.060	.117	−0.001	.975	−0.035	.346
Children	0.055	.536	0.060	.442	0.054	.515	0.041	.562
White	−0.329	.008***	−0.186	.088*	−0.349	.003***	−0.198	.049**
Own home	0.007	.972	−0.022	.878	−0.025	.886	0.035	.785
Year moved into home	0.007	.002***	0.005	.017**	0.007	.002***	0.005	.014**
Primary residence	−0.087	.464	−0.032	.751	−0.131	.250	−0.054	.567
Residence status unknown	−0.094	.531	0.008	.951	−0.138	.330	−0.038	.754
Constant	0.409	.613	0.775	.263	0.538	.484	0.954	.148

[a]Stratification variable.
***$p < .01$; **$p < .05$; *$p < .10$.

project. Developer adoption of open and transparent approaches is critically important too; we find it to be a more important component of the fair process perception than the extent of participation provided. We also find compensation to influence attitude while holding constant whether or not a wind turbine is on one's property suggesting developers may wish to broaden royalty arrangements beyond owners on whose property turbines are placed. This is particularly so given that the number of individuals who can host a wind turbine is relatively constrained. That said, levels of compensation are very different between those who host and those who do not, necessitating further investigation to disentangle the relative effects of hosting and compensation – an investigation that is beyond the scope of this article.

The results indicate that jurisdictions should consider developing procedures that ensure citizens are consulted and heard and establish benchmarks or best practices for developer interaction with communities and citizens (Devine-Wright, Devine-Wright, & Cowell, 2016). Developers on their own can adopt proactive measures that should be of great effect (Aitken et al., 2016).

The findings on place attachment, turbine view and appearance, and landscape depart somewhat from the literature. We neither find place attachment/identity to be a significant determinant of attitude nor that 'It's the landscape, stupid' (Wolsink, 2007b, p. 2695), although a strong human relationship to a landscape may be indicative of an avoided location or where a project has failed. Among those who *do not like* the look (26%) of their local wind project, 74% indicate it does not fit the landscape. Yet, similar percentages (73%, 78%, and 81%) indicate that the project is unattractive, industrial, and disruptive to the community feel. Interestingly, among those who *like* the look (63%), almost all (96%) indicate that it 'symbolizes progress toward clean energy' compared to just 49% who indicate that it fits well within the local landscape, highlighting the importance of symbolic meanings (Devine-Wright, 2005, 2009; Firestone et al., 2015) and that discussion of identity and wind power perceptions may need to be broadened beyond place to personal identity (Pedersen, Hallberg, & Waye, 2007). The results may depart from those at European wind power projects because of different values and culture (e.g. projects may be viewed as enhancing livelihood) in the Midwestern (farm) and Great Plains of the United States or due to the case study nature of much of the published research. Stronger place attachment parallels have been found between the US and Europe in regard to offshore wind power, as there may be something special about the ocean (Kempton, Firestone, Lilley, Rouleau, & Whitaker, 2005) and in certain settings where 'land and life' are intertwined (Pasqualetti, 2011, p. 914). It also may be that place attachment/identity lead to place-consistent action rather than place-protective opposition (Devine-Wright, 2009). Indeed, in two nearby communities, Bates and Firestone (2015) found place attachment in one led to less support while in the other, offshore wind power was interpreted as consistent with place. Further, van Veelen and Haggett (2016) found that the form of place attachment could vary even within a single locality.

And here, while a strong majority of those who do not like the look of their local wind project find it to be disruptive to community, 43% who like the look indicate that the project is a 'community landmark.' In a broad cross-sectional analysis (and perhaps even on a local basis), different manifestations of place may offset one another. Moreover, the relationship between place and RETs may be guided more by place meaning (Wynveen & Kyle, 2015) than place attachment. Researchers, developers, and policy-makers thus need to remain cognizant that each wind power project will face its own unique challenges driven by place, actors, and the policy regime (Ellis & Ferraro, 2016).

Our findings might be best summed up as: 'It's the public process, the developer, aesthetics and general wind power attitude/clean energy values.' Wind turbines can only be made to be so attractive and un-industrial, and as such, landscape fit will remain a first-order condition. Moreover, given that one's aesthetic judgments and values are likely relatively fixed at least in the near-term while developer transparency and public processes are more malleable, and that the latter may result in changes to the number or location of turbines at a given project, at the end, for most wind project proposals it may be 'the public process and the developer' or simply 'governance.'

