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SPECIAL ISSUE — COMMUNITY ENERGY PLANNING IN CANADA:
INSIGHTS AT THE NEXUS OF RESEARCH AND PRACTICE

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TABLE OF CONTENTS

EDITORIAL INTRODUCTION

1. [The emergence and evolution of community energy planning in Canada: Introduction to a special issue](#) 1-10
Kirby Calvert, Abhilash Kantamneni, and Ian McVey

ARTICLES

2. [Why is there an implementation gap in community energy planning?](#) 11-34
Rose Murphy, Aaron Pardy, Morgan Braglewicz, Brett Zuehlke, and Mark Jaccard
3. [Enabling community energy planning? Polycentricity, governance frameworks, and community energy planning in Canada](#) 35-54
Mark Winfield, Scott Harbinson, Susan Morrissey Wyse, and Colleen Kaiser
4. [The CEP Crosswalk: A community energy planning tool for interdepartmental alignment and stakeholder engagement](#) 55-70
Cody Walter, Michelle Adams, and Alexander L. MacDonald
5. [Social and municipal influences on intention to purchase electric and hybrid electric vehicles in London Ontario, CA](#) 69-88
Jordan Michael Fuller, Jamie Baxter, and Jamie Skimming
6. [Participatory mapping and spatial planning for renewable energy development: The case of ground-mount solar in rural Ontario](#) 89-100
Kirby Calvert and Rebecca Jahns

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PARTICIPATORY MAPPING AND SPATIAL PLANNING FOR RENEWABLE ENERGY DEVELOPMENT: THE CASE OF GROUND-MOUNT SOLAR IN RURAL ONTARIO

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Résumé

Le remplacement des combustibles fossiles par des ressources énergétiques renouvelables est essentiel pour atténuer le changement climatique. La mise en œuvre de systèmes d'énergie renouvelable entraîne des changements radicaux dans les paysages locaux; par exemple, des éoliennes parsemant un paysage rural ou des panneaux solaires couvrant des terres fertiles qui fournissaient auparavant de la nourriture. Ces changements peuvent susciter une forte opposition sociale, même parmi les personnes généralement favorables aux ER. La recherche suggère que les tensions publiques autour du développement des énergies renouvelables sont réduites grâce à des processus décisionnels inclusifs (c.-à-d. amélioration de la justice procédurale) ainsi que le partage des avantages (c.-à-d. , amélioration de la justice distributionnelle). Nous développons et testons un processus de planification spatiale proactive et inclusive pour le développement des ER dans une région. Notre travail combine une cartographie participative et une analyse des sentiments basée sur des sondages et des groupes de discussion afin de comprendre les préoccupations de la communauté autour des projets d'énergie renouvelable, et comment ces préoccupations sont reflétées dans l'espace. Nous avons mené une étude de cas sur les systèmes d'énergie solaire au sol dans la ville de Caledon, Ontario, Canada. À partir de cette étude, nous avons cherché à déterminer quelles régions et quels types de paysages les membres de la communauté pourraient trouver acceptables ou non pour de nouveaux projets solaires, et à faciliter le dialogue sur les opportunités et les impacts potentiels avec le grand public, les principales parties prenantes et les influenceurs (services publics, propriétaires, promoteurs, personnel municipal) dans la localité.

Mots-clés: énergies renouvelables, aménagement du territoire, cartographie participative, énergie solaire

Abstract

Displacing fossil fuels with renewable energy resources is essential to mitigate climate change. The implementation of renewable energy systems brings stark changes to local landscapes; e.g., wind turbines dotting a rural landscape, or solar panels covering fertile land that previously supplied food. These changes can evoke strong social opposition, even among people who are generally supportive of renewable energy (RE). Research suggests that public tensions around renewable energy development are reduced through inclusive decision-making processes (i.e., improved procedural justice) as well as benefits sharing (i.e., improved distributional justice). We develop and test a process for proactive and inclusive spatial planning for RE development in a region. Our work combines participatory mapping and survey- and focus-group-based sentiment analysis in order to understand community concerns around renewable energy projects, and how those concerns are reflected spatially. We conducted a case study on ground-mount solar energy systems in the Town of Caledon, Ontario, Canada. From this study, we aimed to determine what regions and kinds of landscapes community members might find acceptable or not for new solar projects, and to facilitate dialogue about opportunities and potential impacts with the general public, key stakeholders, and influencers (utilities, land-owners, developers, municipal staff) in the locality.

Keywords: renewable energy, spatial planning, participatory mapping, solar energy

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INTRODUCTION

The rapid development of renewable energy resources is imperative if we are to avoid the worst effects of climate change, maintain a clean local environment, and drive local economic development opportunities. At the same time, the transition to renewable energy (RE) is having profound implications on land-use systems and landscapes. Wind turbines are an increasingly common sight in rural areas, altering the aesthetics of the landscape and introducing a new risk to bird and bat populations, while massive fields of solar panels now cover fertile land that previously supplied food. Land and crops that once fed people are now feeding biofuel markets. These land-use trade-offs and landscape impacts underpin local opposition to RE projects (Cleland et al., 2016; Pasqualetti, 2011; Wolsink, 2018), particularly in regions that have well-established land-based livelihoods through some combination of agricultural, forestry, and tourism. Indeed, even where support for RE is generally favourable, support for specific projects is usually lower, largely as a function of these site-specific issues: a phenomenon referred to as the ‘social gap’ (Bell et al., 2013).

