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Thirty years of North American wind energy acceptance research: What have we learned?

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Abstract:
Thirty years of North American research on public acceptance of wind energy has produced important insights, yet knowledge gaps remain. This review synthesizes the literature, revealing the following lessons learned. (1) North American support for wind has been consistently high. (2) The NIMBY explanation for resistance to wind development is invalid. (3) Socioeconomic impacts of wind development are strongly tied to acceptance. (4) Sound and visual impacts of wind facilities are strongly tied to annoyance and opposition, and ignoring these concerns can exacerbate conflict. (5) Environmental concerns matter, though less than other factors, and these concerns can both help and hinder wind development. (6) Issues of fairness, participation, and trust during the development process influence acceptance. (7) Distance from turbines affects other explanatory variables, but alone its influence is unclear. (8) Viewing opposition as something to be overcome prevents meaningful understandings and implementation of best practices. (9) Implementation of research findings into practice has been limited. The paper also identifies areas for future research on wind acceptance. With continued research efforts and a commitment toward implementing research findings into developer and policymaker practice, conflict and perceived injustices around proposed and existing wind energy facilities might be significantly lessened.

Keywords:

Wind energy; social acceptance; support and opposition; attitudes

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negative attitudes toward existing sites (Bidwell, 2013; Brannstrom et al., 2011; Slattery et al., 2012; Songsore & Buzzelli, 2015).

5.1.1 Positive economic aspects

Positive economic aspects of wind energy development include rural economic development (Mulvaney et al., 2013b) including creation of jobs and other economic opportunities (Slattery et al., 2012), local tax revenue and/or lower tax rates for individuals (Slattery et al., 2012), increased tourism (Groth & Vogt, 2014), reduced electricity rates (Baxter et al., 2013) and landowner compensation (Jacquet, 2012). Landowner compensation, however, is not a universally positive socioeconomic impact for individuals living near turbines. It may create perceptions of "winners" and "losers" (Firestone et al., 2012b) and increase intra-community conflict (Baxter et al., 2013; Walker et al., 2014b). Compensation can even be seen as a form of bribery (Gipe, 1995). Having some form of compensation for nearby residents that are not hosting turbines on their land may lesson conflict and notions of winners and losers. For example, non-monetary, non-individual compensation such as the creation of dedicated wildlife habitats or support of community projects was supported by non-hosting community members in one study (Groth & Vogt, 2014). Other research suggests that non-hosting community members prefer public compensation over private compensation (García et al., 2016). Another form of compensation that has been examined is community investment in or ownership of wind facilities. Local ownership enables more equitable distribution of financial benefits as well as a higher degree of participation and influence in the development of a wind facility (Fast et al., 2016). This model has been shown to increase support in the European context, but little evidence exists in the North American context where community ownership remains rare (Bolinger, 2005; Ferguson-Martin & Hill, 2011; Sovacool & Ratan, 2012). In general, more research is needed to understand appropriate and acceptable compensation mechanisms for individuals and communities.

5.1.2 Negative economic aspects

Perceived negative socioeconomic impacts include reduced property values (Abbott, 2010; Firestone & Kempton, 2007; Hoen et al., 2015), decreased tourism (Landry et al., 2012; Lilley et al., 2010; Lutzeyer, 2013), increased traffic (Slattery et al., 2012), exacerbating economic inequality (Walker et al., 2014b, 2014c), impacts to fishing and other recreational opportunities (Firestone et al., 2009), and increased electricity rates (Baxter et al., 2013). Impacts on electricity rates are seen as a two-sided coin, with supporters citing reduced rates and opponents citing increased rates (Firestone et al., 2012a). Although nationwide and state-level studies in the United States have not found evidence of consistent, measurable, or significant reductions in home values near operating wind facilities (Hoen & Atkinson-Palombo, 2016; Hoen et al., 2015; Lang et al., 2014), the *perception* or belief of property value impacts may still affect acceptance of wind (Abbott, 2010; Walker et al., 2014a). Additionally, there is evidence that home-value effects might exist in the U.S. (Heintzelman & Tuttle, 2012) and Canadian (Fast et al., 2015) contexts, and there is growing evidence that effects exist in the European context (e.g. Dröes &

Koster, 2016; Gibbons, 2015; Jensen et al., 2014). More research in this area could not only untangle conflicting results, but also increase understanding of how perceptions of property value impacts influence acceptance.

5.1.3 Distributional justice

The distribution of the costs and benefits of wind energy developments, broadly referred to as *distributional justice*, has been widely studied in the literature. Survey respondents consistently express concern that the energy and economic benefits produced from local wind facilities do not stay local and benefit local residents (Baxter et al., 2013; Groth & Vogt, 2014). Some studies have shown angst and opposition toward multinational corporate wind developers (Pasqualetti, 2011a; Petrova, 2013), and Firestone and Kempton (2007) demonstrate that support would increase for a proposed wind facility if it were being developed by the local government, rather than a private developer. The inability of local community members to invest or share ownership in wind energy developments has been cited as a factor in negative attitudes (Songsore & Buzzelli, 2015).

