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Reconsidering Barriers to Wind Power Projects: Community Engagement, Developer Transparency and Place

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Abstract

In 2016, we undertook a nationally representative wind power perceptions survey of individuals living within eight 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 nonresponse. 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

Keywords: wind power, fair process, public attitudes, transparency, public perceptions

1. 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 than 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, and Boso, 2015). While the literature often refers to “acceptance,” RET perceptions 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.

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,” (ibid.) are broad enough to encompass “acceptance” and “support.”

Batel, et al., (2013, 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 a 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 (Firestone, Kempton, Lilley, & Samoteskul, 2012a; Aitken, 2010, Ricci, Bellaby, & Flynn, 2010, Walker, Devine-Wright, Hunter, High, & Evans, 2010, Wolsink, 2007a). Public Participation can take a variety of forms (Rowe and Frewer, 2000). The International Association of Public Participation (IAP²) (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, Winqvist, & 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, 737) or a “*fait accompli*” (Haggett, 2008, 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 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., Rand and Hoen, 2017; Ellis and Ferraro, 2016; Wiersma and 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., Jami and Walsh, 2016; Groth and Vogt, 2014; Firestone and Kempton, 2007), 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 nonresponse 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 lands¹; 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 (Stanton, 2012; NCSL, 2016). 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?

2. Methods

We first determined the relevant community to sample. To the extent all citizens of a jurisdiction are asked to finance a 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, Baxter, & Ouellette, 2014), and without regard to view/sound (e.g., Jacquet, 2015; Swofford and Slattery, 2010) or taken a “sittings” approach based on social links and local jurisdictional decision-making (e.g., Nadai, 2007; Firestone, Bates, &

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.

Knapp, 2015). Batel and Devine-Wright (2014) suggest that even a sitings approach may be too narrow as a 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 eight 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 eight km of a “utility-scale” wind turbine—defined by us as greater than 111 meters 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 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 fifteen 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.ⁱⁱ

Based on our prior research (e.g., Firestone, et al., 2012a, Pohl, et al., 2012) and a review of the literature (Rand and 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.

ⁱⁱ We re-calculated 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.

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 7,845 loaded records.

We sampled an additional 6,000 homes by mail/Internet. This sample comprises of 750 phone non-responding homes and 5,250 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 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 6,332 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 4,637 eligible addresses (accounting for undeliverable mail, etc.), an effective response rate of 17.9%, for a grand total of 1,705ⁱⁱⁱ 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 eight 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.

ⁱⁱⁱ We received 1729 responses. Further investigation revealed 24 were not from a home within eight km of a wind turbine.

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).^{iv} 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.

3. 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.

^{iv} When the answer to the first question was substituted as the dependent variable the model performed similarly although with slightly less explanatory power.

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%

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 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 IAP²), 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 or influence over the outcome (disagree or strongly disagree). 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 IAP² 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.

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

	Individual Say	Community Say	Developer Open/ Transparent	Community Influence Outcome
n	904	908	907	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%

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.

Table 3. Planning process fairness

	Process Fair	Process Annoying
n	915	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%

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 attitudes 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, individual compensation, etc.) 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 than 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).

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)*	3.56(.08)	3.58 (.10)	3.50(.13)

*Excludes "Don't know"

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 two categories and 4.3% in three.

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%

Of those who took action, almost 72% characterized their actions as either solely supportive or opposing; with 16.8% neither in support nor opposition and 5.7% in both support and opposition, and 5.8% did 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% to 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 at those that were not built.

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	63.00%	36.80%

a. 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.

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

Variable	Variable Description/Definition	Weighted Mean/ Proportion ^b (SE)
Dependent		
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 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 yrs)
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)
^a Nearby project > 10 turbines	Large: greater than 10 turbines	0.34(.029)
^a Case study project	“1” if case study project; “0” if “national” sample	0.12(.012)
^a Dominant project	“1” if under-sampled given nearby population; “0” otherwise	0.19(.036)
^a 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)	^b 0.018(.001)
^a Live 0.8 to 1.6 km from nearest turbine	“1” if in specified distance range to nearest turbine; “0” otherwise	^b 0.048(.004)
^a Live 1.6 to 4.8 km from nearest turbine	“1” if in specified distance range to nearest turbine; “0” otherwise	^b 0.33(.037)
^a Live 4.8 to 8 km from nearest turbine	“1” if in specified distance range to nearest turbine; “0” otherwise	^b 0.60(.035)