Collaborative and inclusive planning processes are critical to understanding and resolving this social gap. Research has shown local citizens to be insistent on some form of public participation in the planning process for RE development and, furthermore, see opposition to these projects as a lack of public participation and procedural injustice (Adams et al., 2011; Firestone et al., 2020; Giordano et al., 2018; Rand & Hoen, 2017; Simcock, 2016; Walker & Baxter, 2017; Wolsink, 2007). In many cases, opposition is not toward the wind turbines or the solar panels directly, but to the decision-making process and social relations through which that infrastructure came to be present on the landscape.

One way to better understand and address social opposition to RE development is through inclusive spatial planning (Calvert et al., 2019). Spatial planning is an “integrative, (preferably) public sector-led socio-spatial process through which a

vision, coherent actions, and means for implementation are produced that shape and frame what a place is and what it might become” (Albrechts, 2006, p. 1152). It is not a reactive engagement process, as in a town-hall announced to discuss a project that has already been conceived and proposed. Instead, it is proactive in that it aims to shape the conditions under which new projects are conceived and proposed in the first place. In theory, it breaks free from hierarchical planning processes to embrace inclusiveness (Healey, 2006). The explicitly ‘spatial’ aspect is critical for RE development, given the spatially diffuse and land-intensive nature of renewable energy systems (Calvert & Simandan, 2010; McCarthy, 2015). Furthermore, the place-specific context is a critical factor in shaping community concerns around proposed RE development (Devine-Wright & Wiersma 2020). Connecting the conversation to the landscapes and places that matter to people can unpack public sentiment around local RE development. In other words, inclusive spatial planning allows planners and analysts to ask about how specific technologies might ‘fit’ into particular landscapes (Devine-Wright & Wiersma 2020), and what new kinds of landscapes and relationships to those landscapes these technologies might co-produce (c.f. Albrechts et al., 2020).

To date, however, techniques for inclusive spatial planning related to RE are underdeveloped. Although knowledge about causes of public opposition is strong, scholarship is lacking in solutions (Cohen, Reichl, & Schmidthaler, 2013), particularly solutions that are delivered ‘upstream’ well before a technology or project is actually proposed in an area (Devine-Wright & Wiersma 2020). With this in mind, the purpose of this study is to develop and implement an inclusive spatial planning process for RE development. We report on this methodology using a case-study approach in the Town of Caledon, a lower-tier municipality in the Regional Municipality of Peel, Ontario, Canada, that has high technical potential for land-based RE development from wind, solar, and biomass resources. The paper unfolds as follows. First, we

review techniques that have been used to establish inclusive spatial planning processes for RE development. Second, we formulate an approach that addresses some of the shortcomings upon which spatial planning processes have been designed to plan for RE development. Third, we present outputs from this approach and reflect on the extent to which they could guide formal spatial plans for RE development.

INCLUSIVE SPATIAL PLANNING AND RENEWABLE ENERGY DEVELOPMENT

Spatial planning for renewable energy development is often rooted in a multi-criteria analysis (MCA) using a geographic information system (GIS), whereby sites are identified and/or ranked based on a wide range of geophysical, technical, and legal factors (Angelis-Dimakis et al., 2011; Anwarzai & Nagasaka, 2017; Díaz et al., 2018; Guo et al., 2020; Lopez, Roberts, Heimiller, Blair, & Pollo, 2012; Marques et al., 2014; Villacreses et al., 2017). Typically, MCA are based on GIS, and begin with a goal or a set of goals that the analyst or decision-maker would like to achieve, along with evaluation criteria or attributes which form the basis of decision: for example, optimizing for profit or balancing profit maximization with minimizing local environmental impacts. In the context of RE development, this typically involves guiding RE development toward areas that are considered ‘lower impact,’ while accounting for regulated/mandated land use priorities (Ruggiero et al., 2014; Wüstenhagen et al., 2007). One way to make this process inclusive is to solicit input from the community on which objectives are to be optimized, or which evaluation criteria and attributes should be weighted more heavily in the assessment (Adams et al., 2011; Giordano et al., 2018; Rand & Hoen, 2017; Simcock, 2016; Walker & Baxter, 2017). This approach leaves a lot of analytical control in the hands of the ‘expert’ who must ultimately translate input into algorithms and cartographic models that reflect stated values.

One alternative to this analyst-driven process is participatory mapping, loosely defined as a method that focuses on providing those with limited access

to GIS knowledge and decision-making power access to geographic information technologies so that their spatial knowledge may be included directly in decision-making processes (Mukherjee, 2015). Providing the public with a tangible way to influence spatial planning decisions is a key component to the attractiveness of this technique, particularly in the world of natural resource management and conservation (Brown, Reed & Raymond, 2020; Brown & Raymond, 2014; Boucquey et al., 2016; Mukherjee, 2015; Strickland-Munro et al., 2016). Others caution that participatory mapping is limited by technological and social barriers, e.g., map illiteracy or computer illiteracy (when mapping is done online) (Byrne & Pickard, 2016).