We see several promising areas for future research. One gap in our work is that it does not include perceptions of the public 'approval' process and of developers at abandoned or failed projects. In that regard, the present analysis suffers from a selection bias. While admittedly it is more difficult to assemble a representative sample of such projects, broad cross-sectional studies, and comparative case study research as well, of process fairness in those matters should be undertaken. In addition, repeat (Firestone, Kempton, Lilley, & Samoteskul, 2012b) and longitudinal studies of perceptions of approved and built wind power projects would add considerably to the body of knowledge. There, case study research has much to offer. Offshore wind power, in particular, may lend itself to before and after studies (e.g. Hübner & Pohl, 2017) given the much longer planning horizons involved, although the planning processes tend to be much less locally driven given national ownership of the seabed and offshore energy resources.

In addition, more generally, we believe the case study research can build off of large cross-sectional studies such as this one to further illuminate findings. This is particularly so when more qualitative research methods are employed. For example, while we find developer transparency to be important in shaping attitudes, we have not explored what it means to be transparent. Inquiry into this question would likely benefit from case study approaches. At the end, however, we believe that cases will be more valuable if selected randomly or at least more strategically to diminish selection bias.

Notes

1. Siting in federal waters – generally in the ocean between 3 and 200 nautical miles (5.5–370 km) from shore – likewise triggers a substantial federal role
2. We recalculated geodetic distances from each home to the nearest turbine with turbines installed through 2015 (increasing turbines in sample frame to 34,145) and post-stratified the homes into distance bins accordingly.
3. We received 1729 responses. Further investigation revealed 24 were not from a home within 8 km of a wind turbine.
4. When the answer to the first question was substituted as the dependent variable the model performed similarly although with slightly less explanatory power.
5. Although the sampling frame included only homes located within five miles of a 'utility-scale' wind turbine commissioned prior to 2015, local wind turbine and project characteristics (e.g., distance to homes, height, project installed capacity) for each respondent were updated using 2015 wind turbine data.
6. This variable combines perceptions of a project's appearance (like its look, neutral or don't like) with a description that followed (fit the local landscape well).
7. We did not expand fair process models because considerations such as *actual* project appearance and sound annoyance do not arise until the project is operational.
8. We ran a nested model that included predicted fairness and excluded the process metrics; the model performed similarly but with R^2 of only .61.
9. Among residents who have moved into their home prior to project construction, 91%, 89%, and 84% compared to 4%, 4%, and 6% would rather live near the wind power project than a coal, nuclear, or natural gas plant, respectively, and by 52–14% would prefer to live near their local project than a commercial-scale solar project.
10. When a community measure (landmark or disruptive to community) is substituted for landscape fit, the coefficient difference disparity (.428–.069) between look and community effect is even greater.

Acknowledgements

The authors thank Ryan Wiser (Lawrence Berkeley National Laboratory) for his comments on an earlier draft of the manuscript as well as Eric Lantz and Amber Johnson for their roles in survey development and implementation.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Funding

We would also like to thank Valerie Reed, Patrick Gilman, Maggie Yancy and Jocelyn Brown-Saracino of the U.S. Department of Energy (DOE), and Jose Zayas, formerly with the DOE, for their support. This work was funded by the Wind Energy Technologies Office within the Office of Energy Efficiency and Renewable Energy of the DOE, under Contract No. DE-AC02-05CH11231.

Notes on contributors

Jeremy Firestone is a Professor in the College of Earth, Ocean, and Environment and the Director of the Center for Carbon-free Power Integration (CCPI) at the University of Delaware. His research and writing focus primarily on wind power, with emphasis on public perceptions, economic preferences, spatial planning, environmental effects, regulation and governance. He has a PhD in Public Policy Analysis from the University of North Carolina, a Juris Doctorate from the University of Michigan, and a B.S. in Cellular and Molecular Biology from the University of Michigan.

Ben Hoen is a Research Scientist in the Electricity Markets and Policy Group at the Lawrence Berkeley National Laboratory and was the Principal Investigator for this project. He conducts research and analysis on renewable energy, including: renewable energy policy analysis and assistance; cost, benefit and market analysis; and, public acceptance and deployment barriers. He has a Master of Science degree in Environmental Policy from Bard College and Bachelor's degrees in Finance and General Business from the University of Maryland.

