CHARACTERIZING THE SOCIAL GAP IN UTILITY-SCALE SOLAR ENERGY

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ABSTRACT

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Many consider utility-scale photovoltaic solar power to be an essential component of decarbonizing the United States power sector and mitigating climate change. This technology is well accepted by the public in general surveys, yet often faces local resistance during project siting. This phenomenon is known as the "social gap." Using social gap theory from the wind energy literature as a foundation, this study examines the causes of and offers recommendations for addressing the solar social gap in Michigan. The study relied on 33 semi-structured interviews with citizens, government officials, and developers across four Michigan communities, each facing a prospective utility-scale solar project. Through thematic analysis, I show that the solar social gap can be attributed to both a vocal minority that dominated community sentiment and project proposals that failed to meet the community's standards for acceptable development. The gap was exacerbated by the presence of organized opposition groups as well as decision-makers relying on ineffective public processes to engage citizens. This research makes it clear that government officials and developers need to adopt practices that enhance community representation, process transparency, and decision-influence. Though decision-making strategies are not the only factor that affects community acceptance, implementing improved procedures could help close the solar social gap.

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1. INTRODUCTION

1.1. Background

Climate change is a critical issue with significant ecological and societal impacts. The Intergovernmental Panel on Climate Change estimates at least a 2° C increase in global temperatures by 2100 if our fossil-fuel intensive lifestyle prevails (IPCC Working Group I, 2013). Increasing temperatures will change hydrological systems and atmospheric circulation, resulting in conditions that will amplify temperature extremes, drought, flooding, and storms (USEPA, 2016; IPCC Working Group II, 2014; Kharin et al., 2018; Abram et al., 2021; Trenberth et al., 2018). This will cause alterations in species' range and habitat, threatening biodiversity (Thuiller, 2007). Further, climate change jeopardizes infrastructure, agricultural production, clean water access, availability of habitable land, and even human health, disproportionately affecting low-income communities and people of color (IPCC Working Group II, 2014; Levy & Patz, 2015; Otto et al., 2017; Shonkoff et al., 2011).

The most straightforward way to mitigate climate change is to rapidly transition to carbon-free fuel sources such as wind or solar. Hundreds of local governments and almost 15 states have committed to power their communities with 100% renewable energy (Sierra Club, 2021; Fields, 2021). The aspiration for a zero-emission grid has even been discussed at the national level (Fawthorp, 2020). Yet, there are still many challenges that need to be understood and handled appropriately to bring these goals to fruition. One of increasing importance is host community acceptance (Rand & Hoen, 2017; Firestone et al., 2018; Gross, 2007).

It is not uncommon for renewable energy developments to encounter project-impeding resistance during development (Waldon, 2021; Bradley, 2020; Johnston & Lafond, 2019; Solis, 2019; Schneider, 2019; Ehrmann, 2018). Aversion to renewables may be somewhat due to society's expectations of energy systems. The fossil-fuel industry has normalized the disconnect between energy production and energy consumption (Boudet, 2019). Fossil fuels tend to be harvested in one location and transported to another location where they are used. This practice has created an energy system that exists out of sight and out of mind for most people. However, wind and solar resources cannot be easily contained and moved like coal, oil, and natural gas. Instead, renewable technologies must go where the resources are to produce energy, which also happens to be where people are located. This often forces the integration of renewable energy infrastructure into communities, inevitably upsetting the norm (Wüstenhagen et al., 2007).

Onshore wind turbines are a pioneer for renewables, being one of the first to demonstrate that there are clean and competitive alternatives to fossil fuels (Kaldellis & Zafirakis, 2011). At the same time, wind farms are particularly notorious for encountering pushback from host communities (Simard, 2018; Pasqualetti, 2011; Fast et al., 2016). Michigan is just one of many states to experience postponements or cancellations of wind projects due to public opposition (Waldon, 2021; Bradley, 2020; Johnston & Lafond, 2019; Solis, 2019; Schneider, 2019; Ehrmann, 2018). Typical reasons for active resistance stem from concerns over aesthetics, place disruption, noise, socio-economic injustices, and wildlife impact (Rand & Hoen, 2017). Citizen uproar during project implementation seems to contradict opinion polls that claim 70% or more of the U.S. public support wind energy development (Rand & Hoen, 2017). This discrepancy between high support for wind energy in a general sense and low reception of wind farms on the ground is described as a "wind social gap" (Bell et al., 2005; Bell et al., 2013).

The wind social gap is suspected to form in part because of meager decision-making strategies (Bell et al., 2005; Wolsink, 1996; Gross, 2007; Jami & Walsh, 2017). The conventional “decide-announce-defend” method does not always handle community concerns appropriately. This framework involves government officials and developers making a decision, announcing it to the public, and defending any criticisms that come forth (Bell et al., 2005). Community members tend to get frustrated by this approach because there is no real opportunity to contribute to the decision at hand (Wolsink, 1996). Those that experience a limited ability to share their opinions or receive insufficient responses from project leaders actually become less accepting and adopt more negative attitudes toward wind farms (Motosu & Maruyama, 2016). The “decide-announce-defend” model is a manifestation of hierarchical decision-making that superficially permits public input. Failure by the decision-makers to address citizens’ concerns can result in the community using drastic measures such as protests, petitions, or legal actions to get their voice heard (Senecah, 2004; Lafond, 2019; Solis, 2019; Schneider, 2019; Heineman, 2020.) Consequently, wind farm proposals have been negatively impacted (Firestone et al., 2012; Waldon, 2021; Schneider, 2019; Ehrmann, 2018; Simard, 2018; Solis, 2019; Johnston & Lafond, 2019; Bradley, 2020). Not only are these outcomes unproductive because they may derail progress towards a clean energy future, but they also cause community division as well as distrust in government officials and developers (Gross, 2007; Upreti & van der Horst, 2004).

As these issues continue to be problematic for wind energy siting, it begs the question if other types of renewables will also be subject to similar experiences as they follow in the footsteps of this renewable energy trailblazer. Of particular interest is the next most prominent zero-emission technology in the lineup: photovoltaic (PV) solar.

1.2. Problem Statement

Solar PV is undoubtedly a key player in the future of energy (IRENEA, 2020). This technology continues to see cost reductions and is significantly contributing to new additions in generation capacity (USEIA, 2021; USEIA, 2020; IRENA, 2020) (see Section 1.8.1.). Utility-scale solar projects, i.e., ground-mounted systems that produce 50 MW of power or more for consumption by utility-users (see Section 1.8.), have a distinct competitive edge. As solar PV becomes increasingly attractive in the market, there will likely be a surge in development of large-scale solar arrays on what has been termed “sub-prime land” or land lacking one or more of the three prime requirements for development: solar resource potential, aesthetic buffers or distance from communities, and necessary grid capacity (D. Bessette, personal communication, May 5, 2020). Michigan may already be experiencing this trend (Acosta, 2017; Smith, 2020; Heineman, 2020; Balaskovitz, 2020; Asplund, 2020; Steeno, 2020).

Additionally, there is high national public acceptance for solar energy; over 80% of the U.S. supports its development (Reiner et al., 2006; Greenberg, 2009; Carlisle et al., 2015). Though, as we have learned from wind, favorable survey results do not always adequately reflect what is happening in reality. There has been documentation of community disapproval of solar developments in the Southwestern U.S. (Pasqualetti & Schwartz, 2013; Pasqualetti, 2011; Roth, 2019; Sokolova, 2020); one researcher has even identified the solar social gap in that area (Mulvaney, 2017). These utility-scale solar farms have been scrutinized for intermittency, aesthetics, socio-economic impacts, wildlife hazards, human health hazards, and cultural infringement (Boudet, 2019; Carlisle et al., 2014; Mulvaney, 2017). This response may provide a glimpse into what is to come as large-scale solar farm proposals expand beyond the Sun Belt. Therefore, there is a need to study how the deployment of utility-scale solar farms in unprecedented areas are received by the public compared to hypothetical circumstances, i.e., the unfolding of a Midwestern solar social gap.

There are a limited number of studies that have examined the acceptance[1] of people living near large-scale solar farms or having experienced local solar development in the Midwest. This may have been previously due to a lack of projects available to study; however, continued improvements are inviting more solar energy onto the grid (USEIA, 2021; SEIA, 2019) which is creating new opportunities to capture the public's reaction. Uebelhor et al. (2021) were among one of the first to seize this research potential. They performed a content analysis of newspapers to understand reasons for citizens' support and opposition to solar projects in four Great Lakes states. My research will take a deeper dive into *the* Great Lakes State by using semi-structured interviews to examine community acceptance of and related decision-making processes for proposed utility-scale solar projects.

1.3. Motivation

Michigan presents a unique case study to research the solar social gap. It does so for three reasons: its novelty, existing policy, and zoning jurisdictions. First, the state is relatively new to the idea of large-scale solar projects. As of mid-2020 there was only 1 existing solar farm producing 50 megawatts (MW), 2 others over 10 MW, and 10 projects above 1 MW (SEIA, 2020). Michigan has not been typically viewed as an ideal location for solar. This Midwestern

[1] This paper uses "acceptance" to mean point of view. "Acceptance" can be thought of as a broad category that bundles the following terms: "support," "opposition," "attitudes," "perceptions," and "values." Each of these terms are distinct from one another. "Support" and "opposition" relate to proposed projects and "attitudes" correspond with existing/pending projects (Mills et al., 2019; Rand & Hoen, 2017). Furthermore, "perceptions" refer to a person's own understanding about attributes of a proposed or existing project and "values" indicate a person's stable life-guiding principles (Stern et al., 1995).

state has a relatively low global horizontal irradiance at about 3.5-4 kilowatt-hours/m^2/day whereas areas in the Southwestern U.S. that house most of the country's solar have a global horizontal irradiance twice as high (Sengupta et al., 2018). Yet, Michigan's solar conditions are still capable of producing an ample amount of electricity. In fact, even the State of Michigan identified solar as necessary for its achievement of the current Renewable Portfolio Standard of 15% renewable energy (State of Michigan, 2016). Furthermore, Michigan's largest investor-owned utilities have set strategic goals to increase renewable energy with large-scale solar PV projects being a major contributor (Consumers Energy, 2018; DTE Energy, 2020; UPPCO, 2019). There have been a handful of utility-scale solar projects developed across the state in the past few years, and more are on the horizon (Acosta, 2017; Smith, 2020; Heineman, 2020; Balaskovitz, 2020; Asplund, 2020; Steeno, 2020). The timing of this study was intended to catch the initial reaction of local communities as more and more solar farms are proposed in Michigan. Collecting data at the infancy of the state's solar energy transition is key to building a baseline that can be used to examine acceptance in the future.

Second, Michigan recently approved a statewide policy that allows the adoption of large-scale solar arrays on land enrolled in Farmland Preservation, i.e. PA 116 land (MDARD, 2019). Land that was once designated strictly for farming is now able to be leased to solar developers. Though, there are some requirements in place to attempt to secure the land's agricultural longevity. For example, the land must house cover crops and pollinator habitat to sustain soil fertility during solar project operation. At the end of the solar project's life (at least 25 years according to NREL, n.d.), the developer is also responsible for decommissioning the infrastructure and the landowner is required to convert the land back to its original agricultural use (MDARD, 2019). This new policy will increase the availability of continuous, flat land ideal for deploying utility-scale solar projects. At the same time, it may generate backlash due to the fundamental and sentimental importance of farmland.

Lastly, Michigan's zoning law allows municipalities, e.g., townships, cities, and villages, to create their own land use regulations (State of Michigan, 2006). While some communities take advantage of this right, others adopt their county's zoning ordinance since self-zoning requires a considerable amount of planning, time, money, and legal consultation (Neumann, 2019). Consequently, those who take on the county's zoning are also subject to the county's vision; this can create tension if the two governing bodies have different goals. The dilemma of conflicting land use preferences between governments that share zoning has already resulted in delayed utility-scale solar development. In one instance, a county-approved solar farm was temporarily halted by the actions of a township that did not want the proposed project in their community (Redacted 2[2]). The emerging boom of utility-scale solar in Michigan may spark more zoning battles and cause municipalities to assert their right to zone, demonstrating the importance of distinguishing local community values from regional ones.

1.4. Preliminary Study Justification

To determine the plausibility of Michigan's solar social gap and further justify this research, I conducted an informal investigation in early 2020. The first part of determining the solar social gap involved examining the public's general opinion about solar energy at the state level. A recent study performed in September of 2018 found that 90% of Michigan's public supports increasing solar power in the state (MAPRR, 2018), confirming that Michiganders have a high acceptance of solar energy.

[2] References for my study sites are redacted for confidentiality.

The second part in verifying the solar social gap had to do with looking at how host communities were responding to proposed solar projects. Bell et al. (2013) measured this by comparing the installed capacity of wind farms to the number of wind farm planning applications. However, Michigan does not have a comprehensive database of all the solar project applications. Even if it did, Bell et al.'s (2013) method inaccurately assumes that all application delays or cancellations are due to opposition. Therefore, I used my own anecdotal means to gauge the extent that Michigan communities hampered solar projects. This was done by performing a keyword search of online news articles using the terms "public," "community," "residents," "citizens," "large," "solar farm," "solar project", "Michigan," "[specific] County." I plugged in each of Michigan's 83 counties into the search to capture potential solar farms across the state. I recorded all the proposals found through this search and noted instances of social barriers, i.e., actions taken by the community that impacted the timeline or outcome of the proposal. Out of 15 proposals identified, 5, or 33%, of them had occurrences of social barriers.

Given that 90% of Michigan residents say they support solar energy (MAPRR, 2018), anything greater than 10% of solar project proposals facing social barriers would support the existence of the solar social gap. The 33% of proposals that encountered social barriers meets this criterion. The discrepancy between statewide and local acceptance rationalized the study described below.