These challenges notwithstanding, there are already examples of participatory mapping being used in RE spatial planning. Mekonnen and Gorsevski (2015) conducted a hypothetical case study for offshore wind farm suitability in Lake Erie, Ohio, that used web-based participatory mapping and allowed users to select and rank relevant criteria for the purpose of creating maps as spatial output to visualize optimal site locations for the project. This study was strictly methodological, for the purpose of demonstrating the flexibility and depth of a prototype. Another recent study conducted in the Kimberley coastal region of northwest Australia used an online participatory mapping interface that allowed users to choose icons indicating a particular place value or resource management activity (i.e., ‘aesthetics’ as a value or ‘exclude oil/gas development as a management activity’) and distribute them throughout the map to highlight areas that are valuable to them, or where they feel certain management practices should occur (Strickland-Munro et al., 2016). Researchers engaged 372 respondents and used their findings to create maps representing the most important place value and management preferences, which local decision-makers and land use planners may use (Strickland-Munro et al., 2016).

In examples described above, engagement is still mostly ‘at a distance.’ These platforms are hosted

mainly online, which means relatively little interaction between the participant and the mapping professionals or the decision-makers who are interested in the results of the mapping process. This lack of interaction is significant for two reasons. First, it can lead to a sense of powerlessness among participants: that their input is going into a ‘black box’ and is not meaningful. Second, misperceptions about particular places or particular activities are more likely to prevail and manifest in the participants mapping decisions; misperceptions that could otherwise be discussed and/or corrected through face-to-face interactions. In other words, without interaction, wider community debates and concerns are not engaged and any map outputs or plans developed on the basis of map outputs are less likely to be seen as legitimate (Moss et al., 2015; Pitt & Bassett, 2013). Indeed, a dialogue-based or interactive approach helps to build networks, manage expectations and facilitate learning: all of which are widely recognized as the most important factors to achieving broad, system-level energy goals (Hoppe et al., 2015; Pitt & Bassett, 2013).

History is replete with poor and often counter-productive collaborative planning processes that tend to reach only the ‘same ten people’; i.e., rarely extending beyond easily motivated and directly vested citizens (Colvin et al., 2016; Warbroek & Hoppe, 2017). One major underlying problem is that innovations in community engagement focus primarily on techniques (e.g., focus groups vs. charrettes) rather than unpacking the *purpose* of community participation, and the *outcomes* that are needed from engagement, in the first place (Bickerstaff & Walker, 2001). Addressing purpose and anticipated outcomes is crucial to designing effective engagement processes.

A PARTICIPATORY MAPPING APPROACH

The methodology used in this work is best described as ‘map elicited’ engagement. Eliciting conversation and ideas with a map fosters a place-based conversation, focusing general imaginaries of RE (e.g., abundant, inclusive, sustainable, costly, noisy, and so on) on actual places and landscapes

that matter to people, and connecting these imaginaries to actual sites and landscapes at which RE systems might be developed. In other words, when the conversation is grounded through participatory mapping, general impressions of RE energy are sharpened, polished, or corrected. It opens opportunities to align communities of interest (interests in accelerating implementation of RE) with communities of place (interests in the form and function of particular landscapes) which, in turn, tends to foster a higher level of understanding and acceptance (Baxter et al., 2020).

As a starting point, the conversation begins by asking participants to indicate on the map any areas that they might find ‘acceptable,’ ‘not acceptable,’ or ‘conditional/possible’ for the development of a particular RE resource. The base-map used for participatory mapping includes results of a technical analysis that identifies where RE resources could be legally developed under existing regulations, using a color gradient to indicate the relative economic feasibility of development. Previous experience shows that respondents are less likely to provide their own input without this guidance and will instead quickly defer to ‘experts.’ Providing a highly generalized map of feasibility is a way to start the conversation. To help overcome barriers of map illiteracy, participants are guided with the support of analysts, including access to online mapping technologies/satellite imagery and contextual information (e.g., information about existing land-uses) that participants often find helpful when interacting with a map.

One notable issue when using static papers maps is around ‘scale,’ because the marker (sticker) used to make an indication on the map for a particular site or area can cover tens of hectares or square kilometers, depending on the scale of analysis. Participants are given a reference of scale to help ensure they consider it when making choices, and conversations or annotations are used to be more specific when appropriate (e.g., “this site is unacceptable because it is a vibrant greenspace” which we can take to mean that the individual means to indicate the entire greenspace, or *only* the

greenspace, as unacceptable). Because this is a planning tool, and not a siting tool (i.e., we are gather information to establish plans rather than to locate a specific project), this level of granularity and margin of error in map precision is acceptable.

The map-elicited methodology unfolds in three stages, summarized in Figure 1 and with details provided in sub-sections below. Each stage involves variations of the methodology depending on the objectives of engagement, in order to ensure that as broad a range of participants as possible are able to engage in the exercise. In all phases, a map is produced to indicate areas of least conflict or highest collective preference. The annotations and conversations surrounding the map product, meanwhile, provides insight on sentiment toward RE more generally.