Unfair distribution of costs and benefits may lead to intra-community and/or rural-urban conflicts (Hirsh & Sovacool, 2013; Larson & Krannich, 2016; Pasqualetti, 2000; Phadke, 2013; Rule, 2014; Sovacool, 2009; Walker et al., 2014c) or injustices toward indigenous communities (Huesca-Pérez et al., 2016). Phadke (2013, p. 248) summarizes this conflict: “Rural communities at the forefront of new energy development are asking why they are disproportionately being asked to carry the weight of the new carbon economy while urban residents continue their conspicuous use of energy.” Rural residents may also feel exploited by urban, multinational, corporate project developers seeking profits over public welfare (Petrova, 2013; Sovacool, 2009). Thus, some individuals who oppose or hold negative attitudes toward wind facilities may be fighting against a feeling of injustice as they find themselves on the front lines of development impacts while still on the margins of politics and economic opportunity. On the other hand, rural-urban conflicts may also propagate when the local, rural residents *support* the wind facility. Sovacool (2009, p. 4510) suggests that, in some cases, “rural [longstanding] residents want renewable power projects for their own use, as a vehicle for economic development, and resent what seems like meddling by urban [newly arrived] residents intent on preserving the countryside for its scenic and recreational value.”

Perceived socioeconomic impacts are at the forefront of concerns for many individuals living near existing and proposed wind facilities, but those perceived impacts and the ways they influence acceptance are complex. More research is needed to understand inter- and intra-community conflicts, the effects of and community responses toward compensation mechanisms, and the relationships between perceived economic impacts and perceived fairness of planning processes and outcomes.

Table 1: Summary of economic impacts and their relationship to wind energy acceptance

Economic impact	Summary of research findings	Citations
Rural economic development, job creation, sustaining farming/rural economies	Wind development can create short- and long-term jobs as well as other local economic activity. It is seen as a way to protect farmland, sustain rural economies, and reverse economic decline. These impacts are associated with greater acceptance; however some individuals express concern over the temporal nature of most jobs created.	(Brannstrom et al., 2011; Mulvaney et al., 2013b; Slattery et al., 2012; Songsore & Buzzelli, 2015)
Local tax impacts	Wind energy developments often contribute to local taxes, increasing local tax base and potentially decreasing resident tax rates. This impact is associated with higher support (positive attitudes).	(Slattery et al., 2012)
Tourism impacts	Most studies have examined the extent to which wind energy development may decrease tourism, particularly beach tourism for offshore wind. However some local residents believe that wind development may *increase* tourism in certain cases.	(Groth & Vogt, 2014; Landry et al., 2012; Lilley et al., 2010; Lutzeyer, 2013)
Impacts on electricity rates	Impacts on electricity rates are a two-sided coin, with supporters citing reduced rates and opponents citing increased rates. Directly reducing electricity rates for local residents is not feasible for wind developers in most cases as electric utilities are separate entities from wind facility owners, though it may be possible to offer money to offset electricity costs.	(Baxter et al., 2013; Firestone et al., 2012a)
Landowner and/or community compensation	Landowners on whose land wind projects exist deserve individual monetary compensation. This compensation may be correlated to acceptance, but it also can create community conflict, exacerbate inequality, and be seen as bribery. Some forms of community level compensation may also increase acceptance. Community compensation may take the form of payments, energy efficiency retrofits, visual or sound mitigation measures, investments in parks or community centers, or offsetting electricity costs.	(Baxter et al., 2013; Firestone et al., 2012b; García et al., 2016; Gipe, 1995; Groth & Vogt, 2014; Jacquet, 2012; Walker et al., 2014b)
Local ownership or investment opportunities	Local ownership or investment enables more equitable distribution of financial benefits and more participation in the development process. It has been shown to increase acceptance in Europe, but such ownership structures are uncommon in North America.	(Bolinger, 2005; Fast et al., 2016; Ferguson-Martin & Hill, 2011; Sovacool & Ratan, 2012)
Property value impacts	Some large-scale, statistically robust, and longitudinal studies in North America have not found evidence of consistent or significant reductions in home values near operating wind facilities, but other case studies do show a reduction. Regardless, the *perception* of value reduction reduces acceptance.	(Abbott, 2010; Fast et al., 2015; Heintzelman & Tuttle, 2012; Hoen & Atkinson-Palombo, 2016; Hoen et al., 2015; Lang et al., 2014; Walker et al., 2014a)
Distributional justice and inequality	There is significant concern that economic benefits produced from local wind facilities do not stay local and benefit local residents. Residents may feel exploited by urban, multinational, corporate project developers seeking profits over public welfare. Unfair distribution of costs and benefits may exacerbate conflict.	(Baxter et al., 2013; Groth & Vogt, 2014; Hirsh & Sovacool, 2013; Larson & Krannich, 2016; Pasqualetti, 2000; Pasqualetti, 2011a; Phadke, 2013; Rule, 2014; Sovacool, 2009; Walker et al., 2014c)