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Beyond rhetoric to understanding determinants of wind turbine support and conflict in two Ontario, Canada communities

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Abstract. The literature concerning local opposition to wind turbine developments has relatively few case studies exploring the felt impacts of people living with turbines in their daily lives. Aitken even suggests that such residents are subtly or overtly cast as deviants in the current literature. Our mixed-methods, grounded-theory case study of two communities in Ontario, Canada provides insights about such residents though twenty-six face-to-face in-depth interviews, 152 questionnaires, and basic spatial analysis involving locals who have been living with operating turbines for several years. Despite being neighbours the communities differ on several measures including the spatial clustering of turbines. Opposition is significantly predicted by: health, siting process, economic benefits, and visual aesthetic variables. Though a majority supports the turbines we focus on the interplay of that majority with those experiencing negative impacts, particularly related to health. We highlight an asymmetry of impacts at the local level on those who oppose turbines, which is supported by rhetorical conflict at multiple scales. The findings point to the need for greater attention to mitigating impacts, including conflict, by understanding how siting policies interact with social processes at the local level.

Keywords: wind turbine, impacts, conflict, health, mitigation, technocratic siting

Introduction

The move towards intensifying wind energy production has led to well-documented pushback from some host communities—at the same time new concepts continue to emerge to understand the nuances of turbine opposition (Aitken, 2010a; Devine-Wright, 2005; Murphy and Smith, 2013; Pasqualetti, 2011). High-growth areas for turbines like Ontario, Canada are places to productively further advance conceptual development. Ontario is currently Canada's leading province in terms of turbine installations with over 1100 turbines and more than 2000 MW of capacity—or 31% of the country's total (Canadian Wind Energy Association, 2013). The province has promoted renewable energy through the Green Energy Act (GEA) which guarantees rates of return on renewable energy, but also severely limits the capacity of local residents and municipal governments to say "no" to local turbines (Government of Ontario, 2009). This is akin to the "minimal permitting requirements" model as described by Bohn and Lant (2009) in their threefold characterization of US wind turbine development siting in the sense that local authorities under such a regime cannot prevent a wind turbine facility. That is, unlike Bohn and Lant's "standard" model where local municipal authorities administer siting and environmental assessment processes and have final say, environmental assessment

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for turbines in Ontario is administered by provincial authorities. Overall, the GEA frames a technocratic approach which streamlines siting in the name of reaching sustainability goals.

While there is a "plethora of negative media stories" about turbines (Warren and McFadyen, 2010), the academic literature does not contain much on the nuances of resistance in the words of the people living with turbines (Burningham, 2000). Instead, those who oppose turbine developments are tacitly or overtly cast in the role of barriers to sustainable energy development (Aitken, 2010a). Objections are often couched in terms of aesthetics and procedural issues (Devine-Wright, 2005; Eltham et al, 2008; Wolsink, 2000; 2006). Yet, there are phenomena that are relatively less explored like health impact debates (Hill and Knott, 2010), and stress-inducing intracommunity social conflict (Baxter, 2006; Murphy and Smith, 2013).

In terms of rhetoric, objections to turbines are framed antagonistically as the provincial premier explained: "NIMBYism will no longer prevail" and "municipalities will no longer be able to reject wind turbines because they don't like them" (Ferguson and Ferenc, 2009, page 1). The issue of turbine-induced health impacts is a major driver of concern and opposition in Ontario and has increased significantly since the GEA (Baxter et al, 2013). The development of and response to policy in the province have set the stage for intensified rhetoric on wind turbines and their impacts at multiple scales (Haggett and Toke, 2006; Hill and Knott, 2010).

Literature review

This section briefly reviews the literature on the determinants of turbine support/opposition and considers the potential roles for health risk perception and intracommunity conflict as our inductive grounded theory study ultimately led us in such directions.

Polls in Europe and Ontario have found strong majority support for renewable energy and wind turbine energy production in the general population—89% (Ipsos Reid, 2010) and 87% (Green Energy Act Alliance, 2009), respectively—yet local opposition to specific developments is often quite pronounced. A common explanation for this apparent disconnect, particularly in policy circles, is NIMBY (not-in-my-back-yard)—that people who oppose turbines locally are implied to hold a selfish position in relation to the majority who favour turbines; or worse that local opposers support the turbines anywhere except near them. Wolsink (2007) and Burningham (2000) are notable among many academics who have discredited such an explanation as simplistic. Yet, the quotation from the premier of Ontario above underscores a fundamental inconsistency between academic theory and policy on the ground (Wolsink, 2000).

Among academics aesthetic visual and noise annoyance are among the most prominent explanations for low turbine support (Eltham et al, 2008; Walker, 1995; Wolsink, 2000). Pedersen et al (2009) find that wind noise can be more annoying than other industrial noises at the same level, which supports the idea that such noise disturbs sleep and may in turn negatively impact health (Shepherd et al, 2011). Further, visibility of turbines from the home and whether or not residents benefit economically are both significantly linked to noise annoyance (Pedersen and Larsman, 2008; Pedersen and Persson Waye, 2004).