^astratification variable

^bproportion rather than mean

^cincome rather than ln(income)

Table continues on next page

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

Variable	Variable Description/Definition	Weighted Mean/ Proportion ^b (SE)
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 \$67847 (\$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 yrs)
Secondary residence	"1" if home a secondary residence; "0" otherwise (omitted category)	^b 0.063(.02)
Primary residence	"1" if home primary residence; "0" otherwise	^b 0.85(.03)
Residence status unknown	"1" if unknown; "0" otherwise	^b 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)	^b 0.12(.03)
Do not like wind project look, but fits landscape	"1" if don't like look, but fits; "0" otherwise	^b 0.042(.026)
Neutral or no opinion on wind project look	"1" if neutral or no opinion on look; "0" otherwise	^b 0.18(.04)
Like wind project look, but does not fit landscape	"1" if like look but does not fit; 0" otherwise	^b 0.34(.06)
Like wind project look & fits landscape well	"1" if like look and fits landscape; 0" otherwise	^b 0.32(.05)
Other		
Imputed		Model dependent

^astratification variable

^bproportion rather than mean

^cincome rather than ln(income)

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, 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.^v 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^{vi}), 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 39MW, on average turbines are 126m 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 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.

^v 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.

^{vi} 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).

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	0.007***	0.182	0.021***
I had say in planning process	0.204	0.004***	0.145	0.026**
Developer open and transparent	0.955	0.000***	0.937	0.000***
Community able to influence outcome	0.351	0.000***	0.370	0.000***
Relationship to Wind Project				
Wind turbine on property	0.642	0.024**	0.486	0.073*
Family received compensation	0.031	0.880	0.199	0.322
Year nearest turbine installed	-0.017	0.677	-0.022	0.577
Nearest turbine total height	-0.001	0.568	-0.002	0.374
Installed capacity of nearby project	-0.002	0.087*	-0.002	0.061*
+Nearby project > 10 turbines	-0.293	0.159	-0.336	0.087*
+Case study project	0.103	0.493	0.218	0.131
+Dominant project	0.022	0.951	0.199	0.554
+Live 0.8 to 1.6 km from nearest turbine	0.554	0.002***	0.536	0.002***
+Live 1.6 to 4.8 km from nearest turbine	0.381	0.083*	0.364	0.075*
+Live 4.8 to 8 km from nearest turbine	0.788	0.001***	0.622	0.006***
Other				
General attitude toward wind power	0.602	0.000***	0.696	0.000***
Place attachment/identity	-0.056	0.112	-0.067	0.053*
Demographics				
Age	0.063	0.102	0.031	0.371
Age squared	-0.0004	0.197	-0.0001	0.663
Education level	0.052	0.303	-0.002	0.965
Female	0.152	0.266	0.112	0.426
Ln(income)	-0.021	0.834	-0.024	0.812
Children	0.202	0.327	0.259	0.178
White	-0.341	0.238	0.001	0.996
Own home	-0.847	0.052*	-1.008	0.006***
Year moved into home	0.002	0.696	0.004	0.442
Primary residence	0.514	0.063*	0.331	0.204
Residence status unknown	0.286	0.414	0.225	0.490
Constant	-2.71	0.150	-1.43	0.422

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

+stratification variable

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 a 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 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.^{vii} 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.^{viii} This suggests that a more robust planning process, closer to IAP²’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 variables’ standardized coefficients (.458) is greater than that (.398) for having generally positive wind power attitudes (Model 3).

^{vii} 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.

^{viii} We ran a nested model that included predicted fairness and excluded the process metrics; the model performed similarly but with R² of only .61.