Map input from participants are collected mostly as a point or series of points, although in some cases respondents provided their map indications as an area or polygon. Each indication was tagged with a respondent ID to cross-reference to their written survey responses. Overlapping or clustered points/areas are interpreted as higher levels of interest in particular places. Written responses and notes are coded using the VESPA framework developed by Petrova (2016). VESPA refers to the high level, first-order themes that characterize sentiment to RE in terms of focusing on visual, environmental, socioeconomic, and procedural aspects. A second round of coding is conducted to identify secondary themes. Crucially, this study codes for ‘nature of support’ which indicates whether the comment was supportive, unsupportive, or qualified within each theme (see also Calvert et al., 2019; Fast, 2015).

In the end of the three phases we are able to communicate broad trends in terms of public sentiment toward RE, as well as the kinds of places, landscapes, and features that are more or less likely to receive support for project development. This information can be used as a basis upon which to develop a spatial plan for RE. Our work does not go so far as to propose a spatial plan for RE development, and all participants were notified that the work is a proof-of-concept and not connected to

a formal decision-making process. That said, in terms of the International Association for Public Participation, the approach described below assumes that participants are at the very least “involved” in the planning process: that is, their concerns are reflected in the alternatives assessed and decisions made in terms of any spatial plan that emerges from the process.

Community Engagement	Stakeholder Engagement	Capacity-holder Engagement	
Who?	Individuals entitled to participate in discussions about major changes to their local landscape	Individuals / organizations who stand to directly gain or lose from decisions about RE development	Individuals / organizations who possess resources and mandates that can drive RE projects
Why?	<ul style="list-style-type: none">• Identify key concerns across population• Raise awareness	<ul style="list-style-type: none">• Discuss specific issues and impacts, including options to mitigate	<ul style="list-style-type: none">• Facilitate cross-sector dialogue to identify common opportunities
How?	<ul style="list-style-type: none">• Bring information to community spaces (library, farmer's market)• Open-ended surveys	<ul style="list-style-type: none">• Targeted invitations to key constituencies• Focus group centered on specific theme / issue	<ul style="list-style-type: none">• Targeted invitations to key constituencies• Focus group centered on specific theme / issue

Figure 1. A framework for organizing participatory mapping processes.

Community engagement

A survey tool and a mapping exercise is conducted at multiple community spaces over the course of a few weeks to one month; including libraries, recreation centers, and farmers markets. In taking the engagement to multiple locations, at different times of the day, the aim is to align data gathering to spatial and temporal rhythms that are likely to connect to as broad a cross-section of the community as possible. Each engagement session at each location is approximately four hours, which includes frequent 10 to 15 minute interactions with individual members of the community.

The survey is designed to gauge general sentiment around RE technologies, asking questions about particular technologies and the conditions under which they would be considered appropriate for the region. Respondents are asked to submit responses into a tablet computer, with technical support from a researcher. Administering the survey in person

Participatory Mapping and Renewable Energy Development

helped to facilitate conversations, along with opportunities for shared learning and correcting common misperceptions about specific technologies. At the same time, respondents were in no way compelled to share their responses verbally, and therefore had the chance to provide feedback discretely.

After completing the survey, participants place markers on a mounted paper map to indicate their concerns and preferences around possible RE development opportunities within the region. This provides an opportunity for participants to reflect their concerns spatially, relative to their community. In red, they indicated where they did not want to see new PV systems developed and in green they indicated where they would like to see new PV systems developed. Respondents are also given the option of 'yellow' which represents a conditional support – e.g., in a case where a respondent would support development as long as certain conditions around system design or ownership was met. We provide a reference for scale to the participant, showing them the total area (approximately 10 hectares) represented by each marker. As participants are making their indications on the map, a researcher is taking notes to capture the sentiment and the logic underpinning participants mapping decisions. These notes are cross-referenced anonymously to the map indicator. After each session, the paper map is digitized and all notes are transcribed for analysis.

Stakeholder engagement

Stakeholder engagement is much more targeted in terms of the individuals that are involved and the concerns that are addressed. One way to organize stakeholder engagement in the context of RE is to consider different stakeholders' relationships to the land, which is heavily dependent on what people do with/in a particular landscape (Colvin et al., 2016). With this in mind, stakeholder engagement efforts focus primarily on two stakeholder groups: farmers and naturalists/recreationalists. These two groups have historically been at the 'front lines' of support and opposition to RE systems, primarily because they have a very intimate relationship with the

landscape that is so fundamentally altered by RE development. The stakeholder groups targeted will change depending on geographic and social/political context.

This involves a combination of purposive and snowball sampling techniques. The purposive sampling is guided by a stakeholder mapping exercise to ensure an illustrative sample of key stakeholder groups, which is especially important in cases where time and resource limits prevent a statistically representative sample. Consistent with Colvin et al. (2016), mapping stakeholder groups helps to ensure forethought that allows the sample to go beyond 'the usual suspects.'

Focus-group meetings of approximately four hours were held with representatives of these stakeholder groups. Participants are given a small paper map which includes space for the participants to write down their thoughts/concerns about their support or opposition to the particular RE technology of interest. Participants are encouraged to develop their own legend to ensure that their thoughts/concerns can be cross-referenced to specific indications on the map. After this individual exercise, all participants are brought together to contribute to a single, larger map. This part of the exercise facilitates peer-to-peer dialogue and learning while discussing particular opportunities or impacts in their region of shared interest. A note-taker captures the nature of the dialogue for later analysis.