The issue of health impacts from turbines is gaining traction in Ontario (Hill and Knott, 2010; Krogh et al, 2011), yet the literature is silent on the effects of such debates on turbine support/opposition (Baxter et al, 2013). While there is no comprehensive peer-reviewed academic review, grey literature reports claim that any connection between health and turbines is weak or that the *main* mechanism is psychosocial (Colby et al, 2009; King, 2010). The individual epidemiologic studies that do show health effects also tend to be cross-sectional (Nissenbaum et al, 2012; Pedersen and Persson Waye, 2009; Pedersen et al, 2009; Shepherd et al, 2011) which, among other design issues, leaves sufficient room for heated debate whereby government agencies draw very different conclusions than concerned

residents. Recent publications about Ontario push a broadly defined health agenda forward by outlining how health impacts could be studied and how they are connected to issues of social justice (Horner et al, 2011; Krogh, 2011; McMurtry, 2011; Shain, 2011).

Conflict has generally been conceptualized in the turbine literature as battles between locals, turbine developers, and governments with little regard to the nuances of conflict at the local level (Aitken et al, 2008; Walker, 1995). Brannstrom et al (2011, page 849) suggest: "the need to move beyond the headlines of conflict and resistance and to study, instead, the subtle but significant changes that wind-power development has on rural landscapes and communities" (see also Wolsink, 2007). For example, Pedersen et al (2007) urge researchers delve deeper into the lived experience of felt injustice, intrusion, lack of control, and not being believed so that conflict may be conceived as an impact on local residents regardless of their position on turbines (see also Baxter, 2006; Murphy and Smith, 2013).

As this brief review suggests, there may be much more that can be learned by inductively studying turbine communities to understand the contingencies of opposition/support in terms that are meaningful to the residents themselves.

Research design

Site selection

As the overall purpose of this study was to investigate how residents who have lived with turbines for several years view them; we initially selected only one 'case': Port Burwell, Ontario. Their Erie Shores turbine development is one of the oldest fifty-plus turbine projects in Ontario and the fifth largest in Ontario at the time of study with sixty-six 1.5 MW turbines (Canadian Wind Energy Association, 2013). Our grounded theory design described below was intentionally flexible, so interviews led us into the neighbouring Clear Creek area—home of the 'Cultus', 'Clear Creek', and 'Frogmore: developments each comprised of six 1.65 MW turbines (figure 1). In this sense difference and comparison were not the initial bases of study site selection; they were learned as the study developed. Together, the two sites currently comprise 7.6% of Ontario's 1100 turbines and approximately 6% of the province's total wind energy capacity.

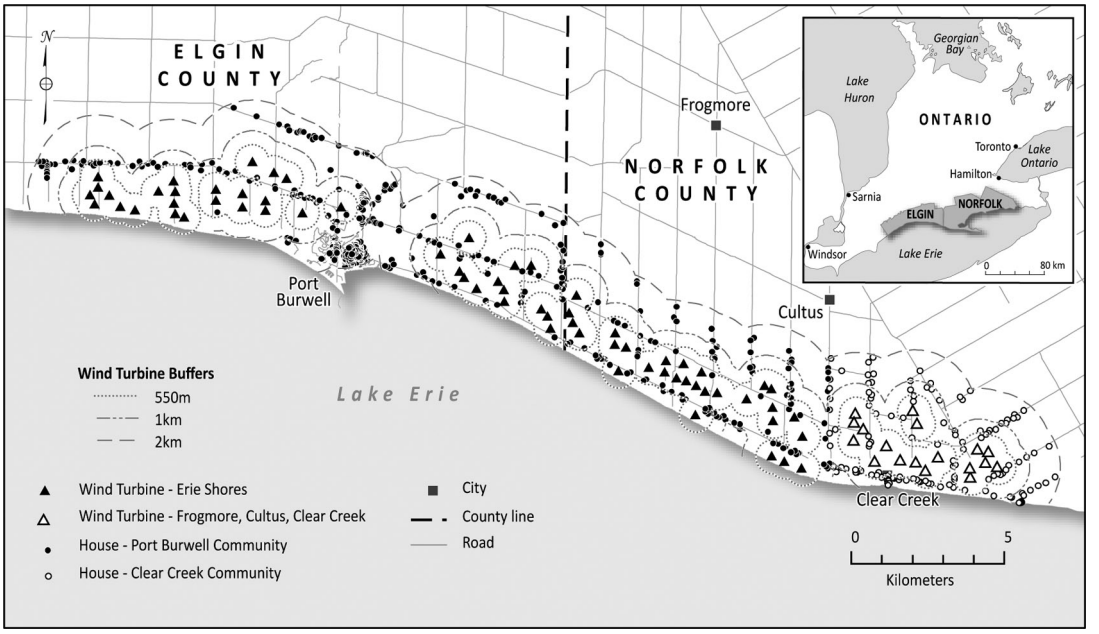

Figure 1. Study site—juxtaposition of turbines and homes in Port Burwell and Clear Creek, Ontario.

The study area is mainly rural with two main centers: the village of Port Burwell and the hamlet of Clear Creek. The main industry has been agriculture (formerly tobacco) with about 15% of residents aged 15+ employed in agriculture or resource-based industries. The area is less affluent than the province with median incomes of $54 800 in the Municipality of Bayham (Port Burwell) and $62 100 in the County of Norfolk (Clear Creek/Frogmore/Cultus) compared with that of Ontario ($69 200). Likewise they differ from each other and the province in terms of education, with 46.5% and 31.6% *not* holding a diploma, certificate, or degree (Ontario average: 22.2%) (Statistics Canada, 2007).