1.5. Objectives

The objectives of this research guided my inquiry and analysis to sufficiently identify and describe the various elements of the solar social gap. I attempted to set up the layout of my results and discussion to match the order of my objectives to demonstrate clear connections. The objectives of this research are as follows:

i. Determine public support or opposition, attitudes, perceptions, and values associated with utility-scale solar projects.
ii. Analyze the solar social gap using Bell et al.'s (2005) wind social gap determinants.
iii. Investigate how government- and developer-led public engagement processes address or contribute to the solar social gap.
iv. Identify best practices for public engagement in utility-scale solar project siting to help diminish the solar social gap.

1.6. Research Questions

I identified research questions that are in line with the objectives described in the previous section. As with the objectives, these questions provide direction for my study and are answered in chronological order in my findings. The research questions are as follows:

i. What is the current state of communities' acceptance of utility-scale solar development?
ii. How does the solar social gap manifest as explained by the social gap theory?
iii. How are decision makers' public engagement processes affecting the solar social gap?
iv. What are public engagement strategies that can close the solar social gap?

1.7. Wind Social Gap Theoretical Framework

Bell et al.'s (2005) theoretical framework on the wind social gap (along with the relevant updates from Bell et al., 2013) was used to steer my examination of the solar social gap; its application to utility-scale solar has not been done previously. This framework provides three possible explanations to the wind social gap: democratic deficit, qualified support, and self-interest. Each is described below.

1.7.1. Democratic Deficit

The democratic deficit states that there is a minority of people who oppose wind energy and they are the ones that control the decision to develop a wind farm (Bell et al., 2005). This is based on the notion that opponents may be more likely to voice their opinions and be involved in the decision-making process. Toke (2002) explained that those that are against a wind farm believe that the cost of their actions during decision-making is worth the potential benefit of impacting the development. On the other hand, people with neutral or supporting opinions may be less inclined to participate. This is because these people may believe their own actions will have negligible effect on the project and that the developer's own advocacy will sufficiently propel the project to approval (Toke, 2002). As a result, many non-opponents act as "free riders" (Bell et al., 2005). The problem of the democratic deficit is also in part due to the "decide-announce-defend" framework that ultimately seeks criticism rather than support (Wolsink, 1996).

1.7.2. Qualified Support

The qualified support explanation states that a particular wind farm may not meet a person's criteria for wind energy (Bell et al., 2005). In this case, people are supportive of wind energy as long as certain standards are met in order to limit impacts on the landscape, wildlife, humans etc. Qualified supporters would consequently oppose a proposed wind farm in their community if it did not meet their principled requirements. However, some people dress up their personal reasons as qualified justifications when the proximity of a project gets too close for comfort. It is difficult to distinguish true qualified supporters from impersonating qualified supporters based on what people say in public settings (e.g., public hearings) (Bell et al., 2005). This is because people are unlikely to claim self-interest in front of others since it is not typically seen as a good argument. Bell et al. (2005) advised to use a private setting when trying to determine a person's reasons for opposition, which I made sure to do in my own application.

1.7.3. Self-Interest

The last explanation of the wind social gap is self-interest (aka "not-in-my-backyard" NIMBY): people support wind in a general sense but have selfish reasons for opposing a wind project in their own community (Bell et al., 2005). Many people who act in their own self-interest will cause the gap. This is a classic "prisoners dilemma" scenario where collectively, it is best to accept wind energy, but at an individual level, it is most advantageous to not have a wind farm in your own community (Bell et al., 2005). Therefore, with everybody acting in self-interest against wind, there is no wind farm built for anyone. NIMBYism is likely not the only or even most relevant contributor to the wind social gap (Bell et al., 2005). The NIMBY reasoning for the wind social gap has faced significant criticism due to its vague explanation of causes for opposition, inconsistent use in the literature, and/or negative connotation (Devine-Wright, 2005; Devine-Wright, 2009; Wolsink, 2000; Wolsink, 2006; Petrova, 2013; van der Horst, 2007).

1.8. Utility-Scale Solar

The wind social gap literature described above will be used to explore the *solar* social gap for utility-scale solar PV systems. Consistent with Roddis et al. (2020), I define utility-scale solar as ground-mounted systems with a power capacity of at least 50 MW. A project of this magnitude is either owned by a utility company or the output electricity is sold to a utility company so that the power can be used to supply utility-users. Utility-scale solar is not the same as commercial or residential solar. Commercial solar arrays, which can be ground-mounted or rooftop, are only intended to power a business' specific building or operation (Marsh, 2020). Similarly, residential solar systems are designed to supply electricity for one's home (Richardson, 2021). In some instances, excess electricity from commercial or residential solar can be sold back to the utility for bill credits (State of Michigan, 2021). But ultimately, these types of solar differ from utility-scale because of size and end-user.

Utility-scale solar was selected because it is commonly considered the least expensive type of solar power as well as the most practical size used to meet utilities' or governments' renewable energy production goals (USEIA, 2020; Goodrich et al., 2012). Thus, currently, large-scale farms are the most rational solar option for developers to pursue. It should be noted that commercial and residential solar may be feasible for some on a case by case basis (Zhang et al., 2016; Haegermark et al., 2017). However, these types of solar will not be the target of this study since their sizes typically have negligible impacts on the community at large.

1.8.1. Economics and Technical Capacity

Utility-scale solar PV is currently less expensive than commercial or residential systems (IRENA, 2020). This is due to economies-of-scale as well as standardization in design that leads to improved labor efficiencies (Goodrich et al., 2012). Additionally, utility-scale solar is one of the most economical forms of power in general. Two-fifths of utility-scale solar PV projects commissioned in 2019 generated electricity cheaper than coal-fired power plants (IRENA, 2020). Large-scale solar PV systems that will go live in 2025 have an estimated levelized cost of electricity that will outcompete combined-cycle natural gas and onshore wind, even without subsidies (USEIA, 2020). But solar tax credits still remain available for the next several years, making this technology even more financially appealing (St. John, 2020).

In addition to its low market price, utility-scale solar also has the potential to produce a significant amount of electricity. Jacobson et al. (2015) provided a roadmap to 100% clean electricity by 2050 in the United States using wind, water, and sunlight. In Jacobson et al.'s (2015) scenario, utility-scale solar PV contributed just over 30% of the estimated electricity needs in 2050 (numbers were determined based on technical limitation and resource capacity). Consequently, these solar arrays would require 0.19% of U.S. land area (Jacobson et al., 2015) or well over the size of the state of Connecticut. The case for Michigan estimated roughly 19% or 7.6 GW of the state's 100% clean electricity could be feasibly produced from large-scale solar farms (Jacobson et al., 2015). Based on how Lopez et al. (2012) calculated utility-scale solar technical capacity in relation to land requirements, 7.6 GW of solar farms would need nearly 160 square kilometers of space, which is as much as 0.17% of Michigan's land area (practically twice the size of Lansing). These estimates for power capacity and required space might even understate Michigan's solar PV future since Consumers Energy alone is proposing 6.6 GW of solar power by 2040 (Consumers Energy, 2018). It is clear that large solar projects have the ability to generate a substantial amount of power, but may also require a hefty amount of land. Thus, there needs to be consideration for the communities that will host these solar farms as development expands.

1.8.2. Social Acceptance

The tangibility of utility-scale solar projects affects their social acceptance. Larson & Krannich (2016), who studied Utah residents' response to prospective renewable energy projects, found that support for proposed utility-scale solar farms in a general sense was significantly higher than the support for utility-scale solar farms within 25 miles of one's home. An even steeper difference occurred when a project was proposed within sight (Larson & Krannich, 2016). Carlisle et al. (2015) conducted similar research about people's (a national sample and a California sample) positions on proposed large-scale solar farms within the country or within their own county of residence. Contrary to Larson & Krannich (2016), Carlisle et al. (2015) did not find a discrepancy in support between the national and local levels. This could be because county-scale is not narrow enough for residents to be directly impacted by a solar farm and therefore a proposed project would not elicit considerable change in one's stance. However, Carlisle et al. (2015) did discover differences between the predictors of support or opposition amongst solar projects proposed in the U.S. and one's own county. The most significant predictors in the U.S. depended on a person's view of a solar farm as a symbol of government commitment to renewable energy, perception about the solar farm's impact on cost of electricity, and belief regarding the seriousness of climate change (Carlisle et al., 2015). Support for a potential utility-scale solar farm in one's own county hinged on the person's political ideology, perception about the solar farms' impact on scenery, and trust in developers (Carlisle et al., 2015).

The location of a solar development may be another factor that plays a role in how host-communities respond. Mulvaney (2017) assessed reasons for land use conflict of utility-scale solar energy projects (both photovoltaic and concentrated solar power) in the U.S. Southwest.

Part of this involved gauging public resistance through Bell et al.'s (2005) social gap framework. He suspected that many people had qualifications for ecosystem and wildlife conservation as well as demands for decision-makers to better engage with Native American groups to preserve cultural resources. This finding is not surprising given that the proposal sites are surrounded by nature preserves as well as indigenous reservations. Interestingly, most of the public pressure was related to projects on public land rather than private land. Mulvaney (2017) proposed that the essence of public land—areas intended to be managed for the collective's best use—makes it particularly prone to controversy since there are many different interpretations of what the best use is.

Perceptions about the benefits and risks of utility-scale solar arrays vary. Potential benefits included economic development, tax revenues, landowner and/or community compensation, rejuvenation of a place, reduced air pollution, and carbon savings (Boudet, 2019; Carlisle et al., 2014). Possible risks of utility-scale solar included aesthetic impacts, ecosystem/wildlife impacts, effects on property values, effects on electricity rates, tourism, toxicity/flammability of materials, and intermittency (Boudet, 2019; Carlisle et al., 2014). Unlike much of the wind literature (Devine-Wright, 2009; Devine-Wright & Howes, 2010; Phadke, 2013; Stedman, 2002), Carlisle et al. (2014) found that large-scale solar farms did not have negative impacts on place attachment and place-identity for people in regions with abundant utility-scale solar farms. However, citizens still wanted solar farms sited away from places of importance. Those in the Southwest preferred that utility-scale solar farms were at least one to five miles from residential, cultural, and recreational areas and up to 11+ miles away from wildlife migration routes or breeding grounds (Carlisle et al., 2016). The distance preferences of Southwesterns were slightly different than what the national population was comfortable with, which was looked at by

Sharpton et al. (2020). These authors found that U.S. citizens required buffers of at least five miles from their home in order to be more accepting of a large-scale solar farm (Sharpton et al., 2020).

Understanding the perceptions and values of those who live in the area of a proposed solar project is important for decision-makers (Carlisle et al., 2014; Pasqualetti & Schwartz, 2013). Public perceptions of energy systems are linked to a value system that can help to explain people's attitudes towards a certain energy technology (Demski et al., 2015). It is vital to identify and incorporate these public values during the early phase of project decision-making to potentially generate a more tolerated outcome (Demski et al., 2015). Pasqualetti & Schwartz (2013) stated that consideration of public values during energy siting is necessary, yet obtaining public input, especially in rural communities, is the most neglected part of the process. Failure to incorporate public values into decision-making may hinder expansion of solar projects (Pasqualetti & Schwartz, 2013). For these reasons, this study will investigate how developers and government are (or not) addressing public perceptions and values in their approach to utility-scale solar development.

2. METHODS

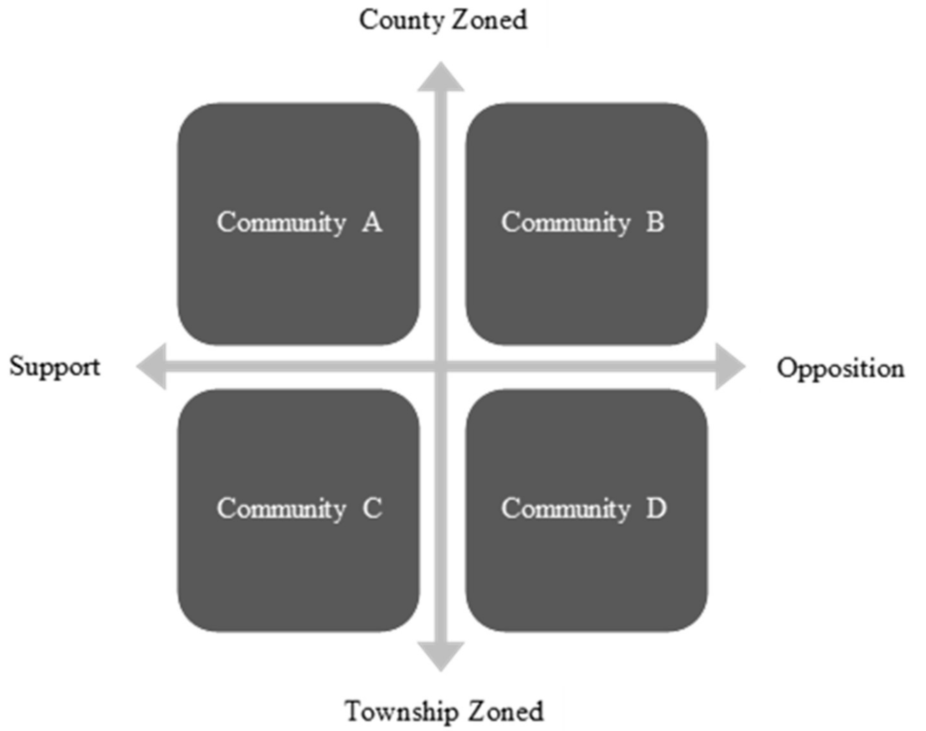
2.1. Study Areas

Four communities[3] in Michigan have been targeted to examine acceptance and procedures related to large-scale solar projects. The locations of these study sites are left unnamed to protect participants' privacy. Instead, I will refer to the four communities as Community A, B, C, and D. I also redacted the site-specific references (e.g., media sources, public records, project websites) from this report as a further discretionary precaution.