Capacity-Holder engagement

RE projects are only developed if/when individuals and organizations that hold 'capacity' facilitate them. The particular capacity-holders will vary with geographic context but typically involves the willingness/ability of: developers/financiers to invest at a particular location; the electric utility to enable connection to the grid; planners to zone accordingly; Indigenous groups to enable access to land; and so on. Methodologically, capacity-holder participatory mapping is similar to stakeholder participatory mapping. Representatives of capacity-holder groups are given a small paper map which includes space for the participants to write down

their thoughts/concerns about their support or opposition to the particular RE technology of interest. Our capacity-holder focus-group allows us to identify specific areas that might be of common interest among these enablers. By engaging these individuals separately, rather than as part of community and stakeholder engagement, we reduce the chance that these ‘experts’ dominate the conversation at a public meeting and ensure that we are separating their role as the audience of the community and stakeholder mapping stages, but also as contributors to the overall mapping process.

Case Study and Data Analysis

The methodology described above was applied in the Town of Caledon, within the Regional Municipality of Peel, Ontario, Canada (Figure 2) in 2018. Based on input from municipal staff, participatory mapping focused on solar energy resources only. Wind and biomass energy development were highly contentious in the region at the time. The purpose of the research was to test and refine the methodology while stimulating dialogue in the community, and we did not want to weigh in directly on, and reignite, controversial topics. Discussing solar energy was a way to enter

into conversations about RE amicably, rather than addressing the most contentious issues at the start.

RESULTS AND DISCUSSION

The community survey was completed by 112 individuals, 81 of whom are residents of the Town proper. From those survey results, it was clear that solar energy had the highest level of support from the general community, due primarily to the fact that it was perceived as less intrusive to the landscape and could be developed at a small scale and therefore owned by residents. Participants’ interest in having more ownership over their energy production was often coupled with a desire for more participation in the planning process of local RE development. In general, participants were most concerned with the efficiency of renewable energy technologies (i.e., being cognizant of choosing projects that give the most ‘bang for our buck’ in the area) and positive environmental effects that could come from increased renewable energy development. Wind and biomass energy received the lowest support; though it is important to note that biomass as well as biogas options were least well understood. Many respondents noted these options as intriguing, but ranked them lowest due to lack of information.

The focus group meetings for the stakeholders and capacity holders each had a participant pool of approximately 10 people. The stakeholder groups represented included local environmental organizations, community groups, and farmers. The capacity-holder groups represented included planners from the Town as well as at the Regional Municipality of Peel (Caledon’s upper tier municipality), Ontario’s electricity system operator, and conservation authorities. The conversation among stakeholders – farmers and recreationalists – centered heavily on reusing land that has already been used for industrial purposes, and in particular a decommissioned gravel pit near Caledon East. Stakeholders and capacity-holders were in general clearly unsupportive of the southern area of the Town, primarily because it hosts all of the Town’s ‘prime’ agricultural land, which is in relatively short supply across the region due to urban expansion.

Figure 2. Study area: the Town of Caledon.

Participatory Mapping and Renewable Energy Development

Results from the community engagement show some support for this southern area, but in few cases was the trade-off over prime agricultural land acknowledged by the general community.

The results of the mapping process for each stream – community, stakeholders, capacity-holders – are visualized below in Figures 3, 4, and 5. Overall, the maps suggest a possibility for low conflict and high support in an area just north of Bolton, where a cluster of ‘acceptable’ indicators were marked by the general community, as well as by stakeholders and capacity-holders. Based on feedback from participants, this area seemed to be in a ‘goldilocks zone’: far enough from major population centers to be mostly ‘out of sight,’ close enough to population centers to limit the need for transmission infrastructure, and sufficient ‘open space’ (though currently in use as commercial agriculture).

Several actions might be taken based on this information. Municipal staff may approach the landowners in the area to discuss whether a RE project may be of interest. Indeed, most of the land that presents an opportunity for RE development is currently owned by private interests. Early engagement, and creative partnerships will be necessary to realize these opportunities. Municipal staff may also amend their land-use by-law to include a ‘green zone,’ and to designate this area as such. Green zoning policies have been used to clarify the kinds of land-use types that may be eligible for large-scale RE development and to specify the conditions under which a project would be granted a permit to proceed. One example comes out of Saint John New Brunswick (see Saint John, 2019) which implemented a green zoning policy to support the development of a new wind farm in the municipality, while also providing clarity to prospective developers on which lands might be developed for RE generation moving forward. In other words, the results of this mapping exercise are not an answer or a solution, *per se*, but provide the basis upon which thoughtful actions can be developed.

In many cases, respondents were reluctant to provide any indications on the map. In some of

Figure 3. Participatory mapping output from community engagement.