Methodology

Our grounded-theory study involved a mixed-methods design with qualitative face-to-face semistructured interviews followed by a quantitative survey and spatial analysis which together allowed triangulation of concepts (Devine-Wright and Howes, 2010). This addresses the need for alternative designs to purely positivistic approaches for explaining wind turbine support/opposition (Devine-Wright, 2005; Ellis et al, 2007). Interviews were audio recorded with permission, transcribed verbatim, and analyzed with the assistance of NVivo 9 qualitative data management software. The drop-off, mail-back survey questionnaire that followed was built on the interview findings and consisted of five main sections: support, impacts, attitudes, trust, and justice; with questions answered on a five-point Likert agree scale.

Interview participant selection and grounded theory

In the summer/fall of 2011 and the fall of 2012 we conducted face-to-face semistructured interviews with twenty-six adult residents (ten women and sixteen men): sixteen[(1)] in Port Burwell and eight in Clear Creek along with two policy experts. The reason for the differences between the communities is that conceptual categories[(2)] rather than balance (eg, community, gender) or randomness guided participant selection according to grounded theory's principles of theoretical sampling and saturation (Corbin and Strauss, 2007). For example, in the initial set of interviews we did not find many unsupportive of turbines, but seven people in our initial interviews referred to strong opposition to turbines "down the road" in Clear Creek.

The first set of interview participants were recruited with letters dropped off at randomly selected households from the 210 that were located within a 1 km radius of a turbine in Port Burwell—this being the distance beyond which audible-range turbine noise is supposedly difficult to differentiate (Ontario Ministry of the Environment, 2008). Consistent with grounded theory we also snowball sampled from existing interviewees. After member-checking,[(3)] which involves sending preliminary findings to interview participants (Baxter and Eyles, 1997), five more interviews were conducted in Clear Creek to further investigate the social dynamics of opposition/support.

Survey sample

For the survey we selected randomly within a 2 km radius of turbines for a larger pool of potential participants and because concerned residents suggested 1 km was too limited. In February 2012 questionnaires were distributed to 178 households in Clear Creek and 306

[(1)] Three of these people had turbines on their property with lease agreements that paid for the use of their land.

[(2)] Throughout this paper the Clear Creek and Port Burwell communities refer to the collection of residents within 2 km of the Clear Creek + Cultus + Frogmore wind developments and the Erie Shores development, respectively.

[(3)] Of twelve member-check responses eight agreed with our preliminary findings; two people neither agreed nor disagreed; and two disagreed. The latter two felt we grossly underrepresented the impacts of turbines (particularly health), so we reengaged them in person and by e-mail to work through these issues.

households in Port Burwell. From these, seventy were returned from Clear Creek (39% response) and eighty-two from Port Burwell (27% response). We did not conduct follow-up drop-offs as we had contacted many of these households twice already. Our samples are in line with Statistics Canada data and the community subsamples are quite similar across demographic categories, with a slightly higher than expected percentage of males (Clear Creek 54%; Port Burwell 53%).

Findings

Support for turbines in the community

While few had strong objections to the turbines in Port Burwell, the *type* of support was more pragmatic than it was enthusiastic. Although they saw benefits for the environment and the local economy, 11/16 saw wind energy simply as a 'better alternative' among energy generation choices in the province. For example, Jerry[4] admits turbines have "negative aspects" like: "noise" and "altered aesthetics of the landscape"; and while he feels it is "not the cheapest" he does suggest it is the "cleanest":

> *Jerry (PB, support):* "Whether you like it or whether you don't like it, you have to have an alternative source of energy … there are some negative aspects, or noise, fine. But it's got to be analyzed on a practical, commonsensical basis that means, 'what's better and what's worse?' And those windmills are just as preferable than any other form of energy…. One thing for sure is [they have] altered the atmosphere in the country and it's altered the aesthetics of the landscape, and that's a negative. But the positive is that it gave us a surge of extra electrical power when it's necessary and not the cheapest but it's the cleanest."

Our survey results show majority turbine support in both communities, but significant differences across the two communities. In table 1, 80% agreed (67% strongly) that they "support the existing wind power project in my community" in Port Burwell, while Clear Creek is statistically significantly lower with only 63% agreeing (44% strongly). Overall, support for wind turbines was significantly higher in Port Burwell for all four 'support' questions as indicated by the difference of means test results in the first column (left).

While supporters tended to be pragmatic about their support, opposers were quite emotional about being impacted by turbines. Henry's comments are representative of Clear Creek turbine opponents we interviewed and their anger, disappointment, and frustration contrast starkly with the tone of supporters:

> *Henry (CC, oppose):* "And they've [provincial Liberals] sort of ignored us. So … I don't like that because that's basically an insult to us. To call us to say that there's no problem; because there is a problem. There's a big problem and it's affecting people and it's affecting their health and who knows how it's going to affect them in the long run."

Consistent with recent literature, we found little in the interviews to sustain the NIMBY hypothesis. In fact, all of the interviews with those opposed in Clear Creek suggest that their principle objections are multiscalar, extending well beyond their immediate community. From the survey, the precise number of participants who could be classified as having a NIMBY attitude by simultaneously (i) disagreeing they support local turbines and (ii) agreeing they support more wind power in Ontario is only one resident in Port Burwell and one in Clear Creek; and for more wind power in Canada—four and two, respectively.