Site selection was based on what is already known about each community's public response to a solar farm proposal, zoning level, and estimated project size. According to online news articles and public records, Communities A and C have yet to report much, if any, controversy regarding their projects (Redacted 3; Redacted 4), while Communities B and D have experienced notably contentious development processes (Redacted 2; Redacted 6). Within both groupings, there is one township that is zoned locally and one that is (or was) zoned at the county level. See Figure 1 for a visual. This case selection was done to achieve a more accurate representation of the views on and approaches to utility-scale solar (Seawright & Gerring, 2008). Additionally, at the time of this writing, these projects would be the largest solar farms in Michigan.

[3] This study defines a community as the people that live in the township (or townships) where the solar project is located.

Figure 1: Matrix of study areas by zoning level and anticipated acceptance.



2.1.1. Community A

Community A consists of two townships, each housing less than 2,500 residents (Redacted 10; Redacted 12). Both townships are zoned at the county level. A special use permit was unanimously approved by the county planning commission to permit construction of a solar farm that will span over 1,000 acres and produce more than 200 MW of power.

Based on information from the developer's website, they worked closely with township residents to hear their thoughts and answer any questions that came forth. They facilitated this discussion by hosting several community forums (Redacted 1). Overall, media accounts have claimed that the public has been receptive to this solar farm (Redacted 3). Even back when the project was first introduced to the area, there were few complaints from the residents (Redacted 5).

2.1.2. Community B

Community B is a single township and home to just over 2,800 people (Redacted 8). This area was formerly county zoned until the prospects of solar development were introduced. The county established a large-scale solar ordinance and a developer subsequently submitted a proposal to build a solar array shy of 1,000 acres on rural land primarily in Community B (Redacted 6). Many of the township residents were reportedly unenthusiastic about the idea of living next to a large solar farm (Redacted 6). Further, township officials claimed that the solar array was not in accordance with their master plan (Redacted 6). In response, Community B moved to execute their right to self-zone and created an interim ordinance that would temporary block any large-scale solar development. The township's actions caused the county to postpone consideration of the solar farm application (Reference 6). The developer subsequently sued the township, and litigations are pending at the time of this writing. The proposed project will remain on hold until the township finalizes their zoning ordinance and settles matters in court.

2.1.3. Community C

Community C has an estimated population of just over 2,100 (Redacted 11). This self-zoned municipality unanimously passed a solar energy ordinance several years back and have since approved multiple utility-scale solar projects collectively exceeding 1,000 acres.

Both developers in Community C claimed to have used a similar public engagement approach as the developer in Community A (Redacted 7). Online news articles have not identified residents raising concerns or disapproval (Redacted 4).

2.1.4. Community D

Community D has a population of roughly 3,400 residents and is locally zoned (Redacted 9). The township board initially approved a solar ordinance from which a developer proposed a utility-scale project that would cover nearly 1000 acres. However, due to some technicalities, the original ordinance was not legal and had to be sent back to the planning commission for modifications (Redacted 2). At this point, the community began to get involved and significant opposition developed. The planning commission worked with the developer to tailor the logistics of the zoning amendment (and subsequent project design) to better balance community interests. For example, the original setback distance of 250 feet from residential areas was increased to 500 feet. Despite these changes, there remained strong public resistance. Regardless, the planning commission attempted to move forward and made a motion to recommend the zoning amendment to the township board. The amendment was denied by the board and sent back to the planning commission for further revisions (Redacted 2). There have been numerous additional meetings, but the ordinance has yet to be finalized. At the time of this writing, the project remains on standby.

2.2. Data Collection

Qualitative methods were used to examine the solar social gap in my four research communities. Three groups within each of the four communities were targeted for semi-structured interviews: government officials, solar project developers, and nearby citizens. These groups were chosen to demonstrate perspectives of decision-makers and the public about both the solar projects and the specific public-engagement approaches used to develop them.

A number of methods were used to recruit each group; however, no methods could or did involve in-person contact due to restrictions put in place as a result of the COVID-19 pandemic. Michigan State University's Institutional Review Board approved this research, Study ID: STUDY00004254. For government officials, I tried to contact everyone involved in the decision-making of the project, e.g., township officials, zoning administrators, planning commissioners, board members, etc. If both county and township authorities were involved, I made attempts to talk to a representative from each level. Emails and phone numbers were found through the counties' or townships' websites.

I connected with developers through emails or phone numbers that were made available online. Efforts were made to speak with one individual per project; this was most often the project manager.

Citizens were the most difficult group to contact because their information was not as virtually accessible. Thus, I tried multiple tactics to contact people, including:

i. Scanned the meeting minutes of public hearings related to the solar projects and identified individuals that made comments. I reached out through Facebook Messenger if I could confidently locate someone's profile. If not, I searched county parcel mapping websites to get their address and mailed them a letter.
ii. Searched for Facebook groups linked with the solar projects and messaged contributors.
iii. Drove through accessible communities and noted the addresses with "no solar" signs to later mail them a letter
iv. Emailed government clerks to request contact information for potential land-leasers and mailed them a letter.

v. Identified the solar project site maps and overlaid them with parcel mapping to find individuals near the development site. Letters were mailed to the 25 non-land-leasing property owners that were the closest to each project.

vi. Used snowball sampling from other participants.

Throughout all these attempts, I explicitly searched for both public opponents and supporters of the project. Acceptance was estimated based on the comments that individuals made about the project, their affiliation with the project, or what others had labeled them in referrals. My initial judgment of a person's acceptance would be later confirmed or denied through interview questions (no participant's initial classification was incorrect).

I followed up with all unresponsive individuals two weeks after the first contact attempt (sent another e-message or mailed another letter). In total, I reached out to 141 individuals and secured interviews with 33 people, resulting in a response rate of 23.4%. One developer spoke about projects in two communities; thus, the overall number of interviews was 34. Table 1 shows the layout of the interviewees. Interviews were done via phone and typically had a duration of 40 minutes. A short list of open-ended questions was prepared to help direct the interviews (see Appendix A), but the semi-structured nature of the data collection allowed flexibility for the interviewees to talk about what was important to them. Responses were captured with written notes and audio recordings to ensure the accuracy of note transcriptions.

Table 1: Interview participants by group and community.

Interviewee	A	B[4]	C	D
Citizen- Supporter	2	2	1	2
Citizen- Opponent	5	3	1	3
Citizen- Neutral	0	0	2	0
Government Official	5	1	1	1
Developer/Consultant	1	0	2	2
Total Per Community	13	6	7	8
TOTAL[5]	34			

2.3. Data Analysis

Data was analyzed using thematic coding, which is the process of finding and labeling (i.e., tagging) information that represents ideas relevant to the research questions (Rubin & Rubin 2012). The first step in the process involved transcribing each recorded interview verbatim. Trint software (Trint, 2021) was used to help transform the audio file into written text; however, due to transcription errors, I reviewed and corrected each interview transcript. This process worked to maximize descriptive validity, or the factual accuracy of the participants' statements (Maxwell, 2002). After the transcripts were completed, I read through all interviews several times in consultation with my research advisor.

During this process, I wrote memos about tentative themes in the data, and my advisor and I discussed each theme during regular meetings. The memos generated for all interviews were then used to start the construction of an initial codebook that would provide the guidelines for how I eventually coded the data. I built a codebook in Excel that had separate columns for the code names, definitions, rules, and examples. Both my advisor and I tested this codebook on several interviews, which led me to iteratively revise it until the codes were appropriate for all the

[4] Unfortunately, the developer in Community B was unable to speak with me due to their pending litigations.
[5] The same developer was interviewed for both Community A & Community C; this was counted as two separate interviews. Thus, 33 individuals resulted in 34 interviews.

interviews. The first finalized codebook was dubbed Codebook1 (see Appendix B) and I used it to begin tagging data in MAXQDA software (MAXQDA, 2021). Upon completion of my first cycle coding, I reviewed the data within each code to see if more specific themes had emerged. Again, I collaborated with my advisor to make memos that were ultimately used to develop a second cycle codebook which I called Codebook2 (see Appendix C). The codes in both codebooks were further categorized as “neutral,” “positive,” or “negative” to help organize the passages by perspective. After the coding was complete, I pulled all the tagged data for each community and wrote summaries of the content for each parent code and child code. I laid out these summaries so that I could look at themes within and across all the communities. This method of comparison was used to understand differences and similarities between communities to help generate meaning and assess threats to validity (Huberman & Miles, 1994; Maxwell, 2013). The next section depicts the findings of this work.

3. RESULTS AND DISCUSSION

3.1. Community Sentiment

As a result of my study design, I initially classified Community A and C as supporters and Community B and D as opponents based on information I found online. I attempted to verify these classifications by interviewing people with varying opinions in each community. I asked participants about their own perspectives as well as to characterize the reactions of others in the area to gain a better understanding of overall community sentiment. These interviews suggested that the original classification of all four communities was accurate.

It should be noted that these labels are mainly generalizations used to aid in reporting. Supporting communities still had adversaries and opposing communities still had advocates. The difference lies in intensity, with opposition remaining fiercest in Community B and D. In fact, both of these communities had well organized opposition, so much so that their presence was a key determinant in the existence and extent of the solar social gap. To elucidate my findings, the following subsections review organized opposition in each community and link it to overall perceptions of the solar farms.

3.1.1. Organized Opposition

I define organized opposition as a coordinated network of people working together against a shared cause. Opposition coalitions appear to be started and led by several passionate, well-respected members of the community. All it takes is just a few influential people to effectively diffuse attitudes and behaviors to a larger group (Goldman-Benner et al., 2012). These community leaders can be the driving force behind effective opposition efforts. When responding to a question about why one of the projects hardly faced any fierce backlash, a developer said:

> "You know, I've certainly been in communities that weren't too dissimilar where there was more opposition. I think sometimes it's if you get that one or two influential people that are against it and they're going to kind of rally the anti-crowd. Big difference. You know, and it just cascades."

It is evident that opposition leaders know how to rally up a network and put it in motion to fight an unwanted clean energy project. One way this is done is by using the network to circulate information amongst members. For example, a citizen from Community D described their group as follows:

> "You know, we're working with the 250 of us that are kind of working as a group. We've got group text and everything to remind everybody of you know, there's a meeting tonight at seven thirty. And all this stuff."

Encouraging group members to attend public hearing helps the opposition gain influence in the decision-making process. Their large numbers create a united force that can easily sway government officials. A developer in one of the opposing communities explained this occurrence:

> "They can trick the board members into thinking it is an actual issue, but it's not. … I've never seen [opposition] like this be as effective as they are in the board resisting facts. And the board not voting in the best interests of the broader community. It's really shocking."

Not only are these organized groups able to effectively exert their point to their local boards, but their tenacity has even driven some board members out of office. This may or may not have been part of their strategy. However, they are quick to take advantage of the situation by promoting their own to fill the vacancies. A member of an organized opposition group said:

> "No doubt the board is leaving in November. A couple of trustees, our supervisor's leaving, and we need two extra trustees, so we [opposition] packed them all. There are people that run uncontested."

Overall, organized opposition has undeniable power. There is increasing evidence that organized opposition groups are receiving financial and administrative support from fossil fuel interests, which may share in the goal of obstructing renewable development (Zwickle et al., 2020). They have been successful in doing so given that the presence of these groups during the siting process significantly hinders wind farm approval (McLaren Loring, 2007).

3.1.2. Stated Concerns and Benefits

Organized opposition groups, most often comprised of nearby neighbors, had predominantly negative perceptions of solar development. On the other hand, the far less organized land-leasers (i.e., people who rent or sell their land to solar developers) and self-proclaimed environmentalists mainly expressed positive views. To help distinguish between the arguments used by the opposition and those residents in favor of the projects—or at least those unopposed—here I describe participants' stated concerns and perceived benefits of large-scale solar farms. A list of these perceptions can be found in Table 2. It is notable that perceptions did not very greatly from one community to another; the rationale of opponents and supporters was similar regardless of location. Thus, I briefly discuss some of the common themes found across the communities.

Table 2: Citizens' commonly stated concerns and benefits of local utility-scale solar farms.[6]

Stated Concerns	**Number of Unique Reports[7]**
Poor aesthetics	13
Diminished property values	10
Misuse of agricultural land	9
Low economic benefits (e.g., small tax base, few jobs)	7
Inefficient and still emerging technology	7
Substantial size/growth	7
Ground water/soil contamination	6
Human safety hazards (e.g., natural disasters, EMF exposure)	6
Technology is too reliant on financial assistance	6
Electricity does not stay in the community	6
Fear of failure to decommission the project after its lifespan	5
Transfer in project ownership makes accountability questionable	5
Imported materials	4
Construction disturbance	4
Wildlife barrier	4
Drainage issues	3
TOTAL	102
Stated Benefits	**Number of Unique Reports[7]**
Economic benefits for individual land-leaser	8
Economic benefits for community	7
Clean source of energy	6
It is not a more burdensome development (e.g., wind, housing)	5
Land-leasers' profits can help keep farmers in farming	4
Gives land break/serves as a land bank	4
Technology is advanced enough to work in Michigan	3
Energy exporter	2
Not that visible	2
Farming solar energy is another form of producing	2
Less pesticide sprayed on ag land with solar	2
Native plants good for pollinators in PA 116 land	2
Technology is safe	2
TOTAL	49

[6] This does NOT include perceptions from government officials or developers. Nor is this inclusive of every concern or benefit stated in the interviews. This table is intended to show how many different people spoke about each concern or benefit; this is NOT a ranking of importance.

[7] A concern or benefit was only counted once per individual regardless of how many times that individual may have stated it.

3.1.2.1. Aesthetics

The visual impact of a solar project was the most frequently stated concern. Some people simply did not want to look at a solar farm because they found it unsightly. Most did not want to see solar panels in lieu of farmland. The overarching problem was that the technology hindered the rural aesthetic of the area (i.e., the visual appeal of the countryside), which many said drew them to that location in the first place. One of these individuals quoted:

> "I still wish I could be looking at farmers farming their field. That's what really seemed nice when we moved here. I thought, you know what better thing than to sit on your front porch and watching the farmers plow."