Joseph Rand is a research affiliate in the Electricity Markets and Policy Group at Lawrence Berkeley National Lab, where he conducts research and analysis on renewable energy, including: cost and market analysis; spatial data analysis; and research related to public acceptance and deployment barriers of renewable energy. He has an MS in Energy and Resources from the University of California, Berkeley and a BA in Environmental Studies from Macalester College.

Debi Elliott has been Director of the PSU Survey Research Lab since 2002, with expertise in survey sampling, survey development, multiple modes of data collection, and data analysis. She holds a joint appointment with the Regional Research Institute for Human Services in the School of Social Work and has been a human services researcher for 25 years. She is a member of PSU's Human Subjects Research Review Committee, with expertise in research ethics and participant protection. She has a PhD in Clinical Child Psychology from Ohio State University.

Gundula Hübner is a Professor of Social Psychology at the MSH Medical School Hamburg and leads the health and environmental psychology research group at the Institute of Psychology, Martin-Luther-University Halle-Wittenberg. Her research is focused on the social acceptance of renewable energies, biomass, solar and wind energy, and high-voltage transmission lines as well as the stress impact of wind turbine emissions on neighbors. Besides survey research, she uses experimental settings to analyze the impact of persuasive communication and visualizations techniques on the social acceptance of on- and offshore wind energy projects. She collaborates with several institutions including Swiss ETH Zurich, Technical University of Denmark and the University of Nagoya, Japan. She holds a PhD in Social Psychology.

Johannes Pohl has worked since 1985 as a research assistant and lecturer at the Universities of Würzburg, Kiel, Halle (Saale) and MSH Medical School Hamburg. His focus has been on bio- and neuropsychology. For the last ten years, he has participated in research projects on social acceptance of wind energy (small vertical wind turbines, offshore wind energy) and stress effects of wind turbines on residents (shadow flicker, aircraft obstruction markings, noise, distance). He studied psychology at the Heinrich-Heine-University Düsseldorf and received his PhD in 1993 from the Julius-Maximilians-University Würzburg, where he focused on behaviour under conflict conditions.

References

Aitken, M. (2010). Wind power and community benefits: Challenges and opportunities. *Energy Policy*, *38*, 6066–6075.

Aitken, M., Haggett, C., & Rudolph, D. (2016). Practices and rationales of community engagement with wind farms: Awareness raising, consultation, empowerment. *Planning Theory & Practice*, *17*(4), 557–576.

Batel, S., & Devine-Wright, P. (2015). A critical and empirical analysis of the national local 'gap' in public responses to large-scale energy infrastructures. *Journal of Environmental Planning and Management*, *58*(6), 1076–1095.

Batel, S., Devine-Wright, P., & Tangeland, T. (2013). Social acceptance of low carbon energy and associated infrastructures: A critical discussion. *Energy Policy*, *58*, 1–5.

Bates, A., & Firestone, J. (2015). A comparative assessment of proposed offshore wind power demonstration projects in the United States. *Energy Research and Social Science*, *10*, 192–205.

Battaglia, M. P., Izrael, D., Hoaglin, D. C., & Frankel, M. R. (2009). Practical considerations in raking survey data. *Survey Practice*, *2* (5), 1–10.

Bell, D., Gray, T., & Haggett, C. (2005). The 'social gap' in wind farm siting decisions: Explanations and policy responses. *Environmental Politics*, *14*(4), 460–477.

Bidwell, D. (2016). Thinking through participation in renewable energy decisions. *Nature Energy*, *1*(5), 16051.

Deming, W. E. (1943). *Statistical adjustment of data*. New York, NY: Wiley.

Devine-Wright, P. (2005). Beyond NIMBYism: Towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy*, *8*, 125–139.

Devine-Wright, P. (2009). Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *Journal of Community & Applied Social Psychology*, *19*, 426–441.

Devine-Wright, P., Devine-Wright, H., & Cowell, R. (2016). *What do we know about overcoming barriers to infrastructure sitting in local areas?* (Project report). Department of Energy and Climate Change.

Dietz, T., & Stern, P. C. (2008). *Public participation in environmental assessment and decision making*. National Academies Press.