[4] All names are pseudonyms.

Table 1. Support for turbines in Port Burwell (PB) and Clear Creek (CC).

Survey question		Agree[a]			Disagree		Mean[b]	Corr[c]
		1	2	3	4	5		
(**[d]) I support the *existing* wind power project in my community (dependent variable)	PB	67	13	5	7	7	1.74	na
	CC	44	19	4	6	27	2.53	na
(**) I support installing more wind turbines in my community	PB	50	17	9	11	13	2.21	0.85**
	CC	39	13	6	4	39	2.91	0.90**
(*) I support more wind power projects in Ontario, outside my community	PB	59	11	11	10	10	2.01	0.79**
	CC	46	10	11	9	24	2.56	0.89**
(**) I support using more wind power to meet Canada's energy needs	PB	59	11	11	10	10	1.85	0.67**
	CC	47	13	9	7	24	2.49	0.90**

[a] 1 = strongly agree; 2 = somewhat agree; 3 = neither agree nor disagree; 4 = somewhat disagree; 5 = strongly disagree—values shown are percentages of each community subsample.

[b] Mean score for the subsample—see note a.

[c] Spearman ordinal correlation coefficient with first item (dependent variable): ** $p < 0.01$; na—not applicable.

[d] Significance of difference of community means test: * $p < 0.05$; ** $p < 0.01$.

Impacts of turbines

Health

An iconic wind turbine protest sign in Ontario states: "Health studies BEFORE wind turbines" (Ontario Wind Resistance, 2013). That Health Canada is only now studying health impacts (Michaud, 2012) conjures both vindication and outrage for those opposed to turbines since those experiencing health problems claim to feel like guinea-pigs in an unethical experiment. The three of the eight people interviewed in Clear Creek who attributed experienced health effects to the turbines spoke of a range of negative experiences from "heart attack"-like symptoms (pain) to dizziness, sleep deprivation, and loss of balance:

> *Barbara (CC, oppose):* "So, the pains that I did feel were in my arm, starting here in the shoulder and when you do some research into that in people who are having heart attacks that's one of the kinds of pains that they feel."

In contrast to Clear Creek residents, those in Port Burwell tended to attribute any changes in health to other causes like the "aging process", but 14/16 we interviewed in Port Burwell also tended to ridicule the very idea that turbines cause health problems:

> *Kelly (PB, support):* "Like it is kind of a joke …. I think it was after we got your letter about doing this survey and we were standing there, and [husband] says "Well, you know I guess if you stood here long enough you'd get dizzy [laughter] looking up at them! Watching those blades go around". And I go, 'Ya I guess' [laughter]."

The comments above provide clues to the nature of the relationship and rhetoric between supporters and opponents which we elaborate below.

The survey data are consistent with the idea that more people in Clear Creek attribute health problems to wind turbines. As all of the means are above 3 both community samples tended towards disagreeing they are experiencing negative health effects. Yet, there are significant differences between the two communities, with 22% versus 3% agreeing to the first statement and 16% versus 1% agreeing to the second statement for Clear Creek and Port Burwell, respectively (table 2). The table also shows statistically significant negative correlations between these two 'health effects' questions and local support suggesting that opposition is influenced by suspected health effect linkages, particularly in Clear Creek.

Table 2. Health effects attributed to turbines.

		Agree[a]			Disagree		Mean[b]	Corr[c]
		1	2	3	4	5		
(*[d]) I have experienced negative health effects due to the wind turbines (NHI[e])	PB	2	1	26	6	65	4.29	−0.60**
	CC	19	3	13	10	55	3.80	−0.86**
(*) Another member of my household has experienced negative health effects due to the wind turbines (NHI)	PB	1	0	27	5	67	4.37	−0.59**
	CC	14	2	18	11	56	3.94	−0.81**

[a] 1 = strongly agree; 2 = somewhat agree; 3 = neither agree nor disagree; 4 = somewhat disagree; 5 = strongly disagree—values shown are percentages of each community subsample.
[b] Mean score for the subsample—see note a.
[c] Spearman ordinal correlation coefficient with first item (dependent variable): ** $p < 0.01$.
[d] Significance of difference of community means test: * $p < 0.05$.
[e] See regression results indexes: NHI = negative health impacts.

Feelings towards 'the other' and rhetorical conflict

Rhetorical conflict, which we define as disrespect/contempt without direct confrontation, is one of the strongest interview themes. This theme developed initially in Port Burwell interviews where supporters would often make light of the problems of those opposed to wind turbines. Christine suggests that it is the type of person who "lives to be annoyed" who complains about wind turbines—a view shared by twelve Port Burwell interviewees:

> *Christine (PB, support):* "I mean that's part of our society. A lot of people live to be annoyed. [laughter]. The older you get you realize that more. Like I myself am shocked at what people like to complain about. You know, we're so blessed in this country and yet people continue to ... complain about ridiculous things."

However, such residents may not always reflect critically on the impact of being so dismissive. For example, one written response we received from an interview participant through the member-checking process was about not having the right to "shrug off" opponents' feelings:

> *Anonymous (PB, support):* "Upon reading the quotes (negative attitudes toward others) I realized how disrespectful I may have sounded (and probably was) in regard to the opponents. Although I cannot see or hear anything extremely terrible about the wind towers it does not give me the right to shrug off or criticize the thoughts and feeling of those who differ."