Boudet (2019) also reported negative public perceptions on the appearance of utility-scale solar projects. This may be partially related to individuals' perceived incompatibility of the solar development with the existing scenery. Brittan (2001) commented about how "industrial" wind turbines may "clash" with areas that have not experienced much development. I suspect that the same interpretation may apply for abundant solar panels in rural settings

It might be presumed that solar arrays hardly affect peoples' viewsheds because they can be easily shielded from sight with buffers. Yet, citizens were convinced that the measures used to conceal solar projects were not that effective. For instance, the proposed vegetative buffers were believed to be too short at the time of planting to sufficiently block anything. Additionally, the fencing that was going to be installed was considered just as unappealing as the solar development. A resident in Community B put it this way:

> "I mean, like I can see all across the field. So, I don't know how high of a fence they got to put up before I won't be seeing that stuff anymore. But even so, if they do put a fence up, I'm looking at a fence instead of a field."

A few citizens commented on how the solar projects would not be that visible to the broader community. Unlike wind turbines, which can be seen up to 36 miles away (Sullivan et al., 2012), the visibility of large solar farms was thought to be limited to just the nearby neighbors. Roddis et al. (2018), who studied indicators for acceptance of both wind and solar farms in Great Britain, stated that aesthetics is a greater consideration for wind farm approval than it is for solar farm approval because wind has a more highly noticeable presence.

3.1.2.2. Financial Impacts

The negative financial implications of the solar projects varied. One of the most common concerns amongst residents was the devaluation of property. The rationale behind this concern may be in part fueled by false consensus, or people thinking that since they do not want to live next to a solar farm, no one will. For instance, a resident from Community B stated:

> "I know where there's another one [solar project], … and I mean, it's an eyesore. … Who would want to live there? Not nobody that I know."

However, perceptions do not always match reality. Sokoloski et al. (2018) examined how citizens perceive support from other members of the public regarding offshore wind energy. The authors found a partial pluralistic ignorance effect (i.e., underestimated support) among offshore wind supporters and a false consensus (i.e., overestimated opposition) among offshore wind opponents. It could be possible that opponents are overestimating others' unwillingness to live by a solar farm, which could leave them to the conclusion that no one will want to buy their property. However, there is some research that shows that utility-scale solar farms built in rural areas have statistically insignificant effects on property value (Gaur & Lang, 2020). These authors define rural areas as having no more than 850 people per square mile, a standard of which all the research communities in my study meet (densities ranging from 58-95 people per square mile). Even if there is evidence to suggest that solar farms may not impact property values, this does not change the fact that many people still identify it as an issue, thus, making it still an essential concern to address.

Beyond property values, participants also thought that the local economic benefits purported to be associated with solar projects would not be as great as they were made out to be. For example, an opponent in Community D broke down the total revenue projections to demonstrate individual gain:

> "And when we figured out how much of the savings that we are [getting], they were throwing this ... savings of ten million dollars on your electric bill. When we figured it out, it comes up to a $1.27 a month that we would save on our electric bills."

Economic benefits when calculated per capita are of course less than the total benefits. How the benefits are framed (personal benefit vs. community benefit) can appeal to different psychological values (self-enhancement vs. self-transcendent) (De Dominicis et al., 2017). Thus, it is easy to see how those who value self-enhancement would not be impressed by the economic benefits this project has to offer.

The last economic concern mentioned was the importation of solar panels. A minority of people did not like the fact that the parts for the project were imported from China. They disapproved of supporting foreign manufacturers at the expense of domestic producers. This factor seemed to add insult to injury rather than being a primary reason fueling opposition.

There were also several perceived economic benefits of the solar projects. A main one was the direct source of income gained from participants that leased their land to developers.

Additionally, some farmers saw the extra income from solar as an opportunity to keep farming. A land-leaser from Community B put it this way:

> "So looking at it as a farmer, and I'm like, OK, I got this, … basket of land that we farm, own, rent, whatever. And, you know, we produce crops off it. And the way to keep me sustainable, we all got to pay our bills. … what better way to keep farmland sustainable [than] take a piece of our farmland [and] turn it into a solar panel."

These land-leasers intended to use some of their earnings to maintain or improve their operations to ensure their future. This finding may suggest that large-scale solar projects could help sustain agricultural practices, though a deeper dive into this idea is necessary to be sure. If so, this would correspond with the work of Mills (2015) who showed that farmers who housed wind turbines were more likely to invest in and plan for future farming initiatives compared to farmers in non-wind communities.

Additionally, there were several participants that believed the solar projects offered a boost to the local economy. Similar to Boudet (2019), people highlighted the extra tax revenues, surge of jobs, and need for services (e.g., food, lodging, etc.). A supporter in Community A recapped some financial advantages:

> "Well, I think it's good for their business and it's good for our tax base, for the school districts and for the local roads."

Uebelhor et al. (2021) found that these benefits were commonly remarked on throughout solar developments in the Midwest.

3.1.2.3. Land Use

The misuse of agricultural land was one of the top reasons why host communities were upset with their local solar development. People did not believe that this land type was conducive to power production, and it conflicted with the agricultural essence of the area. This is a common perception of rural communities throughout the Midwest (Uebelhor et al., 2021). There were also significant concerns that once the land was taken out of agricultural production, it would not be able to return to its former use. As one opponent stated:

> "And I just think that there's something to be said for preserving the agricultural land and the heritage of this area. Once they ruin that, it's never gonna come back. There's always going to be parts of it that's ruined."

All communities were adamant about their deep agricultural roots. This connection with agricultural land may indicate rural place attachment or place identity. Place attachment is the process and product of attaching to a place whereas place identity relates to the symbolic attributes a location contributes to one's sense of self (Devine-Wright 2009). A disruption can create a change of place, demonstrating how the bond between people and place are no longer visible, which causes people emotional distress (Devine-Wright 2009). Those that have a strong connection to place are more likely to take action to hinder undesirable change, especially if the place also has symbolic meaning (Devine-Wright 2009; Stedman 2002). Devine-Wright & Howes (2010) found that those with place attachment were more likely to have poor perceptions of outcomes, negative attitudes, and opposing behavior toward a wind farm. Roddis et al. (2020) also showed that place attachment can hinder acceptance of utility-scale solar projects. This may be why communities that spoke strongly about their local agricultural tradition were on the defense.

One community did not have a problem with using farmland for solar, even though it was as agriculturally intensive as the rest. However, these residents were quick to admit that they do not have good farmland and had been struggling to make money. The solar project in this instance offered a sense of financial relief, giving the farmers another shot at sustaining their lifestyles. Thus, the solar project may have actually enhanced residents' feelings about their place. Devine-Wright (2009) states that place attachment can be positively associated with project support if the project is viewed as an improvement to the area.

Some also believed that the solar project itself would serve as a land bank for farmland, again contributing to a positive connection between solar and place values. A supporter in Community A described why solar would be beneficial for the longevity of agricultural land:

> "… solar does not take topsoil away. So all that topsoil, which took thousands of years to develop, will just sit there in a landbank and will not be lost."

These citizens thought that the quality of the land would not be negatively affected by solar development and that its original agricultural use could be easily resumed. Studies have shown that solar panels can change the microclimate and soil moisture of the land they occupy, but they do not alter soil properties such as bulk density (Adeh et al., 2018; Armstrong et al., 2016). What this means for the land's ability to convert back to farmland is unclear and the extent to which community-members know this literature or understand these impacts requires further research.

3.1.2.4. Energy Supply

Each of the four rural communities are hosting solar projects that produce power beyond their own needs. Some viewed this arrangement as their communities bearing all the burden without reaping any benefit. They believed the electricity would be generated in their community but would not stay there and would instead be sent to power large cities. A citizen expressed their discontent about the energy leaving the local area:

> "I understand there is progress that has to be made, but some of the things I learned was the power wasn't staying here that was being generated. It was going probably to Chicago so they could meet their carbon credits. We weren't getting any benefit."

This may increase rural resentment, or the rural belief that urban politicians disregard and shortchange them, a conviction that is fueled by the misaligned social identities (Cramer, 2016). Hosting a solar development that is going to benefit other areas can easily be construed as an unfair strain placed on rural communities. Additionally, this may also be seen as jeopardizing their energy sovereignty given that they do not get to control the consumption of the power that is produced in their town (Bessette et al., 2021).

A couple of land-leasers saw the benefit of generating electricity, regardless of where it ended up. To them, it was just supplying a universal demand. In the words of one person:

> "Everybody likes electricity. They like it when they turn the switch and the light comes on. And this is going to make a way to do this."

However, it is difficult to tell if they were saying this because they had inherent altruistic values or if they were just trying to rationalize their new source of income.

3.1.2.5. Subsidies and Abatements

Several citizens reported discontent with the way solar projects are financed. They do not believe this technology to be financially sustainable because it relies on subsidies from the government, which some people argued was money coming out of their own pocket. Such beliefs may again steepen rural resentment (Cramer, 2016). Barry et al. (2008) studied public attitudes of an offshore wind farm in Ireland and found that people felt that subsidies advanced corporate interests at the sacrifice of local citizens' land, tradition, and rights.

The notion that companies can get tax abatements for solar projects is also troublesome to a few. This is because the promised property tax income, one of the biggest selling points for the projects, is perceived to be substantially diminished if a tax abatement is secured. An opponent from Community D phrased summarized this train of thought:

> "So you're throwing all these big figures out but whether or not you're going to pay it is, number one, very questionable. Probably you're going to be asking to not have to pay that. And even if the township or the state says 'well yeah you only have to pay 50 percent of it,' now, these big figures that you've thrown out to entice us as the carrot, all of a sudden half the carrot is gone."

One study showed that supporters of tax abatements see these financial incentives as an attractant for wind energy projects (Brannstrom et al., 2011), yet there was not much done to assess opponents' views. This is a gap that could be further developed in the energy literature.

3.1.2.6. Health and Safety

Health and safety concerns about the solar farm were identified in each community. The most frequently voiced risk was groundwater contamination. Many believed that the panels themselves were made of toxic chemicals that could leach into the groundwater over time. This issue was especially problematic in one community that had a history of well contamination. A person from this community said:

> "So, you know, so many people have had wells that have been contaminated. And that's the big thing. We don't need any more drilling holes in our bedrock because it opens up to well contamination."

People from this same community also worried that embedding the project's piers into the ground would fracture sensitive bedrock, which was thought to exacerbate conditions for contamination.

Robinson & Meindl (2019) looked at the soil conditions for leached metals near a solar array composed of crystalline solar cells, the type of solar that is the most common on the market. The researchers discovered higher levels of selenium, strontium, lithium, nickel, and barium in the test site compared to the control. However, even with higher levels, the concentrations were still below toxicity thresholds for human and environmental safety. Differences in lead and cadmium levels, the highly toxic metals, were insignificant between the test and control samples (Robinson & Meindl, 2019). Solar is believed to be mostly safe from leaching under standard conditions. Yet, there are still many uncertainties about leachate risks during worst-case scenarios such as natural disasters (Kwak et al., 2020). I talked to several people that brought up these sorts of questions regarding safety in such situations.

Beyond water and land contamination concerns, some people feared that the electromagnetic fields (EMF) associated with the solar panels could cause cancer. They thought that since power lines might be a human health hazard, solar panels might be too. One study did find that the EMFs from large-scale solar projects were negligible and by far met the recommended health standards by the International Commission on Non-Ionizing Radiation protection (Tell et al., 2015). However, evidence is still inconclusive if extremely low-frequency EMF are linked to cancer (Kokate et al., 2016).

There were a few individuals that did not believe solar panels had major health or safety risks. They argued that since panels are safe enough to go on roofs, they should be safe enough to go on the ground. Only one individual commented on how solar panels could improve health through reducing air pollution:

> "I have two children that are adults now. I remember years ago going to their grade school and talking to the front nurse, and she was talking to me [about the] … kids she has to be careful with for asthma. … Now, my kids fortunately did not have that issue. But the thing was, as they talk about air pollution with asthma … it's like a long time ago we started seeing some of those issues. And if you look around and there's been studies done that there's more asthma within the city centers and stuff because they say because of the air pollution. … I'm like, well, jeez, if we have an opportunity to take away some of that, why not?"

Averted air pollution is a commonly highlighted benefit in the energy literature. Millstein et al. (2017) estimated that between 2007 and 2015, the emissions avoided from solar generation in the U.S. resulted in $1.3-$4.9 billion in benefits pertaining to air quality and public health.

3.1.2.7. Size

A couple of people perceived the solar projects negatively simply because they thought the size was too large. Public unease about solar farm size was also found by Roddis et al. (2020). These authors stated that the second most cited concern with projects at least 1,000 acres was their enormous size.

Others in my study seemed to be upset with the ever-expanding growth. Some projects started out as only a few hundred acres but had nearly quadrupled by the end of the development process. This increase sparked fears of limitless expansion. A participant from Community B commented on this slippery slope of project size:

> "Well, then the plans came out. It wasn't a couple hundred acres, it was darn near eight, nine hundred to a thousand."

Two individuals appreciated the size of their nearby project believing it was necessary to bring down costs and increase efficiency. Both of these individuals were commercial farmers, so perhaps their understanding was drawn from personal experience. As I discussed in Section 1.8.1., the greater the size of utility-scale solar, the more financially viable the project.

3.1.2.8. Technology

Some people raised concerns about the solar panel technology becoming obsolete. They were uncertain if the panels would withstand the test of time. One person from Community C said:

> "Technology changes so rapidly and what's going to happen to these in 10 years, 15 years? Will the technology be kept up to date?"

There were also a handful of people that had doubts about the efficiency of the technology, not believing it had much of a chance at being productive in a cloudy state like Michigan. Clouds can impede power production; however, improvements in solar cell efficiency and tracking may help combat this problem (NREL, 2021; Kelly & Gibson, 2011).

A couple of residents recognized that solar technology had become quite advanced and felt confident in its ability to produce electricity, even in an overcast sky. They understood that our solar resources are nothing compared to that of the Southwest, but believed the technology was sufficient enough to make do with what we have.