Figure 4. Participatory mapping output from stakeholder engagement

Figure 5. Participatory mapping output from capacity-holder engagement.

these cases, respondents did not feel sufficiently qualified or informed and therefore unwilling to provide any firm suggestions on the map. The base-map included results of a technical assessment, which identified areas that met very basic technical criteria. This alleviated some concerns, but not all. Other respondents felt as if placing a marker on the map is presumptuous, knowing that any indication they made would implicate land and resources they did not own or have much direct relationship with. Here, we note that participatory mapping and spatial planning “recognize[s] borders and cohesions, but also the tensions, exclusions and conflicts which these generate” (Healey, 2006). Displaying and indicating a plot of land as ‘acceptable’ for RE development, for example, can be perceived as a ‘threat’ of pending land appropriation and landscape change for energy development and some participants were reluctant to contribute to that anxiety. In addition, it was noted that Indigenous voices are immediately marginalized when the base map includes settler-imposed boundaries and place-names. It is hard to imagine starting a participatory mapping exercise in a way that completely avoids these tensions, and as such, inclusive spatial planning and participatory mapping must create space for these tensions to unfold, bubble up, and shape the conversation.

Indeed, we need to be clear here that the purpose of the exercise is not to ‘get to yes’ or to ‘acquire social license’ to build projects in the area. Rather, the purpose is to foreground place-based concerns and opportunities to inform renewable energy action plans and investment strategies at the local level. Asking participants to consider where they might deem acceptable, and evoking a sense of environmental justice – i.e., considering who we are asking to live near new energy infrastructure; what types of landscape trade-offs we are implying; and who participates in these decisions in the first place – is precisely the point.

Although the process does not entirely break free from hierarchical and technocratic approaches, to the extent that official Town boundaries and the outputs of a technical modeling exercise serve as its

starting point, it is trending in the direction of inclusiveness and stitching together multiple interests. Rather than bringing a singular or dominating images of space and place to do the work of planning for RE future, we aim to bring together many, often fragmented, views using a form of participatory mapping.

CONCLUSION

Renewable energy development has been subject to significant public opposition, expressed as site-level demonstrations, explosive town hall meetings, and municipalities declaring themselves ‘unwilling hosts’ of wind farms. Opposition is common to all forms of development. But for many observers, the strength of local opposition to RE can be surprising, given that opinion polls often show widespread support for RE development. In literature, this is called the ‘social gap’ problem: i.e., the gap between support in general, but opposition to specific projects (Bell et al., 2013). This gap is often wider when communities are not involved in the decision-making process, and when the benefits of development are limited to land-owners and developers, even as the impacts are felt by the entire community (Walker & Baxter, 2017). One way to close the gap around opposition-support for renewables is to ensure meaningful engagement at the agenda-setting stage of RE development.

The approach described in this paper aims to do just that: to incorporate community and stakeholder voices into spatial and land-use planning process. In this way, the approach connects energy planning with inclusive spatial planning and collaborative planning theory, which “reframes the role of planners, arguing that rather than serving as subject-matter experts, their more important responsibilities lie in consensus building and the facilitation of participatory decision making processes that involve community residents and stakeholders” (Pitt & Bassett 2013, p. 283). Indeed, the outputs from all stages of participatory mapping can be combined to show compatibility and high density of willingness to accept a project. On this basis, actionable partnerships and policies can be developed to accelerate implementation in areas

that have already been deemed technically and politically feasible. Notably, this mapping exercise can inform the development of green zoning policies as described above, in the case of Saint John, New Brunswick, and can support municipal staff and prospective developers as they prioritize opportunities to pursue in the community. That said, these outputs do not provide answers – i.e., they do not in and of themselves decide where the next RE system will be implemented. Their purpose is to help establish the common values and conditions through which new projects will be conceived and proposed. And, perhaps more importantly, the process can advance the conversation about the new kinds of landscapes RE infrastructure will generate, and about the land-use tradeoffs that are implied by the transition to RE.

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REFERENCES

- Adams, M., Wheeler, D., & Woolston, G. (2011). A participatory approach to sustainable energy strategy development in a carbon-intensive jurisdiction: The case of Nova Scotia. *Energy Policy*, 39(5), 2550–2559. <https://doi.org/10.1016/j.enpol.2011.02.022>
- Albrechts, L., Barbanente, A., & Monno, V. (2020). Practicing transformative planning: The territory-landscape plan as a catalyst for change. *City, Territory and Architecture*, 7(1), 1. <https://doi.org/10.1186/s40410-019-0111-2>
- Angelis-Dimakis, A., Biberacher, M., Dominguez, J., Fiorese, G., Gadocha, S., Gnansounou, E., ... Robba, M. (2011). Methods and tools to evaluate the availability of renewable energy sources. *Renewable and Sustainable Energy Reviews*, 1182–1200. <https://doi.org/10.1016/j.rser.2010.09.049>
- Anwarzai, M. A., & Nagasaka, K. (2017). Utility-scale implementable potential of wind and solar energies for Afghanistan using GIS multi-criteria decision analysis. *Renewable and Sustainable Energy Reviews*, 71, 150–160. <https://doi.org/10.1016/j.rser.2016.12.048>
- Baxter, J., Walker, C., Ellis, G., Devine-Wright, P., Adams,