The environment of majority support seems to make it relatively easy to get caught up in the rhetoric of discrediting opposition. This is further corroborated by the survey results which show strong and significant differences in concern about conflict across the communities, with 45% of Clear Creek versus 16% of Port Burwell respondents agreeing community conflict is at "unacceptable levels".

Explanations for community differences

The next sections briefly explore three sets of specific explanations for apparent community-based differences in local turbine support: experience of the siting process, perceptions of benefits, and the physical characteristics and juxtaposition of the turbines. A brief account of a regression analysis is included to tease out the most important predictors of opposition/support.

Experiences of the siting process

Some of the opposition to the turbines in Port Burwell actually came from residents we interviewed in Clear Creek. However, such residents recounted very negative experiences of participation with Barbara calling public meetings "dog and pony shows" while Henry felt the wind energy company showed a lack of respect during the process:

> *Henry (CC, opposed):* "If they could have showed a little more respect for everybody to start off with, we wouldn't have had the problem that we have now."

Table 3 shows significant between-community differences for only four of nine statements relating to the adequacy of the siting process, government handling of the issue, and equity: transparency (agree: CC 24%, PB 39%), opportunity to voice concerns (agree: CC 43%, PB 57%), adequately dealing with concerns (agree: CC 30%, PB 36%), and approval of the government's handling of the wind energy issue (agree: CC 21%, PB 42%). Nevertheless, the significant bivariate correlations between all nine items and the dependent variable—'support'—suggests that these items differentiate supporters from nonsupporters.

Table 3. Siting process, government handling, procedural fairness/equity.

Survey question		Agree[a]			Disagree		Mean[b]	Corr[c]
		1	2	3	4	5		
(*[d]) The community consultation process was transparent to local residents (SPI[e])	PB	27	12	36	14	11	2.68	0.59**
	CC	12	12	38	16	22	3.24	0.63**
(ns) I was provided with enough information before it was approved (SPI)	PB	36	6	20	18	20	2.79	0.63**
	CC	23	11	16	15	36	3.29	0.63**
(*) I had ample opportunity to voice concerns about the wind project (SPI)	PB	37	20	17	14	12	2.45	0.63**
	CC	23	20	23	7	28	2.97	0.70**
(ns) The information on the existing wind power project was trustworthy (SPI)	PB	34	12	32	11	11	2.52	0.71**
	CC	22	17	32	12	17	2.85	0.77**
(*) Local residents' concerns adequately dealt with (SPI)	PB	27	9	39	12	12	2.73	0.60**
	CC	15	15	28	15	28	3.26	0.72**
(**) I approve of the way the Ontario government is handling the community wind project issue (DGHA)	PB	26	16	32	7	19	2.77	0.64**
	CC	12	9	31	15	34	3.50	0.59**
(ns) I approve of the Green Energy and Green Economy (GEA) Act (DGHA)	PB	34	17	34	3	13	2.44	0.46**
	CC	24	19	34	9	15	2.72	0.48**
(ns) Poorer communities lack the power or resources to adequately oppose wind power projects (PUI)	PB	17	23	30	12	18	2.92	−0.44**
	CC	27	17	20	15	22	2.88	−0.41**
(ns) Poorer individuals within communities lack the power or resources to adequately oppose wind power projects (PUI)	PB	12	25	29	15	19	3.03	−0.47**
	CC	30	15	22	13	20	2.78	−0.47**

[a] 1 = strongly agree; 2 = somewhat agree; 3 = neither agree nor disagree; 4 = somewhat disagree; 5 = strongly disagree—values shown are percentages of each community subsample.

[b] Mean score for the subsample—see note a.

[c] Spearman ordinal correlation coefficient with first item (dependent variable): ** $p < 0.01$.

[d] Significance of difference of community means test: * $p < 0.05$; ** $p < 0.01$, ns not significant.

[e] See regression results indexes: SPI = siting process inadequate; PUI = procedural unfairness/inequity; DGHA = disapprove of government handling and Green Energy Act.

Distribution of benefits

In Ontario turbines are placed on private land and those landowners reap annual lease payments of at least $8000/year (Canadian Wind Energy Association, 2008); while neighbours tend to get no direct payments. Thus, it seemed reasonable to assume that displeasure over this benefits arrangement would predict opposition/support. Surprisingly, non-turbine-hosting residents in our interviews seemed happy for their neighbours' 'windfalls' (15/16) in Port Burwell and 11/16 questioned why neighours should get paid. This may be specific to the context as being happy for turbine-hosting neighbours was bound up with the loss of the cash crop tobacco and poor economic times before the arrival of turbines (9/16 Port Burwell):

> *Matthew (PB, support):* "The people here are left with trying to find some way to make a good living without tobacco and … the lease payments from the turbines doesn't make up the difference but it helps, you know, some of these farmers are happy to know that they've got a guaranteed amount of money coming in every year for a relatively small part of their farm."

However, for others this has been a case of the wealthiest staying wealthy:

> *Barbara (CC, opposed):* "It does replace that tobacco income, right but it's also those who are the wealthiest farmers who started off the wealthiest who are getting the most from it."

Table 4 summarizes measures of economic benefits and fairness of benefits distribution and, contrary to the interviews, there is more dissatisfaction than in the interviews.