3.1.2.9. Decommissioning

Some citizens were worried that the solar panels were going to be left in place after their useable life (at least 25 years according to NREL, n.d.) because developers lacked the necessary commitment or finances. A neutral individual in Community C reflected on this problem:

> "But then who's responsible for removing, you know, this tremendous amount of acreage involved of all the equipment and the solar panels and the electrical. And, ... if something went south, who's going to take care of that bill to get the farmland back?"

This concern was partially fueled by the understanding that there would be a "flip" in ownership, i.e., the company that currently owns the project would sell it to another entity. A "flip" in ownership of a wind farm in Quebec caused citizens to question project leaders' accountability (Simard, 2018), which also happened here. A Community D citizen stated:

> "And, you know, in there, again, we know very well that the developer doesn't usually end up being the end owner of the project. So they walk away from it, leave all the problems to somebody else eventually."

"Flips" are quite common in Michigan. It most often occurs when a renewable energy project is built by a developer and bought by a utility (DesOrmeau, 2019; Lillian, 2019). However, it is unknown if this will cause problems with decommissioning because no wind or solar project has been decommissioned yet in Michigan. This should be something to keep an eye on as renewable energy projects are dealt with at their expiration.

3.1.2.10. Environmental Impacts

Though solar energy is often seen as a green practice, this does not make it free from environmental concerns. Only a couple people saw solar causing potentially negative impacts to wildlife, particularly deer. It was thought that deer would either avoid the area or get trapped within fencing. The sparseness of this concern is inconsistent with Roddis et al. (2020) who found that impacts on wildlife were the greatest concern for a proposed utility-scale solar project in the United Kingdom. Perhaps the difference lies in location. The solar farm in the U.K. study was within close proximity to several protected areas, whereas the four solar farms in this study were not.

Drainage issues were another perceived environmental hazard. Residents worried that the panels would create an expansive area of impervious surface that would cause excess runoff that may result in flooding. Guerin (2017) assessed the environmental field conditions of a 100 MW solar project in Australia and found no instances of excess water discharges. Another study did suggest the possibility that large-scale solar farms can increase runoff and flood risks, but this depends on physical characteristics of the site such as slope of the land and pre-existing vegetation (Turney & Fthenakis, 2011). Solar projects on hillsides that were previously forested are likely going to pose the highest risk to poor water filtration.

Some people thought that the solar project would be better for water and wildlife. The rationale behind this was that these fields would no longer be sprayed with heavy pesticides that crop production often requires, resulting in less pollution runoff. Additionally, the native plants required for solar siting on PA 116 land were thought to absorb excess water as well as increase biodiversity for the species that rely on them.

Amongst most residents, solar projects were perceived to be a source of clean energy that would be environmentally friendly. A supporter in Community B praised the solar project for this reason:

"I think it's a great idea. I think we have to have a reusable source of power. You know, burning coal is not an option for the earth, you know."

Two individuals specifically described solar energy as a solution for climate change, which has been attested to by many scientists (Creutzig et al., 2017; Millstein et al., 2017; IPCC Working Group III, 2014).

3.1.2.11. Could be Worse

A few people, while not wholly supportive of their solar project, believed that it was better than other forms of development in their community. For instance, a few residents expressed how at least it was not more housing units because that would bring more people into the area. Additionally, there was also some relief that the project was solar and not wind. Community A had experienced a contentious wind farm proposal in their county prior to the solar project and it was almost universal across those participants that the solar farm was a better outcome. While large-scale solar has its challenges, it may be the preferred option when it comes down to having to host a renewable energy project. One person expressed their preference of solar:

"Well, what I try to keep in mind is it could be much worse. It could be a windmill farm. Then I would have really had a conniption over that."

Interestingly, surveys have shown that the U.S. public tends to prefer wind energy over solar (Thomas et al., 2018; Firestone & Kirk, 2019; Sharpton et al., 2020). However, these studies only investigated hypothetical situations which do not always adequately reflect how people would respond to actual developments in their hometown. Community A was put in a unique situation where they experienced both a wind and solar farm proposal. In their case, it was evident that solar was more preferable. This might be because the experience with wind set such a negative precedent in the area that solar was a welcomed alternative.

3.1.2.12. Noise

Noise, an oft-stated concern with wind development, was hardly brought up by citizens dealing with a solar farm proposal. It tended to only be mentioned in areas that had been undergoing project construction. In these places, the constant vehicle traffic was the most commonly reported disturbance. One resident explained this nuisance:

> "But, you know, there's a lot of traffic. They get dirt on the road. They make a lot of noise. I mean, they have these machines that pound stakes in the ground and it constantly goes on and you know how machines make that beeping sound when they back up? That's constantly going on."

No concerns about operational noise were stated, which makes sense given that solar panels are not known to produce much sound beyond ambient noise (Dudek, 2018; Bodwell EnviroAcoustics, 2018).

3.2. Social Gap

This section presents evidence for the solar social gap. A democratic deficit appears to have occurred in communities with organized opposition, while qualified supporters were found at nearly every study site. Occurrences of self-interest were difficult to discern.

3.2.1. Democratic Deficit

A democratic deficit arises when only a minority of people oppose solar energy, yet they are the ones that dictate the community's stance on a solar project (Bell et al., 2005). I investigated this phenomenon at all four research sites by looking at the attendance and outcome of the public process.

Public meetings are prone to attract critics (Wolsink, 1996). Both government officials and developers remarked on how opponents were more inclined to participate in public meetings. A county employee affiliated with Community B put it this way:

> "usually when people agree with something, they just don't do anything. And when people are opposed to something, you know, they get together and they make a show and they are very vocal."

As explained in Section 1.7.1., opponents have more rationale to participate because they are convinced that the potential benefit of obtaining their goal outweighs the cost of taking action. This is drastically different from the thought process of supporters who tend to feel that their contributions have insignificant effects on their preferred outcome, giving them less drive to participate (Toke, 2002).

Generally speaking, Community A and C had substantially less opponent involvement in the public meetings than Community B and D. Interviewees from the former communities reported opponents in the single digits. Oppositely, people from the latter communities stated that opponents existed in the hundreds. It is suspected that this difference is linked to the presence of organized opposition. Environments that were dominated by opponents due to organized efforts created an intimidation factor that suppressed the supporters who did show up to meetings. A government official in one of the opposing communities attested to this occurrence:

> “there were a few people here and there that did come out and speak in favor of it. But they felt so overwhelmed by the opposition sometimes that they didn't feel comfortable coming and speaking. You know, they didn't want to be the one person in the room with the ninety-nine that didn't want it.”

Consequently, the opposition had the strongest voice at the public meetings in Community B and D. And because this was the primary source of public feedback, government officials were more easily convinced that the will of the meeting participants was the will of the community. However, a couple hundred opponents with vested interest is hardly indicative of a township that is home to several thousand people. The active opposition may actually be the minority in these communities, yet their overbearing presence in the public process gave the illusion that they are the majority. In other words, a democratic deficit might exist in the study sites that had organized opposition.

It should be noted that speculating a democratic deficit is dependent on how a community is classified. As a reminder, a “community” in this research is defined as the people residing in a host township. If a community was limited to an even smaller geographic area, e.g., people within one mile of the proposed project, then it would be a different story. This speaks to the subjective nature of this theory for application.

Additionally, the purpose of my approach was to study the nature of the democratic deficit rather than to quantify it. This means that I could only rely on the information I gathered through a small number of interviews to make any attempt to determine the extent of its occurrence. To build on what I have already done and further depict this phenomenon, complementary methods could be pursued such as a survey with a representative sample of the community’s population and observations of public meetings.

3.2.2. Qualified Support

Qualified supporters require solar projects to meet their standards for development (Bell et al., 2005). In application, I realized that there was a need to differentiate between a qualification and a concern. For example, someone might dislike that a solar project is financed through subsidies, but that does not necessarily mean they would support the development if it were independently funded. I attempted to clarify this nuance by defining a qualification as a criterion that is explicitly linked to support. This connection had to be clearly identifiable in interviews to count, e.g., "I don't like this solar project because of x, and if x was addressed, I would support the project." My method is fallible because qualifications may be overlooked if they are not stated in the proper format. Yet, if this standard were not in place, almost every concern could be classified as an instance of qualified support, which either cannot be accurate or else becomes a useless theoretical concept.

My results indicate instances of qualified support in each of the four study communities. The qualifications came down to seven main criteria. Some of these qualifications may be fairly universal while others might be context specific. Decision-makers should keep this in mind if they intend to use this information.

Some of the ideas and literature that are relevant to the following sub-sections were already discussed in Section 3.1.2. For the sake of brevity, I do not repeat the same information here.

3.2.2.1. Reduced Visibility

Visual subtlety was a frequently stated qualification amongst participants. There were several comments about how the citizens' reception of the solar project could be improved if it were less noticeable. For example, one person stated:

"Well, if it had been set way back from the road, so I didn't have to look at it, not as much of it. I probably would not have been as opposed to it"

A study that looked at indicators for community acceptance of solar farms in Great Britain found that proposals were more likely to get approved if they did not add a substantial "new visual addition" to the area (Roddis et al., 2018). In other words, less visibility tends to equate to higher acceptance. However, visual qualifications may not exist everywhere. There is evidence that suggests that people in areas with low landscape value and industrial heritage may be more willing to accept green development compared to people that live in and cherish rural landscapes (van der Horst, 2007).

3.2.2.2. Compensation

Several people stated that they would be accepting of the proposed solar farms if they received some sort of direct compensation to offset the perceived burden. This was especially the case for individuals that believed the project affected their property value. A resident from Community B described their rationale for this qualification:

"Yeah, I mean, I'm all for it [solar energy]. As long as it doesn't hurt other people. And if it does hurt other people, then they need to be compensated for that pain."

Citizens that live near wind farms in Ontario have expressed similar criteria (Christidis et al., 2017). However, this qualification is likely dependent on the community. Some places may feel it is their civic duty to host a development that will benefit society, in which case, compensation could cause more harm than good because it can override instinct motivation, create an expectation for financial rewards, and/or signal a greater sense of risk caused by the development (Frey, 1997).

3.2.2.3. Non-Agricultural Land

Many people did not want solar projects on agricultural land. To these qualified supporters, putting projects on a different land type was preferable. One individual put it like this:

> "I'm not anti-business. I'm not anti-solar. I'm just anti, you know, putting green power in a green space"

These agriculturally oriented qualified supporters may alternatively be considered "place protectors" or people who value a particular place for its specialness (Bell et al., 2013). There is no doubt that these people have a strong connection with their community's agrarian tradition. In that sense, they may be protective over their farmland because it is the pride of their hometown. Regardless of how these citizens are classified, the fact of the matter is that solar projects that infringe on local agriculture also infringe on local acceptance.

Renewable energy development on agricultural land has had mixed responses in other studies. Roddis et al. (2018) found that solar projects were 4.5 times more likely to get approved on non-agricultural land compared to high-grade land. They noted that existing farming norms influenced the acceptance of renewable energy projects. Contrarily, Bessette & Mills (2021) reported that areas with higher production-oriented farming had less opposition toward wind farms. This was partially suspected because production-oriented farmers may have seen the value of capitalizing on the extra income from wind turbines while still being able to farm. But solar and wind are not necessarily equal in this sense given that solar takes up most of the land it occupies, restricting farming operations. This could make a utility-scale solar project a harder sell in ag-centric areas.

3.2.2.4. Water Safety

Some residents seemed to be primarily worried about the protection of drinking water. Thus, if that could be ensured, then the solar project would be reasonable. This was mainly a criterion for those who had negative experiences with water contamination in the past. As stated by one individual:

> "Because we do have this problem in this area [with water contamination] ... they [land-leasers] want to use their property to put these solar panels in. Well, that's fine and dandy, if you are in a different place or different location."

The qualification for water safety seems to be context specific. I have not found other instances in the literature where this is a primary driver for acceptance.

3.2.2.5. Reasonable Size

A reasonable size for a solar project was another qualification. What constitutes "reasonable" varied between participants, but it was a consensus that nearly 1000 acres was too large. An opponent commented on how the proposed size of a solar project was excessive:

> "I don't think that that I have talked to anyone that was against solar, but it was overkill. It wasn't we're going to bring some solar into your area and it may affect two or three people, it was we're going to bury you in a solar field and tough noogies on you."

Some researchers suspect that solar energy facilities that are exceptionally large in size draw more attention to the drastic alteration of the pre-existing landscape (Roddis et al., 2020). Thus, limits to project size may be seen as a way to make the change more palatable.

3.2.2.6. Transparency

There were many people that just wanted decision-makers to have open communication from the start of the solar project. A transparent process was identified to be the missing component that could have prevented a lot of unease. One citizen reported how a developer could have improved their approach:

> "So that's the biggest thing, is quit trying to do this under the table. Be open and transparent. Transparent. Like I said, if solar is so amazing and wonderful, feed to us. Tell us how amazing a wonderful it is and we'll buy into it. But at this point, nobody likes [the developer] and nobody likes these farmers [because they] have done this backhanded and underhanded so long."

Firestone et al. (2018) showed that developers' transparency was one of the most important factors linked to the public acceptance of wind projects. Transparency and trust go hand in hand, and many researchers have also found that trust in decision-makers is necessary for host communities' wind project support (Sonnberger & Ruddat, 2017; Hall et al., 2013; Dwyer & Bidwell, 2019). My results show this to also be the case for solar.

3.2.2.7. Decision-Influence

Lastly, people wanted more of a voice in the decision-making for the solar projects. Someone even said that if they had a chance to vote and the outcome was not in their favor, they still would have been fine with it:

> "The fairest way to me would have been … let the township vote on it. But, you know, I wasn't even asking for that, I was just saying, Christ let the county vote on it as a whole. And I know we would have lost, but at least … the democratic process took its wheels in motion

and did what it was supposed to do, and that's the way the vote turned out. But when you don't get that and you just get it shoved down your throat, that leaves a bad taste in my mouth."

This supports the idea that community members who have an opportunity to actively engage during project planning are likely to become more tolerant of the result even if it turns out different than what they prefer (Jami & Walsh, 2017; MacCoun, 2005).