Dillman, D.A., Smyth, J.D., & Christian, L.M. (2014). *Internet, mail and mixed mode surveys: The tailored design method* (3rd ed.). Hoboken, NJ: John Wiley & Sons.

Ellis, G., & Ferraro, G. (2016). *The Social Acceptance of Wind Energy: Where we stand and the path ahead*. EUR 28182 EN, doi:10.2789/696070.

Firestone, J., Bates, A., & Knapp, L. (2015). See me, feel me, touch me, heal me: Wind turbines, culture, landscapes, and sound impressions. *Land Use Policy*, *46*, 241–249.

Firestone, J., & Kempton, W. (2007). Public opinion about large offshore wind power: Underlying factors. *Energy Policy*, *35*, 1584–1598.

Firestone, J., Kempton, W., Lilley, M. B., & Samoteskul, K. (2012a). Public acceptance of offshore wind power: Does perceived fairness of process matter? *Journal of Environmental Planning and Management*, *55*(10), 1387–1402.
Firestone, J., Kempton, W., Lilley, M. B., & Samoteskul, K. (2012b). Public acceptance of offshore wind power across regions and through time. *Journal of Environmental Planning and Management*, *55*(10), 1369–1386.
Frey, B. S., Benz, M., & Stutzer, A. (2004). Introducing procedural utility: Not only what, but also how matters. *Journal of Institutional and Theoretical Economics*, *160*, 377–401.
Gallagher, L., Ferreira, S., & Convery, F. (2008). Host community attitudes towards solid waste landfill infrastructure: Comprehension before compensation. *Journal of Environmental Planning and Management*, *51*(2), 233–257.
Geißler, G., Köppel, J., & Gunther, P. (2013). Wind energy and environmental assessments – A hard look at two forerunners' approaches: Germany and the United States. *Renewable Energy*, *51*, 71–78.
Graham, J. B., Stephenson, J. R., & Smith, I. J. (2009). Public perceptions of wind energy developments: Case studies from New Zealand. *Energy Policy*, *37*(9), 3348–3357.
Gross, C. (2007). Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. *Energy Policy*, *35*(5), 2727–2736.
Groth, T. M., & Vogt, C. (2014). Residents' perceptions of wind turbines: An analysis of two townships in Michigan. *Energy Policy*, *65*, 251–260.
Haggett, C. (2008). Over the sea and far away? A consideration of the planning, politics and public perception of offshore wind farms. *Journal of Environmental Policy & Planning*, *10*(3), 289–306.
Howard, T. (2015). Olivebranches and idiot's guides: Frameworks for community engagement in Australian wind farm development. *Energy Policy*, *78*, 137–147.
Hübner, G., & Pohl, J. (2017). Out of sight, out of mind? Existing offshore wind farms are more accepted than planned ones. In M. Durstewitz & B. Lange (Eds.), *Sea – wind – power: Research at the first German offshore wind farm Alpha Ventus* (pp. 217–226). Berlin: Springer.
International Association of Public Participation (IAP^2). (2014). *Public participation spectrum*.
Jacquet, J. B. (2015). The rise of "private participation" in the planning of energy projects in the rural United States. *Society and Natural Resources*, *28*(3), 231–245.
Jami, A. A., & Walsh, P. R. (2016). Wind power deployment: The role of public participation in decision-making process in Ontario, Canada. *Sustainability*, *8*(8), 713.
Kempton, W., Firestone, J., Lilley, J., Rouleau, T., & Whitaker, P. (2005). The offshore wind power debate: Views from Cape Cod. *Coastal Management*, *33*(2), 119–149.
Khan, J. (2003). Wind power planning in three Swedish municipalities. *Journal of Environmental Planning and Management*, *46*(4), 563–581.
Knapp, L., & Ladenburg, J. (2015). How spatial relationships influence economic preferences for wind power – A review. *Energies*, *8*, 6177–6201.
LBNL (USDOE). (2015). *Comprehensive dataset of U.S. wind turbines*.
Nadaï, A. (2007). "Planning", "siting" and the local acceptance of wind power: Some lessons from the French case. *Energy Policy*, *35*(5), 2715–2726.
NCSL. (2016). *State legislative approaches to wind energy facility siting*. Retrieved from http://www.ncsl.org/research/energy/state-wind-energy-siting.aspx
Pasqualetti, M. J. (2011). Opposing wind energy landscapes: A search for common cause. *Annals of the Association of the American Geographers*, *101*(4), 907–917.
Pedersen, E., Hallberg, L. R.-M., & Waye, K. P. (2007). Living in the vicinity of wind turbines – A grounded theory study. *Qualitative Research in Psychology*, *4*(1–2), 49–63.
Phadke, R. (2011). Resisting and reconciling big wind: Middle landscape politics in the new American west. *Antipode*, 43(3), 754–776.
Pohl, J., Hübner, G., & Mohs, A. (2012). Acceptance and stress effects of aircraft obstruction markings of wind turbines. *Energy Policy*, *50*, 592–600.
Rand, J., & Hoen, B. (2017). Thirty years of North American wind energy acceptance research: What have we learned? *Energy Research & Social Science*, *29*, 135–148.
Ricci, M., Bellaby, P., & Flynn, R. (2010). Engaging the public on paths to sustainable energy: Who has to trust whom? *Energy Policy*, *38*, 2633–2640.
Rowe, G., & Frewer, L. J. (2000). Public participation methods: A framework for evaluation. *Science, Technology and Human Values*, *25*(1), 3–29.
Skitka, L., Winquist, J., & Hutchinson, S. (2003). Are outcome fairness and outcome favourability distinguishable psychological constructs? A meta-analytic review. *Social Justice Research*, *16*(4), 309–341.
Solon, G., Haider, S. J., & Wooldridge, J. M. (2015). What are we weighting for? *Journal of Human Resources*, *50*(2), 301–316.
Stanton, T. (2012). *Put It There! – Wind Energy & Wind-Park Siting and Zoning Best Practices and Guidance for States*. National Regulatory Research Institute, 12-03 (January 2012). Retrieved from https://pubs.naruc.org/pub.cfm?id=539BA6EE-2354-D714-5157-359DDD67CE7F