Table 4. Distribution of benefits.

		Agree[a]			Disagree		Mean[b]	Corr[c]
		1	2	3	4	5		
(ns[d]) The positive impacts are distributed fairly in my community (PUI)	PB	14	23	35	11	17	2.94	0.46**
	CC	10	13	36	15	25	3.31	0.55**
(ns) The negative impacts are distributed fairly in my community (PUI)	PB	7	15	57	8	15	3.09	0.35**
	CC	9	12	42	12	25	3.33	0.33**
(ns) Wind power projects are distributed fairly among communities in Ontario (PUI)	PB	4	18	45	18	15	3.23	0.56**
	CC	5	17	42	12	24	3.35	0.72**
(**) Overall, the existing wind power project has had more positive impacts than negative impacts on my community (LBIC)	PB	34	25	24	5	13	2.38	0.80**
	CC	21	19	21	12	28	3.07	0.81**
(*) Residents have been adequately compensated for the negative impacts of the existing wind power project (LBIC)	PB	4	17	55	7	18	3.18	0.55**
	CC	9	0	45	10	36	3.64	0.49**
(ns) Residents living near wind turbines, but without one on their land should also receive financial benefits (LBIC)	PB	32	17	21	11	19	2.67	−0.43**
	CC	34	24	18	6	18	2.49	−0.62**
(**) The value of my property and/or dwelling has decreased due to the wind turbines (LBIC)	PB	5	4	16	18	57	4.20	0.66**
	CC	28	6	19	13	34	3.19	0.86**

[a] 1 = strongly agree; 2 = somewhat agree; 3 = neither agree nor disagree; 4 = somewhat disagree; 5 = strongly disagree—values shown are percentages of each community subsample.

[b] Mean score for the subsample—see note a.

[c] Spearman ordinal correlation coefficient with first item (dependent variable): ** $p < 0.01$.

[d] Significance of difference of community means test: * $p < 0.05$; ** $p < 0.01$, ns not significant.

[e] See regression results indexes: LBIC = lack of benefits and inadequate compensation; PUI = procedural unfairness inequity

For example, 58% of Clear Creek and 49% of Port Burwell residents agreed that those *without* turbines on their land should receive financial benefits, which includes forty-six turbine supporters. Further, only three of the seven items were significantly different between the two communities: turbines have more positive than negative impacts (agree: CC 40%, PB 59%); compensation has been adequate (agree: CC 9%, PB 21%), and turbines have reduced my property value (agree: CC 34%, PB 9%).

Regression results

Regression results suggest that 'community' may not be as important a predictor of local turbine support as health impacts, visual appeal, benefits and compensation, and the siting process. Linear regressions on local support/nonsupport for turbines allowed us to sort out the relative importance of the various measures—in both a pooled model and one for each community. The predictor variables consisted of community and gender as dummy variables, unacceptable community conflict as a single item, and the rest within indexes constructed from the variables identified in tables 2–4 as well as a lifestyle change index (eg, less time spent outdoors, invite friends and family over less) not shown in the tables.[5] The variables selected were based on a combination of their bivariate correlation with the dependent variable, and their effect on index reliability. The resultant Cronbach α reliability scores are very good as follows: lifestyle changes (0.95), disapprove of government handling and the GEA (DGHA) (0.82), siting process inadequate (SPI) (0.95), procedural unfairness and inequity (PUI) (0.81), lack of benefits and inadequate compensation (LBIC) (0.83), negative health impacts (NHI) (0.96), and turbines visually unappealing (0.86).

Given that several variables had community means that were significantly different, it is somewhat surprising that the 'community' variable was not significant in the pooled model. Yet, the community models themselves have different predictors. The parsimonious[6] pooled model had an adjusted R^2 of 0.82 with the following significant adjusted coefficients: lack of benefits and inadequate compensation (−0.24**), health impacts (−0.33**), and visually unappealing (−0.34**). The model for Port Burwell had a lower adjusted R^2 (0.74) with no influence of the health variable but the following significant predictors: inadequate siting process (−0.23*), lack of benefits and inadequate compensation (−0.31*), and visually unappealing (−0.38**). For the Clear Creek model the lack of benefits (−0.21**), health impacts (−0.40**), and visually unappealing (−0.44**) indexes are the only significant predictors. This reinforces the literature which suggests that visual aesthetics has a strong effect, but so too does the perceived lack of widespread local benefits and compensation; while any effect of 'community' as a variable seems to be overshadowed by the strong effects of health concerns in Clear Creek.

Turbine characteristics and cumulative effects

The third explanation was suggested by residents who link their health problems to turbines. They talked about the type of turbines and their spatial clustering to explain why the Clear Creek–Cultus–Frogmore conglomeration of eighteen turbines produces more negative impacts than the sixty six that make up Erie Shores near Port Burwell. Indeed compared with the 1.5 MW GE "1.5s" turbines in Port Burwell, the 1.65 MW "Vestas V82" turbines in Clear Creek are slightly taller (70 m versus 65 m) and have longer blades (41 m versus 35 m diameter) amounting to a circumference ('swept area') 1.3 times larger (5281 m^2 vs 3904 m^2) (American Wind Energy Association, 2012).

[5] This table is available from the corresponding author.