3.2.3. Self-Interest

Self-interest, otherwise known as NIMBY, is described by Bell et al. (2013) as a "self-interested free-rider who is not concerned about the negative effects of wind energy developments on other people." In operation, it was critical to know how individuals felt about the project impacting themselves and others to distinguish self-interest from qualified support. For instance, if someone said "I don't want this to affect my property value or anyone else's property value," then they would be classified as qualified supporter, whereas if someone said "I don't want this to affect my property value, the project would be better off in the next neighborhood over," then they would be a NIMBY. This meant that the only way to detect NIMBYs in action was to find instances where someone made comments that explicitly said they would be okay with the project if it did not affect them and would be indifferent if it affected someone else. However, participants typically did not say this outright even in a private setting as Bell et al. (2005) recommended. I suspect this is due to social desirability bias, i.e., answering questions in a way that is viewed as appropriate by others. Consequently, my results may underestimate NIMBYs in the four research communities.

Only two people made overt comments about how the solar projects would be more suitable in locations that did not affect them. Here is an example:

"I think if I were not personally invested, you know, this would be the perfect place."

Yet, I do not think this is representative of these individuals' overall sentiment based on the remainder of their interviews. Thus, I would not consider them NIMBYs. Consequently, I technically did not have any NIMBYs in my sample. But this does not necessarily mean that they do not exist. Rather, that the social gap theory is inadequate for identifying NIMBYs. In fact, if one cannot operationalize self-interest, everything becomes qualified support, which means one cannot ever distinguish if a reason is or is not self-interest. Therefore, my takeaway here is that the social gap theory needs to be refined in order for it to be used more accurately.

3.3. Implemented Procedures

This section reviews the approaches used by government officials and developers to involve the public in the decision-making process. In particular, I discuss the procedures that directly pertain to the democratic deficit, qualified support, and self-interest findings above.

3.3.1. Democratic Deficit

The procedures used to combat a democratic deficit were limited. Government officials failed to seek public input outside of a public meeting setting even though most acknowledged that the makeup of the public meeting participants was not representative of the community. Thus, the government did not do anything to address a potential democratic deficit.

Some developers seemed to take a more active role in bringing other citizens' perspectives into the discussion. For example, a developer from Community C (which was not identified as having a democratic deficit) did a Facebook campaign to collect insight from the community about their solar project. This developer was able to use the Facebook responses as evidence to show government leaders that people from the community support the project, regardless of whether they show up at the public hearing. The developer stated:

> "But I do think it's [Facebook] powerful, you know, if we're sitting down with, you know, the planning board and they're … like, OK, well, we're getting a lot of pushback here. We can say, well, you know, look, this is kind of the outreach that we've done on Facebook. … and often you can see it's three or four people that are against and there's a bunch of people from the community [for it], you know, maybe not the type that are going to come to a community meeting and speak out."

Outside of government officials and developers, independent coalitions have also played a role in countering a democratic deficit. I spoke with a member of a grassroots organization that focuses on uniting supporters for renewable energy projects across the Midwest. This individual described their model as the following:

> "We start with, you know, the thought leaders of a community, chambers of commerce, church groups, conservative leaders, landowners, etc., and sort of build out a network that way. … it's kind of our assumption that not all of these people know how many people there are just like them… [we help get] all these people in the same room and use the chair of that meeting to say, hey, look, we all know you, you're pro solar. So let's do it as a chorus of voices of the coalition rather than any one of you having to go out on your own."

While individual supporters can be crowded out in the face of fierce opposition, a band of supporters has more standing. Plus, an active group of supporters that attend public hearings may demonstrate to government leaders that there is a balanced mix of attitudes in the community.

The glory of these networks is that they are meant to merely leverage existing supporters, not create new supporters. This means that this tactic is especially suited for areas with true democratic deficits.

Though, this method has been attempted in Community D (which was identified as having a democratic deficit) and has not experienced great success. The coalition was able to find a bunch of supporters, yet, had a hard time getting people to join their group because many residents still worried about sticking their neck out and supporting the project publicly due to the hostile environment created by the opposition.

3.3.2. Qualified Support

Put simply—and perhaps tautologically, government officials and developers can enhance acceptance that is contingent on qualified support by accommodating citizens' qualifications (Bell et al., 2005). Below I discuss the extent to which this strategy was used for each qualification.

3.3.2.1. Reduced Visibility

The majority of planning commissions responded to the public's need for reduced visibility by setting stricter ordinance requirements for vegetation screening and setback distances. Some developers even handled citizens' qualifications without government intervention. In one instance, a developer claimed that they were able to secure enough land to make setbacks larger than what the ordinance demanded. Other developers offered extra vegetation screening beyond their original design for individuals that made requests. Despite these accommodations, numerous citizens were still not satisfied and thought decision-makers could have done more.

This makes it seem as if there is a threshold that needs to be met for citizens to consider their qualifications addressed. Thus, well-meant actions by decision-makers may not make a difference for qualified supporters if the measures taken fail to satisfy the qualification in its entirety. To simply illustrate this idea, imagine township planners were working on a solar zoning ordinance where they proposed a project setback distance of 50 feet from property lines. Public comment on this matter made it clear that the community required a 200-foot setback to consider solar projects concealed enough to be tolerated. Trying to find a happy medium between the community's requirements and technical feasibilities, the planners revised setback distances to 125 feet. In this scenario, decision-makers made an adjustment for the better, but it was still not enough to fully meet the community's qualifications. Situations may not always be this cut and dry, but the point is that decision-makers must do enough to make their actions worthwhile in the eyes of the qualified supporters.

3.3.2.2. Compensation

While most developers gave indirect payments that would benefit the entire community (e.g., funding for a firetruck), the majority did not offer direct payments to non-land-leasers. Therefore, citizens' compensation qualifications went unmet. There was not much revealed about why direct payments were not used. Insight from one developer suggested that it could be because individual rewards are seen as a moot point:

> "You know, it's always a tricky thing. … I equate it to somebody comes and builds a Target in my town, nobody pays me any money, right? Because they're not on my land. That's just it, you know. And so it can be a bit of a slippery slope where obviously everybody wants something. We aren't really using their land. We're really not impacting their land."

In one instance, a developer offered a benefits package that could be used or distributed however the community saw fit (which could have been direct payments), but government leaders shot the idea down because they viewed it as a bribe. This perspective is not unheard of in the literature (Cass et al., 2010; Walker & Baxter, 2017; Walker et al., 2017).

3.3.2.3. Non-Agricultural Land

Another major qualification that failed to get addressed was locating utility-scale projects on non-agricultural land. Decision-makers found problems attending to this qualification. Government officials were concerned that omission of farmland in their solar ordinance might be considered exclusionary. A county personnel in Community B described their train of thought:

> “the main concern we kept hearing throughout was the destruction of farmland and saving farmland. ... You know, we tried looking at doing something with soils. … And we couldn't find a formula that would work and still be usable. … if you tell them they can only operate in the one to four soils, well some of those are marginal and some of those are floodplains. So then are you restricting your ordinance in such a manner that you're not allowing for the use that they want. So the Planning Commission was very cognizant of making sure that we were not being exclusionary whenever we were talking about it.”

Developers expressed that siting projects on non-agricultural land had too many risks and costs. When discussing siting projects on brownfields, a developer said this:

> “At the end of the day, it does drive up risk and it drives up the price of the power. ... There's certainly a story and I think there are buyers out there that don't mind paying a little bit more to do that. ... But the majority of the market is price driven. So it's very difficult. Because it

> … drives up engineering costs, environmental compliance costs and frankly, risk. So finding people that are willing to operate with that risk can be can be tricky.”

Practical restraints like these make it challenging to appease every qualification. This complication could be why decision-makers seem to respond more to simpler qualifications (e.g., reduced visibility) than complex ones (e.g., non-agricultural land).

3.3.2.4. Water Safety

Accommodations for water safety were made, but citizens’ distrust in project leaders fueled doubt in the effectiveness of their actions. One project developer tried to heed the public’s qualifications for groundwater protection by moving the project away from susceptible areas, setting extra precautions for pier drilling procedures, and offering ground water testing throughout operation. Yet, the community still did not accept the amended proposal because they were not convinced that these measures would safeguard their water. This disbelief was linked to citizens’ lack of faith in the developer, who they accused of using deceitful tactics to get the project approved. A community member described it this way:

> “We became aware after they had been working on it [the solar project] for nearly two years and then found out that they were trying to do it under the table. … every time they say something, we're extremely skeptical. We don't believe anything that they say.”

Therefore, any action that the developer made to try to secure water safety was not seen as legitimate. The atmosphere of distrust created by the developer’s lack of transparency eroded their credibility and any chance they had at adjusting project specifics to win over qualified supporters. In situations where a transparent process is one of several qualifications, a transparent process must be met *first* to build the rapport necessary to successfully address other qualifications.

3.3.2.5. Reasonable Size

Size qualifications were typically not met by government entities for the same reason why land use qualifications went unaddressed: fear of exclusionary zoning.

One developer tried to earn community support by significantly reducing the size of their project proposal. After a series of adjustments, the developer's original project extent dropped four-fold. However, this offering failed to earn the public's approval for the same reason why the water safety accommodations were shot down: distrust. The rest of the developers did not attempt to make any size accommodations. In fact, their projects grew in some cases.

3.3.2.6. Transparency

Transparency was a critical criterion for almost every single participant. Despite its importance, decision-makers rarely delivered a transparent process that met citizens' standards. The interrelated elements of transparency that I will discuss are awareness raising, timing of involvement, and information sharing.

Awareness raising practices, i.e., public notification about solar energy decisions, and the timing of involvement were generally the same across communities. Land-leasers were the first to be contacted by developers at least one to two years before everyone else. After interest was secured with leasers, the developers would contact the local government and inquire about a solar energy ordinance. All but one of these communities built their ordinance in response to a solar developer. The one who proactively zoned for solar only did so because they were already creating their wind ordinance (which was prompted by wind developer interest). These government officials believed that the large crowd drawn in for the wind ordinance would help bring attention to the solar ordinance to increase public participation. A zoning administrator from this community stated:

> "Throughout that process of going through the wind, we decided to roll out a solar energy ordinance. And we figured since there was so much participation in our planning commission meetings at that time, we were hoping that, you know, if there ... was going to be major pushback for it (a solar energy ordinance), we would be able to get some of that input before, you know, anything was officially adopted and in the book."

Even with the ongoing wind controversy, this community seemed to have the least citizen involvement in their zoning process compared to the other communities. The reason for this is not necessarily because of a failure to alert citizens. In fact, all governments followed the same practices for notifying the public about their zoning amendments, e.g., posting a notice in the newspaper (the legal bare minimum) (State of Michigan, 2006). Perhaps the sparse participation was because there was no solar developer to spark imminent threat of a project.

After solar ordinances were solidified across the communities, some developers submitted an application for their project which warranted another public notice by the government. Again, all governments used the minimum legal means for notification about the site application hearings, e.g., post in a newspaper and mail a letter to landowners within 300 feet of a proposed development (State of Michigan, 2006). Developers across the communities claimed to be notifying non-land-leasers through open houses, door-knocking, etc. anywhere between three to eight months before their site application hearing.

The community that proactively zoned received a site application not long after they finalized their solar ordinance and approved the project after a singular notice and hearing. People said they were blindsided by this and felt like they were robbed of opportunities to provide input since they were not aware of the project until it was on the agenda to get approved. On the flip side, the communities that did reactive solar zoning knew there was a possibility of a project early on, which enticed the public to be more engaged during the zoning meetings. Hence, citizens took advantage of all the opportunities to partake in decision-making. This could make the case that reactive zoning is better for raising public awareness and consequently, participation. However, constructing an ordinance in the presence of a developer can also have its problems. Particularly, it can put the developer in a position of influence to advocate for decisions that benefit their proposal (S. Mills, personal communication, October 30, 2019). I have spoken with several citizens that do not think the developer should be involved during the zoning stage because they believe their community needs to set regulations on their own terms.

I should be clear that people were not happy when they were made aware of the project regardless of if it was during the creation of a zoning ordinance or during the site application process. There were citizens who thought that notification at the zoning stage was not soon enough because by that point the developer had already been in the community for years. Those who did not hear about the project until it was up for approval were discontent because they felt like it was too late in the game to do anything, which is consistent with the findings of Gross (2007). This raises an important question: "how soon is soon enough?"

Not only did decision-makers affect when the public was involved, but they also determined how they would provide the public with information. Most methods to inform the public were the same throughout all the communities. Every planning commission held multiple public hearings throughout the development of the solar ordinance. The government bodies in some communities had multiple public hearings for the project application approval while others had one. These meetings often had presentations by the developers as well as printed materials such as site plans and fact sheets. Apart from public hearings, most developers took additional measures (e.g., open houses, door-knocking) to provide information about their solar project and answer questions. Developers also created project websites and social media posts to distribute information. No one community had information sharing tactics that surpassed the rest.

Several citizens expressed that the information being shared was not specific enough. For example, people wanted to know more about project layouts and the developers could not offer extra insight because site plans were not finalized. In another case, a few citizens were apprehensive about the safety of the materials used in the solar panels and their worries only grew when the developers were unable to provide them any details. A concerned citizen stated their suspicion:

> "And to not tell us [about] the panels. That just tells you right there, they don't want you to know."

Again, the developers lacked that information at that point because they did not know who their manufacturer would be until later in the process.

There were also citizens that felt like the information being provided to them was baseless. Since utility-scale solar is relatively new, they were concerned that the long-term effects of these projects had not been adequately studied. Skeptics believed that the developers were making claims without proper evidence to support it, which contributed to their distrust. A Community B resident questioned the developer's logic:

"Well, they say the land will go back or something, but ... this is such a new (thing), how do they know?"

This is a reasonable response given the novelty of utility-scale solar in the Midwest.