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	0.000***	0.239	0.000***	0.137	0.000***	0.141	0.000***
Community had say in planning process	-0.00003	0.999	0.015	0.602	-0.007	0.808	0.013	0.622
I had say in planning process	0.027	0.382	0.041	0.122	0.013	0.654	0.025	0.302
Developer open and transparent	0.121	0.001***	0.123	0.000***	0.098	0.005***	0.112	0.000***
Community able to influence outcome	0.087	0.009***	0.083	0.005***	0.107	0.000***	0.081	0.003***
Relationship to Wind Project								
Wind turbine on property	0.338	0.006***	0.318	0.002***	0.164	0.147	0.160	0.098*
Family received compensation	0.185	0.030**	0.139	0.061*	0.213	0.007***	0.145	0.036**
Year nearest turbine installed	-0.029	0.090*	-0.038	0.014**	-0.025	0.115	-0.038	0.007***
Nearest turbine total height	0.0005	0.638	-0.0003	0.687	0.001	0.240	0.0001	0.854
Installed capacity of nearby project	0.001	0.227	0.001	0.142	0.001	0.066*	0.001	0.046**
See turbine(s) from home/property					-0.331	0.002***	-0.250	0.005***
+Nearby project > 10 turbines	-0.140	0.118	-0.160	0.039**	-0.077	0.356	-0.086	0.244
+Case study project	0.107	0.099*	0.099	0.091*	0.014	0.813	0.033	0.525
+Dominant project	0.230	0.140	0.181	0.193	0.191	0.190	0.140	0.276
+Live 0.8 to 1.6 km from nearest turbine	0.074	0.329	0.083	0.196	0.005	0.941	0.013	0.827
+Live 1.6 to 4.8 km from nearest turbine	0.079	0.406	0.127	0.112	-0.178	0.058*	-0.080	0.316
+Live 4.8 to 8 km from nearest turbine	0.051	0.611	0.007	0.935	-0.281	0.013**	-0.262	0.007***
Landscape, Sound, Place, Attitude								
General attitude toward wind power	0.398	0.000***	0.389	0.000***	0.267	0.000***	0.266	0.000***
Place attachment/identity	0.010	0.519	0.010	0.425	0.001	0.971	0.009	0.452
Do not like wind project look, but fits landscape					0.176	0.189	0.158	0.165
Neutral or no opinion on wind project look					0.336	0.005***	0.291	0.009***
Like wind project look, but does not fit landscape					0.725	0.000***	0.655	0.000***
Like wind project look & fits landscape					0.870	0.000***	0.785	0.000***
Annoyed by the sound of the wind project					-0.145	0.000***	-0.131	0.000***
Demographics								
Age	-0.006	0.725	0.006	0.665	0.004	0.813	0.017	0.194
Age squared	0.0001	0.466	-0.00002	0.891	0.00003	0.833	0.0001	0.272
Education Level	0.017	0.429	0.023	0.213	0.017	0.394	0.024	0.161
Female	0.023	0.694	0.031	0.554	-0.002	0.974	0.006	0.893
Ln(income)	-0.049	0.266	-0.060	0.117	-0.001	0.975	-0.035	0.346
Children	0.055	0.536	0.060	0.442	0.054	0.515	0.041	0.562
White	-0.329	0.008***	-0.186	0.088*	-0.349	0.003***	-0.198	0.049**
Own home	0.007	0.972	-0.022	0.878	-0.025	0.886	0.035	0.785
Year moved into home	0.007	0.002***	0.005	0.017**	0.007	0.002***	0.005	0.014**
Primary residence	-0.087	0.464	-0.032	0.751	-0.131	0.250	-0.054	0.567
Residence status unknown	-0.094	0.531	0.008	0.951	-0.138	0.330	-0.038	0.754
Constant	0.409	0.613	0.775	0.263	0.538	0.484	0.954	0.148

*** p <0.01; ** p<0.05; * p<. 0.10

+stratification variable

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.^{ix} 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 is 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 and Ladenburg, 2015).

Turning to the effect of local wind project appearance and its effect on landscape (models 6-7), 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.^x

4. 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 (DOE), 2017), and the US DOE (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. 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

^{ix} 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% to 14% would prefer to live near their local project than a commercial-scale solar project.

^x When a community measure (landmark or disruptive to community) is substituted for landscape fit, the coefficient difference disparity (.428 to .069) between look and community effect is even greater.

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 of 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 project. Developer adoption of open and transparent approaches is critically important too; we find it to be a more important component of fair process perception than 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, 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, 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 and 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 and 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 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, et al. 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 end, however, we believe that cases will be more valuable if selected randomly or at least more strategically to diminish selection bias.

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