[6] All variables were first included in a stepwise regression. Then only variables that were significant or had coefficients $\geqslant 0.10$ were included in a parsimonious model.

Spatial clustering also indicates that Clear Creek is at a relative disadvantage with turbines there being closer and in larger groups around homes. We entered all of the turbines and surrounding homes into a geographic information system to test whether turbines are closer to homes in the Clear Creek area (figure 1). Consistent with our interview and survey sampling we chose 2 km, 1 km, and 0.55 km zones around the developments. Within 2 km of the turbines the average distance between each home and the nearest turbine is statistically significantly smaller for Clear Creek (879 m) than for Port Burwell (1253 m); likewise for the 1 km zone (601 m versus 653 m); while for the 550 m zone the difference is not statistically significant (417 m versus 435 m). Further, in the 2 km zone each home in Clear Creek has statistically significantly higher exposure: that is, to more turbines with an average of 6.8 turbines within 2 km of each home there compared with only 3.7 in Port Burwell; likewise with 2.8 versus 2.5 turbines within the 1 km zone but an identical 1.2 average turbines-to-home ratio within the 0.55 km zone. Thus spatial clustering is a plausible explanation for community-based differences in concern and opposition.

Discussion

Our case study highlights how the combination of policy context, local social processes (eg, rhetorical conflict), and the physical design and clustering of turbines contributes to the predictive value of health risk perception, visual aesthetics, benefits, and fairness as determinants of turbine support/opposition (Devine-Wright, 2005; Eltham et al, 2008). This adds to a growing collection of multimethod case studies on sustainable energy development (Haggett and Toke, 2006; Warren and McFadyen, 2010; Zoellner et al, 2008). Though the communities are next to each other and share similar socioeconomic contexts, there are stark differences in the lived experience of turbines (Devine-Wright and Howes, 2010; Warren and McFadyen, 2010). Though our study does corroborate findings in the literature, we emphasize the more novel aspects of the findings whereby health and intracommunity conflict may be conceived simultaneously as predictors of opposition as well as impacts in their own right.

We argue that there is an asymmetry of impacts from rhetorical conflict and other social processes that is not accounted for by existing research. The idea of support itself is nuanced. What appears as majority support for turbines is to some extent qualified, pragmatic, and thus potentially fragile (Bell et al, 2005; Ellis et al, 2007); while opposition is asymmetrically more impassioned. Yet, the survey findings are in line with case studies showing pockets of low local support in Europe (Braunholtz, 2003; Krohn and Damborg, 1999). Warren and McFadyen (2010) explain community differences as being largely the consequence all locals sharing the direct financial benefits in the most supportive community; but like our findings they also indicate the size and configuration of turbines (fewer and smaller in the more accepting community) are important. Though the turbine height differences in their study (30 m+) are greater compared with ours (15 m) they do not report on spatial juxtaposition to homes—an important issue in our case.

One of the most unusual findings in our study is the central role played by health, mainly in Clear Creek. Though health is certainly raised as an issue in recent academic writing about the Ontario situation (Hill and Knott, 2010; Krogh et al, 2011; McMurtry, 2011) our study shows it can be a pivotal predictor of opposition. While some of those interviewed in Clear Creek spoke of dismayingly turbine-attributed health effects, others tended to dismiss or mock such claims. The latter phenomenon contributes to the asymmetry of impacts as such processes have served to reinforce the sense of despair felt by those already attributing their ill health to turbines. Thus, if noise and vibration are impacting sleep and health (Nissenbaum et al, 2012), the rhetoric of dismissing health claims as merely psychosomatic adds to the problem for these people. Indeed, dismissive rhetoric was spurred in recent media coverage of a manuscript by Chapman et al (2013) claiming health impacts from turbines are merely

"psychogenic, communicated disease" (Smith, 2013). That this study was posted prior to peer review highlights both the high stakes in this domain and why nonsupporters feel besieged by stakeholders with access to more knowledge resources (Aitken et al, 2008).

We are not suggesting that social explanations supplant physical–somatic ones that are emerging in the research. Instead, we are suggesting a compounding effect, a vicious cycle of claims and counterclaims that serve to spiral downward the mental and physical well-being of residents, particularly those who—in this context—*dare* to oppose turbines. Further, we want to discourage distilling the health issue into an 'either/or' debate—one which suggests turbines do cause health effects or they do not, with no middle ground (Barry et al, 2008; Sher, 2012). We are suggesting that the psychosocial environment of conflict, rhetoric, and denigration simply makes things worse for concerned locals (Baxter, 2006; Murphy and Smith, 2013; Pedersen et al, 2007).

Our idea that conflict is often rhetorical, but the impacts are asymmetrical, is difficult to comprehend against a literature which suggests that opposition from the few successfully thwarts renewable energy development (eg, Bell et al, 2005; Toke, 2002). While Bell et al (2005, page 472) are concerned about "qualified supporters being alienated" regarding *proposed* developments, our case suggests casting a sympathetic lens on those claiming they are impacted by *actual* developments. Others have suggested the power of opposition is overstated in the UK (Aitken et al, 2008; Haggett and Toke, 2006), and power is particularly weak in more authoritarian policy contexts like Ontario's, where the legislation effectively removes local capacity for municipal self-determination.