Participatory Mapping and Renewable Energy Development

- M., & Fullerton, R. S. (2020). Scale, history and justice in community wind energy: An empirical review. *Energy Research & Social Science*, 68, 101532. <https://doi.org/10.1016/j.erss.2020.101532>
- Bell, D., Gray, T., Haggett, C., & Swaffield, J. (2013). Re-visiting the ‘social gap’: Public opinion and relations of power in the local politics of wind energy. *Environmental Politics*, 22(1), 115–135. <https://doi.org/10.1080/09644016.2013.755793>
- Bickerstaff, K., & Walker, G. (2001). Participatory Local Governance and Transport Planning. *Environment and Planning A: Economy and Space*, 33(3), 431–451. <https://doi.org/10.1068/a33173>
- Boucquey, N., Fairbanks, L., St. Martin, K., Campbell, L. M., & McCay, B. (2016). The ontological politics of marine spatial planning: Assembling the ocean and shaping the capacities of ‘Community’ and ‘Environment.’ *Geoforum*, 75, 1–11. <https://doi.org/10.1016/j.geoforum.2016.06.014>
- Brown, G., & Raymond, C. M. (2014). Methods for identifying land use conflict potential using participatory mapping. *Landscape and Urban Planning*, 122, 196–208. <https://doi.org/10.1016/j.landurbplan.2013.11.007>
- Brown, G., Reed, P., & Raymond, C. M. (2020). Mapping place values: 10 lessons from two decades of public participation GIS empirical research. *Applied Geography*, 116, 102156. <https://doi.org/10.1016/j.apgeog.2020.102156>
- Byrne, D., & Pickard, A. J. (2016). Neogeography and the democratization of GIS: A metasynthesis of qualitative research. *Information, Communication & Society*, 19(11), 1505–1522. <https://doi.org/10.1080/1369118X.2015.1125936>
- Calvert, K., Greer, K., & Maddison-MacFadyen, M. (2019). Theorizing energy landscapes for energy transition management: Insights from a socioecological history of energy transitions in Bermuda. *Geoforum*, 102, 191–201. <https://doi.org/10.1016/j.geoforum.2019.04.005>
- Calvert, K., & Simandan, D. (2010). Energy, space, and society: A reassessment of the changing landscape of energy production, distribution, and use. *Journal of Economics and Business Research*, 16, 13–37.
- Cleland, M., Bird, S., Fast, S., Sajid, S., & Simard, L. (2016). *A Matter of Trust: The Role of Communities in Energy Decision-Making*. Ottawa, ON: Canada West Foundation and University of Ottawa.
- Cohen, J. J., Reichl, J., & Schmidthaler, M. (2014). Re-focussing research efforts on the public acceptance of energy infrastructure: A critical review. *Energy*, 76, 4–9. <https://doi.org/10.1016/j.energy.2013.12.056>
- Colvin, R. M., Witt, G. B., & Lacey, J. (2016). Approaches to identifying stakeholders in environmental management: Insights from practitioners to go beyond the ‘usual suspects.’ *Land Use Policy*, 52, 266–276. <https://doi.org/10.1016/j.landusepol.2015.12.032>
- Devine-Wright, P., & Wiersma, B. (2020). Understanding community acceptance of a potential offshore wind energy project in different locations: An island-based analysis of ‘place-technology fit.’ *Energy Policy*, 137, 111086. <https://doi.org/10.1016/j.enpol.2019.111086>
- Díaz-Cuevas, P., Biberacher, M., Domínguez-Bravo, J., & Schardinger, I. (2018). Developing a wind energy potential map on a regional scale using GIS and multi-criteria decision methods: The case of Cadiz (south of Spain). *Clean Technologies and Environmental Policy*, 20(6), 1167–1183. <https://doi.org/10.1007/s10098-018-1539-x>
- Fast, S. (2015). Qualified, absolute, idealistic, impatient: Dimensions of host community responses to wind energy projects. *Environment and Planning A: Economy and Space*, 47(7), 1540–1557. <https://doi.org/10.1177/0308518X15595887>
- Firestone, J., Hirt, C., Bidwell, D., Gardner, M., & Dwyer, J. (2020). Faring well in offshore wind power siting? Trust, engagement and process fairness in the United States. *Energy Research & Social Science*, 62, 101393. <https://doi.org/10.1016/j.erss.2019.101393>
- Giordano, L. S., Boudet, H. S., Karmazina, A., Taylor, C. L., & Steel, B. S. (2018). Opposition “overblown”? Community response to wind energy siting in the Western United States. *Energy Research & Social Science*, 43, 119–131. <https://doi.org/10.1016/j.erss.2018.05.016>
- Guo, J., Fast, V., Teri, P., & Calvert, K. (2020). Integrating Land-Use and Renewable Energy Planning Decisions: A Technical Mapping Guide for Local Government. *ISPRS International Journal of Geo-Information*, 9(5), 324. <https://doi.org/10.3390/ijgi9050324>
- Healey, P. (2006). Relational complexity and the imaginative power of strategic spatial planning. *European Planning Studies*, 14(4), 525–546. <https://doi.org/10.1080/09654310500421196>
- Hoppe, T., Graf, A., Warbroek, B., Lammers, I., & Lepping, I. (2015). Local Governments Supporting Local Energy Initiatives: Lessons from the Best Practices of Saerbeck (Germany) and Lochem (The Netherlands). *Sustainability*, 7(2), 1900–1931. <https://doi.org/10.3390/su7021900>
- Lopez, A., Roberts, B., Heimiller, D., Blair, N., & Porro, G. (2012). *US renewable energy technical potentials: a GIS-based analysis*. (July).
- Marques, A. T., Batalha, H., Rodrigues, S., Costa, H., Pereira, M. J. R., Fonseca, C., ... Bernardino, J. (2014). Understanding bird collisions at wind farms: An updated review on the causes and possible mitigation strategies. *Biological Conservation*, 179, 40–52. <https://doi.org/10.1016/j.biocon.2014.06.014>