Swofford, J., & Slattery, M. (2010). Public attitudes of wind energy in Texas: Local communities in close proximity to wind farms and their effect on decision-making. *Energy Policy*, *38*(5), 2508–2519.

Tiebout, C. (1956). A pure theory of local expenditures. *Journal of Political Economy*, *64*(5), 416–424.

Upham, P., Oltra, C., & Boso, A. (2015). Towards a cross-paradigmatic framework of the social acceptance of energy systems. *Energy Research and Social Science*, *8*, 100–112.

USDOE. (2015). *Wind vision: A new era for wind power in the United States*.

USDOE. (2017). *2016 Wind technologies market report*.

van Veelen, B., & Haggett, C. (2016). Uncommon ground: The role of different place attachments in explaining community renewable energy projects. *Sociologia Ruralis*, doi:10.1111/soru.12128.

Walker, C., Baxter, J., & Ouellette, D. (2014). Beyond rhetoric to understanding determinants of wind turbine support and conflict in two Ontario, Canada communities. *Environment and Planning A*, *46*(3), 730–745.

Walker, G., Devine-Wright, P., Hunter, S., High, H., & Evans, B. (2010). Trust and community: Exploring the meanings, contexts and dynamics of community renewable energy. *Energy Policy*, *38*(6), 2655–2663.

Warren, C. R., Lumsden, C., O'Dowd, S., & Birnie, R. V. (2005). 'Green On green': Public perceptions of wind power in Scotland and Ireland. *Journal of Environmental Planning and Management*, *48*(6), 853–875.

Wiersma, B., & Devine-Wright, P. (2014). Public engagement with offshore renewable energy: A critical review. *Wiley Interdisciplinary Reviews: Climate Change*, *5*, 493–507.

Wolsink, M. (2007a). Wind power implementation: The nature of public attitudes: Equity and fairness instead of 'backyard motives'. *Renewable and Sustainable Energy Reviews*, *11*(6), 1188–1207.

Wolsink, M. (2007b). Planning of renewables schemes: Deliberative and fair decision-making on landscape issues instead of reproachful accusations of non-cooperation. *Energy Policy*, *35*(5), 2692–2704.

Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, *35*, 2683–2691.

Wynveen, C. J., & Kyle, G. T. (2015). A place meaning scale for tropical marine settings. *Environmental Management*, *55*, 128–142.