Another quote from the provincial premier reinforces how this asymmetry is reproduced; by dismissing health impacts as 'unreal': "We're going to say to Ontarians that it's okay to object on the basis of safety issues and environmental standards; if you have real concerns there, put those forward and we must find a way to address those" (Ferguson and Ferenc, 2009, page 1). However, the rhetorical context itself makes it extremely difficult to separate out 'real' impacts. As Breukers and Wolsink (2007) have also shown in Europe, such technocratic/authoritarian approaches to facility siting and mitigation largely serve to entrench opposition and further reproduce asymmetries of power and impact. Meanwhile in Ontario, the backlash against turbines has created a political environment where some politicians are calling for a moratorium on turbine operations (*CTV News* 2011); which calls into question the *political* sustainability of current siting policies.

Our findings support the growing evidence, including another Ontario study (Baxter et al, 2013), that sharing of financial and other tangible benefits among households in the vicinity of local turbines predicts turbine support (Bolinger, 2005; Murphy and Smith, 2013; Walker and Devine-Wright, 2008; Warren and McFadyen, 2010). The interviews again provide important subtlety, in the sense that being happy for former tobacco farmers who lease land to turbine developers need not be interpreted as a rejection of the idea that neighbours should also get a share of profits (Ellis et al, 2007). We concur that the local context and rhetoric present a formidable challenge as residents do not want to be portrayed to either be gold digging or duped by 'bribes' (Bell et al, 2005). Indeed Aitken (2010b) found intracommunity conflict can be linked to how and when community benefit packages are introduced. On the other hand, our findings appear to contrast Cass et al's (2010) conclusion that there is 'ambivalence' towards benefits as a large proportion of turbine supporters even felt that those who live near turbines, but without turbines on their land should receive direct financial benefit. Thus, the 'how' of benefits distribution remains an important area for future research and policy experimentation.

It may seem reasonable to expect that siting process variables would predict nonsupport in a province with tight restrictions on individual and municipal power to stop local turbines

(Gross, 2007; Jobert et al, 2007; Wolsink, 2007). As the current policy was put into effect after the turbines were already operational, in our study communities there may be a complex dynamic between current views and past experience. Our 'inadequate siting process' (ISP) index included items relating to information, voicing concerns, transparency, and dealing with concerns—which is consistent with what Zoellner et al (2008) found in a German grounded theory study. Their frame, though, is procedural justice which, if not compared closely, would appear to contradict the fact that our related "procedural unfairness/inequity" (PUI) index (power of poor individuals/communities + fairness of benefits distribution) was *not* statistically significant. The lack of significance of 'justice' variables in our models may be due in part to how we arranged variables in the indexes. We justify our choices on the statistical grounds of maximizing reliability scores, yet our findings underscore the need for precision in how siting and justice are defined and coupled or decoupled in research (Wolsink, 2007). In-depth qualitative case studies and more complex survey design can help tease out such subtleties (Devine-Wright, 2005).

Two key advantages of our mixed methods grounded-theory approach are triangulation and nuanced/contextualized explanation; but as with all approaches there are limitations. Keeping mixed findings together in the same paper necessitates what may seem to be abrupt treatment of individual issues in the name of holism. Further, the survey respondents, and to a lesser extent the interview participants, are those who self-selected for participation in a single round of participation solicitation. We suspect this maximized the relative proportion of those unsupportive of wind turbines since such people tend to be more motivated to air their views without further prompting (Swofford and Slattery, 2010). Yet none of these limitations necessarily threatens the credibility (validity) of the main concepts, only the degree to which they inhere.

Conclusion/implications

Sustainable energy policy and development practice must involve mitigating harm during both the siting and the operational phases, by first understanding how such harms are constituted in the places in which they occur. Researchers must be mindful of how all studies may be used as tools to discredit legitimate impact claims out of hand and reinforce local asymmetries of power. Impact claims should be investigated on their own terms in the local context, with cautious reference to broad-based studies and debates. For example, the timing of complaints about health effects in the Australian context does not mean complaints in the local context in Ontario are not 'real'. Much the way Hagget and Toke (2006) recommend that we should not be assessing if "impacts of windfarms are 'true'", we suggest a move away from answering the question, "Do wind turbines cause health impacts or asymmetrical impacts from conflict?", to answering questions like, "Under what conditions do wind turbines cause such impacts?", and "How can we prevent/mitigate such impacts in this specific place?"—that is, emphasize how impacts emerge and are reproduced.

Our study gives further reason for developers and policy makers to be cautiously optimistic about the potential positive effects of careful attention to financial benefits arrangements in the local context, including community profit-sharing. Benefits regimes that include paying landowners hosting turbines while simultaneously providing nothing to other residents living closest to turbines is part of the problem. Alternatives might involve implementing smooth contours of financial benefits for homeowners outward from turbines rather than stark dots of all and nothing. Yet, in a context where people are choosing to not live in their own homes because of exposure to clusters of operating turbines, attention to mitigation should be also be priotitized. For example, those who are living among turbines that grossly violate existing setback regulations deserve immediate mitigation attention from policy makers and operators alike. This will require discipline from the latter two groups in particular, as it may seem far

simpler in the context of existing institutional arrangements and cultures to fall back on the rhetoric that seems to readily discredit claims of harm. Concerned citizen groups can play their part too in turning down the rhetoric. In the scramble for higher ground on issues such as health impacts from turbines the toll can disproportionately fall on those nearest the turbines living in divided communities.

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