3.3.2.7. Decision-Influence

Citizens' ability to affect outcomes varied. Every accommodation that was mentioned in the previous sections attests to the existence of citizens' decision-influence to some extent. However, no community had any formal collaborative process where citizens could directly and tangibly see their input being incorporated into decisions. The opportunities for public participation (e.g., public meetings, open-houses) simply used means of informing (i.e., one-way communication) or consulting (i.e., two-way communication); neither of which necessarily involved the decision-makers acting on the views that were shared with them (Aitken et al., 2016).

Zoning authority seemed to play a significant role in decision-influence. Citizens from self-zoned townships had greater connections with their township officials since they were well rooted in the area. This rapport could be a reason why most citizens were content with the way that their township officials represented them and incorporated their input, especially if their perspectives aligned (e.g., opponent citizens appreciated opponent decision-makers).

In contrast, citizens from county zoned townships described a disconnect with county officials. They stated that some board members or planning commissioners did not live in the area where the solar project would be built. To township residents, this meant that county officials took on the mentality that they would not be affected, so they did not have to deal with the ramifications of their actions. An individual in Community B said:

> "I don't think there's one person on the county board that lives in [our] township. So why would they care? They're looking at possible revenues. And, you know, like I said, I'm not trying to bad mouth them, they're looking at [it] from a different perspective. But if they lived in [our] township, they would be thinking a whole lot different."

Consequently, there were multiple accounts where community members voiced their opinions but felt that the county officials did nothing about them. One person claimed:

> "I appeared before the zoning and planning two times and made my pitch, And, you know,... also appeared before the county commissioners. And they listened. And but that's all they did. And they paid no attention to it."

Citizens from one of these county zoned townships felt so strongly about the county officials ignoring their requests, that they pushed their township to exert the right to self-zone before the county could approve a submitted solar farm proposal. Not long after, the citizens petitioned for and subsequently passed a charter, believing it would enhance their capacity to self-zone. This example shows that motivated citizens have the potential to make their own opportunities for decision-influence. Contrarily, citizens from the other county zoned township recognized that self-zoning would be a solution to gain decision-influence, but their township was so limited by resources that they knew this was not a feasible option. This finding corresponds to an interesting point made by both Bell et al. (2013) and Roddis et al. (2018) who suggested that wealthier communities have greater ability to organize social capital which helps them to be more effective at swaying decisions.

3.3.3. Self-Interest

Decision-makers did not do much to make the solar projects personally appealing to NIMBYs, which hypothetically would not be a problem if NIMBYs did not actually exist in my study communities. However, I still present recommendations for addressing self-interest in Section 3.4.3. because I have a hunch that it is occurring even if the theory I used failed to identify it.

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3.4. Recommended Procedures

This section reviews potential procedural actions that can be taken by decision-makers to mitigate each explanation of the social gap.

3.4.1. Democratic Deficit

There are several potential strategies to help counter a democratic deficit. One could be to make the process more democratic by putting the decision in the hands of the people. For example, decisions to pursue a solar project could be made by giving citizens a direct vote (Bell et al., 2005). The way the law works currently is that the public can petition for a referendum on zoning laws or amendments, but not for the approval of development applications (State of Michigan, 2006). Thus, this recommendation would require a change in Michigan legislature, which would be a huge undertaking. Nonetheless, voting may be seen as a more practical option in the eyes of the public because it takes less time and effort than participating in an exhaustive decision-making process. However, there is already low turnout in local elections and including green energy as a ballot measure may further politicize the topic (Bell et al., 2005).

Informal methods such as survey polls could also be used to get a better representation of the community's stance on what constitutes an adequate large-scale solar project (Bell et al., 2005). Surveys can be a more innovative and informative tactic than voting. For example, a survey could be distributed to everyone in the community to seek individuals' preferences for different attributes (e.g., location, size, etc.) of a hypothetical solar farm. The results of the survey could be used to come up with metrics to depict the community's average acceptance for each attribute. Government officials and developers can review these measures as a preliminary source of information to determine what type of project would fit best where. As a solar farm is designed, project leaders could continue to ask the public to participate in surveys to share their opinions throughout the project siting. It of course should be noted that survey results can be misleading due to a lack of response rate or misrepresentation of respondents. The survey distributors would have to spend the time and resources to implement best practice survey strategies to minimize potential faults (Dillman et al., 2014). Also, I have already mentioned in this report that surveys do not always reflect true opinions. It is possible that people's responses to a hypothetical solar farm could be an inaccurate gauge for how they will respond to the real deal. This is why survey data should be collected from the conception of the ordinance through the finalization of the project plan to better understand the adaptations that need to be made as the situation changes.

Another tactic worth exploring is network building of supporters. As described in Section 3.3.1., unifying supporters into a group may limit the intimidation factor at public hearings as well as demonstrate to the decision-makers that supporters exist. Support networks might need to consider offering routes of participation that are anonymous or only disclosed to decision-makers in confidence to further lower people's hesitation to back a solar project in an area with hostile opposition already underway. Having independent organizations facilitate the formation of support coalitions, as opposed to developers, is useful to reduce suspicion of their intentions. Michigan is fortunate to already have efforts like these happening in our state, but other places could benefit from adopting this model. To reiterate, an organized group of supporters might be the most useful in areas with an actual democratic deficit. Otherwise, these groups may have limited impact. There is evidence that claims the existence of a stable network of supporters is not significantly related to successful wind project approval (McLaren Loring, 2007).

3.4.2. Qualified Support

Recommendations to address qualified support in my four research communities are explained per qualification. Again, decision-makers must first understand the qualifications that exist in their target area before they consider what practices to use. The suggestions below may serve as general procedural guidance for other communities with similar acceptance criteria for large-scale solar projects.

As stated in Section 3.3.2.1., a community's qualifications must be satisfied in full to make decision-makers' efforts worthwhile. Even if decision-makers attempt to address the locals' qualifications, those actions can miss the mark if they are not enough. Using the engagement strategies that are described in this section is a way to thoroughly understand the community's qualifications to better know what actions to take and how much is enough. It is possible that the specificities of individuals' qualifications are heterogenous across a community. Bell et al. (2013) proposed using q-methodology or discourse analysis to help categorize qualified supporters into groups based on what conditions they require for development. Government officials could team up with researchers to perform this type of assessment in their own community. This could offer a clearer depiction of the local makeup of qualified supporters to understand what actions would please different groups. Although it may not be possible to satisfy everybody, this type of information would provide insight on the standards that need to be met to satisfy the majority.

3.4.2.1. Reduce Visibility

The best way to secure aesthetic qualifications is to develop an ordinance that has measures in place to minimize visual impact. This could be achieved by setting minimum heights for vegetative buffers and minimum distances for setbacks, as all of the research communities have already done. However, these metrics should not be solely based on other governments' ordinances. Each community is unique and has their own standards for what is considered tolerable. Government officials need to confer with a representative group from the community to find out their viewshed threshold and incorporate that information into the ordinance. As iterated throughout this thesis, public hearings are not an adequate way to acquire input. Governments should use various approaches to help get more comprehensive feedback, e.g., online surveys, suggestion box, door-knocking, etc.

Community members are unlikely to know the exact specifics (e.g., number of feet for a setback distance) of what is considered tolerable. Therefore, they need to be provided with resources to help communicate their qualifications. For example, the use of static images can demonstrate what different vegetative buffers and setbacks might look like. Virtual simulations are another way to do this with even more accuracy (Teisl et al., 2018). Citizens could select the visuals that they would be willing to live with and government officials could then translate that information into a legal document. If a developer is not involved at this stage, then the government might need to hire a consultant to make this type of information available. They could also recruit an intern to take pictures at existing solar project sites. The approach taken here is subject to the time, money, and effort the government is willing to dedicate.

3.4.2.2. Compensation

Direct compensation was recommended by numerous individuals throughout each community. These suggestions included offering cash payments or reduced electricity rates. A resident from Community C summarized their opinion about compensation:

> "Well, I mean, to be realistic, it needs to be directly related to the property for as long as the property is going to be affected. And if that's a fifty dollar a month credit on your electric bill or if that's hey, we'll hook you right up to the grid coming off of the solar farm and you know, the first whatever however many kilowatts are free or something like that."

Providing a financial reward may make up for perceived property value losses from solar development. Even if developers (and scholars) have evidence that solar projects do not impact the worth of nearby homes, they have had little success convincing residents. This is where the use of a payment to non-land-leasers might help smooth things over.

There are a number of elements to consider in the design of a compensation scheme, e.g., the type, amount, and duration of payment, as well as who will receive the payment. What the developer considers fair may not equate to what the community thinks is fair (Aitken, 2010; Leer Jørgensen et al., 2020). One study found that financial incentives used to address property value loss were not deemed sufficient to offset burdens and importantly lacked procedural fairness, consequently rendering this practice ineffective (Leer Jørgensen et al., 2020). It may be particularly challenging to offer just compensation when people have an inflated sense of what is appropriate. Someone who wants $50/month (seen in the above quote) is likely going to be unsatisfied by a bill credit that is $0.50/month. In fact, they may even perceive the latter payment as insulting low, in which case, it would be better to offer no payment at all (Gneezy & Rustichini, 2001; Kerr et al., 2012). A developer must work with the community to understand their expectations for compensation to determine if and how a compensation package could be successful. Not only will this approach be useful to tailor an incentive to best suit the community, but it will also work toward earning citizens' trust (Aitken, 2010; Leer Jørgensen et al., 2020).

Developers and officials must be careful that compensation is not perceived as a bribe, which could jeopardize its effectiveness (Aitken 2010; Cass et al., 2010). Walker et al. (2017) found empirical evidence that financial incentives that were framed as an institutionalized practice had higher public support compared to those that were presented as a voluntary offer by a developer. State mandates for financial rewards affiliated with renewable development may help alleviate perceptions of bribery. However, it is risky to rely on financial incentives as a default practice. Some communities may have strong intrinsic motivation to support these projects. Using payments in these places would not only be economically inefficient, but also might lead to motivation-crowding that could reduce people's future willingness to support renewable development without payment (Frey, 1997; Ezzine-de-Blas et al., 2019). Thus, this type of major policy would have to be used with extreme caution. Recently, the state of New York has adopted a policy that would require the provision of an annual utility-bill credit to all residential electricity customers in a town or city that hosts a solar or wind project with a capacity of 25 MW or more (State of New York, 2021). The owner of the project is required to annually provide $500 per MW for solar or $1000 per MW to fund the bill credits. This will be equally distributed amongst applicable persons (State of New York, 2021). It will be important to keep an eye on how this policy unfolds to understand its impact.

3.4.2.3. Non-Agricultural Land

Governments may satisfy the "no green energy on green land" qualification by adopting more stringent zoning dictating what type of land utility-scale solar is permitted on. Participants suggested only allowing solar projects in industrial or commercial zones. However, limiting development to certain land types may be considered exclusionary if those places do not have reasonable conditions for development. A local government would need to consult with their lawyer to determine if this practice is feasible.

Developers could play a role in meeting this qualification by prioritizing project siting on brownfields. Unfortunately, these locations come with additional complications that make them less appealing to develop. In the words of one solar project manager:

"a developer will always take the path of least resistance and lowest cost."

Therefore, the barriers to develop on brownfields need to be lowered to increase their competitiveness. The state of Michigan could help encourage solar projects on brownfields by enhancing existing financial incentives and streamlining processes for liability protection (Schaap et al., 2019).

Solar energy and agricultural production might be able to co-exist through the implementation of agro-photovoltaic operations. This technology incorporates a strategic design to optimize land productivity to help alleviate the food-energy conflict (Weselek et al., 2019). However, existing systems have yet to reach utility-scale, with the exception of one project in China that has come close with a capacity of 30 MW (Weselek et al., 2019). Most agrophotovoltaic projects average about 1-2 MW. This technology in its current state may be most suited for local, decentralized energy. Agro-photovoltaics require research and development before they can be widely deployed (Weselek et al., 2019). Several key areas that still need to be explored are the solar infrastructure's long-term effects on land viability, the compatibility of solar infrastructure with various ongoing agricultural practices, and market potential (Pascaris et al., 2020). It is important to keep these types of innovations in mind for the future as land use considerations become more pressing.

3.4.2.4. Water Safety

It is essential that the health and safety of a community undergoing or considering solar development be prioritized. Communities with pre-existing problems, e.g., well contamination, may have amplified apprehensions about a utility-scale solar project. Proactive zoning could be executed to ensure that sensitive locations are protected from development. For example, a township could designate a solar overlay district that omits locations with historically high well contamination. Alternatively, a third-party consultant could be hired to evaluate potential water safety problems. This company should be selected by government officials rather than the developer to improve the reception of the findings. A consultant hired by the latter might be accused of skewing results in favor of development, as one study participant articulated:

> "And [the developer] has spent a lot of money and brought in a lot of people. And I'm sure, you know, you can pay people to say anything you want."

As stated in Section 3.3.2.4., a developer has no credibility if they lack transparency. Developers who try to take any part in addressing citizens' water safety qualification must have the community's trust to be successful.

Possible actions for a trusted developer to perform could be periodic groundwater testing. This may help demonstrate that the solar panels are not causing any harmful leachate during operation. However, it may only be a good practice if pollution from the solar farm could be isolated from other sources of pollution, otherwise, developers might be subject to blame for pollution they did not cause.

Several citizens suggested that the developer could reduce groundwater contamination by not drilling into the bedrock. Their solution was to instead pour a thick concrete slab in which to secure the piers. If this practice was implemented throughout the entire extent of the project, it would not only significantly increase costs, but create extra challenges for decommissioning. Then again, using slabs could be a selective practice for high-risk areas.

3.4.2.5. Reasonable Size

Qualified supporters of solar energy argue that they would support proposed solar farms if they were smaller. However, at least for the purposes of this study, immense size is characteristic to utility-scale solar. This means that accommodations need to account for size qualifications, while still allowing for large solar projects. Doing this could possibly involve setting size limits in the zoning ordinance. For example, a township may choose to dedicate no more than 500 acres for continuous solar development. This allows for magnitude and also prevents excessive expansion. Again, this method should be used with caution because it could create unreasonable restrictions that might be challenged in court. Additionally, an ordinance that is too restrictive might also cause potential developers to bring their business elsewhere, making the community less likely to acquire a decent project and its associated economic benefits.