Participatory Mapping and Renewable Energy Development

doi.org/10.1016/j.biocon.2014.08.017

- McCarthy, J. (2015). A socioecological fix to capitalist crisis and climate change? The possibilities and limits of renewable energy. *Environment and Planning A: Economy and Space*, 47(12), 2485–2502. <https://doi.org/10.1177/0308518X15602491>
- Mekonnen, A. D., & Gorsevski, P. V. (2015). A web-based participatory GIS (PGIS) for offshore wind farm suitability within Lake Erie, Ohio. *Renewable and Sustainable Energy Reviews*, 41, 162–177. <https://doi.org/10.1016/j.rser.2014.08.030>
- Moss, T., Becker, S., & Naumann, M. (2015). Whose energy transition is it, anyway? Organisation and ownership of the Energiewende in villages, cities and regions. *Local Environment*, 20(12), 1547–1563. <https://doi.org/10.1080/13549839.2014.915799>
- Mukherjee, F. (2015). Public Participatory GIS: History, Literature Review and Sustainability of PPGIS. *Geography Compass*, 9(7), 384–394. <https://doi.org/10.1111/gec3.12223>
- Pasqualetti, M. J. (2011). Social Barriers to Renewable Energy Landscapes*. *Geographical Review*, 101(2), 201–223. <https://doi.org/10.1111/j.1931-0846.2011.00087.x>
- Petrova, M. A. (2016). From NIMBY to acceptance: Toward a novel framework — VESPA — For organizing and interpreting community concerns. *Renewable Energy*, 86, 1280–1294. <https://doi.org/10.1016/j.renene.2015.09.047>
- Pitt, D., & Bassett, E. (2013). Collaborative Planning for Clean Energy Initiatives in Small to Mid-Sized Cities. *Journal of the American Planning Association*, 79(4), 280–294. <https://doi.org/10.1080/01944363.2014.914846>
- Rand, J., & Hoen, B. (2017). Thirty years of North American wind energy acceptance research: What have we learned? *Energy Research & Social Science*, 29, 135–148. <https://doi.org/10.1016/j.erss.2017.05.019>
- Ruggiero, S., Onkila, T., & Kuittinen, V. (2014). Realizing the social acceptance of community renewable energy: A process-outcome analysis of stakeholder influence. *Energy Research & Social Science*, 4, 53–63. <https://doi.org/10.1016/j.erss.2014.09.001>
- Saint John. (2019). [By-law Number C.P. 111-82: A Law to Amend the Zoning By-Law of the City of Saint John](#).
- Simcock, N. (2016). Procedural justice and the implementation of community wind energy projects: A case study from South Yorkshire, UK. *Land Use Policy*, 59, 467–477. <https://doi.org/10.1016/j.landusepol.2016.08.034>
- Strickland-Munro, J., Kobryn, H., Brown, G., & Moore, S. A. (2016). Marine spatial planning for the future: Using Public Participation GIS (PPGIS) to inform the human dimension for large marine parks. *Marine Policy*, 73, 15–26. <https://doi.org/10.1016/j.marpol.2016.07.011>
- Villacreses, G., Gaona, G., Martínez-Gómez, J., & Jijón, D. J. (2017). Wind farms suitability location using geographical information system (GIS), based on multi-criteria decision making (MCDM) methods: The case of continental Ecuador. *Renewable Energy*, 109, 275–286. <https://doi.org/10.1016/j.renene.2017.03.041>
- Walker, C., & Baxter, J. (2017). Procedural justice in Canadian wind energy development: A comparison of community-based and technocratic siting processes. *Energy Research & Social Science*, 29, 160–169. <https://doi.org/10.1016/j.erss.2017.05.016>
- Warbroek, B., & Hoppe, T. (2017). Modes of Governing and Policy of Local and Regional Governments Supporting Local Low-Carbon Energy Initiatives; Exploring the Cases of the Dutch Regions of Overijssel and Fryslân. *Sustainability*, 9(1), 75. <https://doi.org/10.3390/su9010075>
- Wolsink, M. (2007). Wind power implementation: The nature of public attitudes: Equity and fairness instead of ‘backyard motives.’ *Renewable and Sustainable Energy Reviews*, 11(6), 1188–1207. <https://doi.org/10.1016/j.rser.2005.10.005>
- Wolsink, M. (2018). Social acceptance revisited: Gaps, questionable trends, and an auspicious perspective. *Energy Research & Social Science*, 46, 287–295. <https://doi.org/10.1016/j.erss.2018.07.034>
- Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy*, 35(5), 2683–2691. <https://doi.org/10.1016/j.enpol.2006.12.001>