3.4.2.6. Transparency

Transparency in the decision-making process was a constantly voiced qualification. Though every single government official and developer felt like they had a transparent process, citizens disagreed. This created trust issues that spiraled as development proceeded. Here I suggest three strategies for enhancing transparency: i.) more expansive awareness raising, ii.) earlier involvement, iii.) improved information sharing.

First, increasing awareness about the planning for and approval of solar energy developments demands notification efforts that surpass the legal requirements. Simply distributing notices per the law's bare minimum misses a considerable number of residents. Other avenues for notice should be pursued such as e-news, social media, or mailing letters to households beyond the 300-foot standard (e.g., households within a mile of development or randomly selected households throughout the community). Of course, these tactics may have added up-front costs, but they may also alleviate problems and reduce costs in the future. Increasing the public notification requirements in the state legislation to reflect better practices would be an authoritative way to prompt universal adoption.

Second, community involvement needs to start as early as possible. The public should have various opportunities for engagement during the formation of the master plan and the solar zoning ordinance. Ideally, this should occur before a developer demonstrates interest in an area. Having a proactive process will serve little benefit if the community does not participate (Crawford, 2020). However, people often lack interest until the problem becomes real. This means government officials must do more to entice citizens to get involved. One way to increase participation is to deploy improved notification practices. It is possible that the more people that are aware will result in a better turnout. Additionally, government officials could create participation opportunities that are more appealing to people. For example, making a game out of certain elements of planning has been shown to make the process less dull (American Planning Association, 2016). Informal brainstorming sessions with food and prizes could also sweeten the experience. Alternatively, distributing qualitative surveys may captivate residents who lack the time to partake in lengthy forums. Again, government officials will have to go beyond the business-as-usual methods to get decent public participation. And these practices will again have additional costs that may require the acquisition of external funding sources.

Developers are also responsible for involving community members at the moment they begin considering a solar project in a community. Even if a zoning ordinance addresses most of the community's needs, there will inevitably be project specific qualifications. Upfront engagement can help developers understand what additional accommodations need to be met while also working toward gaining citizens' trust.

At the same time, my interviews with developers identified several realistic concerns with starting too early. One potential problem is that the project could lose its competitive advantage. If information gets out about a project too soon, another developer might swoop in and offer better deals to the land-leasers. This may primarily be an issue when multiple developers are working in the same area. The other dilemma with engaging the public too early is that doing so may create much ado about nothing. A developer in Community C framed it this way:

> "So if you come in and say, hey, we're planning on doing a solar project here, but you haven't even talked to those landowners, you're really kind of putting the cart before the horse. … Because, frankly, you know, if you can't get enough land, there is no project. It's sort of pointless to spin up the public and say, hey, this might be coming. You know, I think that sometimes they don't realize, so, yes, we signed some leases. Yes, we get into the

transmission queue, which is roughly a three to four year process. And we get a feasibility. Because … if those don't line up, there is no point."

In this case, it is arguable that the public might get wound-up whether they know about a solar farm from its conception or if they find out about it after the fact. At least with the former, developers might be able to establish a better standing with the community which could reduce subsequent problems. It is already known that waiting until the last minute to include the public can be detrimental to their project acceptance and even the project itself (Gross, 2007; Firestone et al., 2012; Simard, 2018). Thus, it is worth trying to broadcast the idea of a solar farm to citizens at the onset of leasing to see how those outcomes compare to that of the typical practice. Developers must be willing to push their comfort zones and explore new approaches to adapt to the needs of host-communities.

Lastly, information on the solar project should be more specific, as well as informed by local expertise and preferences. Project developers need to be as detailed as possible when discussing elements of the solar farm proposal. Being vague comes off as elusive. In cases where specifics are not yet known, the people should be given an explanation as to why and offered that information when it becomes available. Information sharing should not stop with site approval.

It is worth noting that trying to solve both earlier involvement and more detailed information sharing can be a Catch 22. If the public is involved too early, exact project descriptions are unavailable. Yet, by the time there is a completed site plan, people feel cheated since they were not informed at its origin. The best government leaders and developers can do is try to offer as much notice and information as they can throughout the entire process.

Some information cannot be provided because it simply does not exist yet due to the newness of large-scale solar in the Midwest. Thus, there is a need to conduct more research on the long-term effects of utility-scale solar projects in order to generate evidence. This is where the research community can assist—studies that are performed by a university or independent organization may be deemed more legitimate to citizens than research that is conducted by a developer's consultant. Effects on property values as well as land viability post-decommissioning are topics of particular interest. There is a bit of peer-reviewed literature that exists on these topics already (Gaur & Lang, 2020; Adeh et al., 2018; Armstrong et al., 2016), but it is unclear how it is used by decision-makers or citizens. Plus, the locations of these studies may not always lend themselves to the same context as the areas of interest. This means additional research needs to be geographically relevant and easily accessible.

Finding the right person to disseminate information is critical to improving its uptake and build trust between developers, officials, and residents. Folks in these communities were hesitant to believe the word of non-locals. Identifying a community leader that has an established connection in the area can help to validate messaging. This recommendation has even been suggested by residents, a person from Community D said:

> "I think when you work with a rural community, you have to gain some footing with the locals or it's never going to work."

The use of community liaisons has improved developer credibility (Dwyer & Bidwell, 2019). Additionally, using community liaisons is a key strategy of the grassroots advocacy coalition mentioned in Section 3.3.1. A person in this group stated:

> "We do best when I'm not the face of something. You know, we look for sort of a local captain to take on that role. … This is exaggerated, but, you know, the idea of this outsider coming in and making all these promises it falls on deaf ears. … So it's finding the right folks

who are deeply embedded in the community that obviously care about the community's future and are going to be part of that community's future."

They have found particular success with selecting liaisons that do not have direct ties with the project because these people lack extrinsic motivations that can be linked to their support.

3.4.2.7. Decision-Influence

Starting early and getting a large amount of people to participate serves the greatest benefit when decision-makers actually use citizens' advice. For example, citizens from one community in this study felt that even though they offered input during the conception of the zoning ordinance, it was not acted on by the county, rendering them powerless. Thus, public involvement becomes meaningful when citizens acquire decision-influence. Officials are responsible for taking what the public has voiced and translating that into tangible outcomes such as ordinance provisions. Resources on community engagement strategies may help guide the adoption of decision-making tactics that encourage citizen empowerment (Bassler et al., 2008; Bryson & Carroll, 2007; Schafer, 2019). Several studies have demonstrated that inclusion of citizen input is linked to improved acceptance of renewable energy development (Dwyer & Bidwell, 2019; Firestone et al., 2018). It also is thought to result in better decisions (Jami & Walsh, 2017). While officials cannot do everything the public wants because of legal and statutory limitations, doing something may be better than doing nothing.

As I have mentioned when discussing a democratic deficit, public meetings are often the only chance for a community to offer input and potentially affect outcomes. To avoid allowing just people who attend the public forums to influence the decisions, government officials need to find more unique ways to collect insight from people. Conducting community-wide surveys, gathering information from focus-groups, or asking for feedback through social media are all recommended strategies. Participants in this study also believed that having a vote would be another way to directly impact decisions. Again, voting has limitations, just as all methods do. Using a combination of tactics for public response will help broaden accessibility. The key, though, is to incorporate a variety of forms of feedback into decisions in a way that makes enhanced opportunities for participation worthwhile.

Having a more localized zoning authority can also make a difference regarding decision-influence. Self-zoning gives the township the power to decide what they want solar energy to look like in their community. A township government may be more capable of meeting people's demands because a smaller population shares more similar values (at least more so than the county scale). Input may go further in a more localized setting. However, the additional costs and liabilities associated with zoning need to be considered. Township zoning can only be beneficial if the township has the time, resources, and training to maintain an ordinance that is legally sound, otherwise, it may backfire. At the same time, a township that does not have the means to self-zone may have less capacity to sway decisions and be more susceptible to unwanted development. This could mean that solar developments may become concentrated in less affluent areas—raising serious concerns for distributive justice (Roddis et al., 2018). Better financial and technical support from the state government could assist townships in adopting ordinances that are more appropriate and equitable.

3.4.3. Self-Interest

A potential solution to appeal to NIMBYs would be to ensure that they personally benefit from a solar project (Bell et al., 2005). This could be done through the provision of a financial reward; however, as discussed in Section 3.4.2.2., using payments has both advantages and disadvantages.

NIMBYs could also be influenced by a financial sanction. For example, those communities that choose to not implement renewable projects when they are possible could get charged an annual fee or increased rates. This would monetize externalities created by “free riders” in the clean energy movement. However, it could also result in socially unjust consequences if those who cannot afford to pay become stuck with a problematic project, while wealthier communities purchase their freedom. Negatively incentivizing communities to adopt renewable energy projects through financial penalties is an idea that has not been explicitly explored in the literature. However, the use of fines for environmental compliance has been studied and there are mixed results on their effectiveness (Gray& Shimshack, 2011; Stretesky et al., 2013; Barrett et al., 2018).

Perhaps a better incentive could be community ownership, or providing options for the public to have a stake in the project. Ownership can be instilled through decision-making processes that allow individuals to contribute to project design. Additionally, more tangible types of ownership could be offered by creating opportunities for individuals to lease a portion of the energy project with adjusted utility rates based on investment. People who have some sort of personal tie to a project are more likely to want to see it succeed (Bell et al., 2005; Jami & Walsh, 2017).

There have been some studies that suggest that community ownership does positively affect acceptance (Warren & McFadyen, 2010; Toke et al., 2008). However, people are not always inclined toward ownership when given other options. Vuichard et al. (2019) looked at Swiss electricity users’ preferences for different financial participation schemes associated with wind farm development. Participants were given three choices: wind shares (i.e., invest in a share and get a varying dividend), wind bonds (i.e., invest in a bond and get a fixed return), or a wind resource tax (i.e., no personal investment, but a developer contributes to an earmark fund that is split equally amongst community members). Results showed that participants preferred the wind resource tax. Similarly, Hyland & Bertsch (2018) found that Irish citizens' acceptance of infrastructure development was greatest in involvement schemes that offered compensation without investment. So even though these communities were already compensated in the form of property tax payments, the additional rewards helped to make the payments more direct and visible. Plus, their lack of interest in investment could mean that financial rewards may be a better solution than ownership in communities that are risk adverse.

4. CONCLUSION

4.1. Conclusion

This study looked at the public acceptance of and decision-making processes for utility-scale solar project development in Michigan. I interviewed 33 citizens, government officials, and developers across four potential host communities. Conducting interviews with individuals that have experienced solar project development allowed me to gather rich information on participants' perspectives. This thorough understanding was necessary to provide a detailed explanation of the solar social gap. At the same time, this method and my findings may be limited due to the purposive selection and small sample size. Nevertheless, I discuss four key takeaway points below.

The first conclusion is that the public in all four communities saw both negative and positive traits of large-scale solar development. Impacts on viewshed, property value, and agricultural land were the most consistently cited concerns, while projects' economic additions and contribution to clean energy were common benefits.

The second conclusion is that Bell et al.'s (2005) and (2013) social gap theory has considerable operational constraints. The qualified support and self-interest explanations were particularly troublesome. The former had a broad definition for what constitutes as a qualification. I had to make a distinction between a qualification and a concern to make this explanation more meaningful. There is a fine line between not liking something about a project and not accepting a project because it lacks necessary features. Yet the theory does not illustrate where that line is drawn. I attempted to do so by deeming a qualification as a project or process attribute that was explicitly identified as the contingent factor for an individuals' support. But this method is heavily subjective to phrasing. More clarification on the characterization of a qualification and how a qualification can be differentiated from a concern in practice would help improve this theory.

The social gap theory's portrayal of self-interest was impractical for use. To discern self-interest from qualified support, I had to establish standards that were nearly impossible to meet. Namely, I would only proclaim NIMBYism if I could find instances where an individual claimed that they did not want a project to affect them, but were indifferent if it affected someone else. This requirement was particularly sensitive to social desirability bias and therefore likely resulted in an underestimation of self-interest. The social gap theory should incorporate better ways to identify self-interest in application so that this explanation retains relevance. A lack of ability to detect NIMBYism may be misconstrued as a lack of NIMBYism, which might not be true. One way to improve the self-interest explanation could be to adjust its definition to merely mean any personal grievances against a project, instead of its current two-part definition which is any personal grievances against a project in combination with not caring about how the project impacts others. The former would be easier to identify because it does not require people to do the socially undesirable act of throwing others under the bus to be considered a NIMBY. Plus, a simplified definition would eliminate the nuances that set apart these two explanations, meaning that self-interest and qualified support could be merged into one. This may take the form of "self-interest" becoming a type of qualification in which an individual's support would depend on how a project impacts them personally. Overall, the social gap theory, as currently described, is unsuitable for application. My expectation is that other researchers who desire to operationalize this theory may struggle to do so.

My third conclusion is that despite the shortcomings of the social gap theory in distinguishing between self-interest and qualified support, I was still able to characterize the solar social gap in Michigan. The most likely explanations are a combination of democratic deficit and qualified support. A democratic deficit may be occurring because standard public processes are relied upon, which mostly attract extreme opposing views. These voices are the ones that tend to be reflected in the decision outcomes. Whether or not they represent the minority can only be determined with more representative sampling of the community's preferences. Regardless, measures to improve public representation should be used to complement the public process to ensure all voices are present at the decision-making table. As far as qualified support, a lot of individuals that I interviewed had criteria that needed to be met in order to accept proposed solar developments. Some qualifications were attempted to be addressed through adjustments in zoning ordinances or site plans. However, these actions were often perceived as insufficient, leading community members to remain unsatisfied with the projects. And in some instances, qualifications were simply not addressed either due to decision-makers' lack of effort or ability. Instilling practices that encourage early and meaningful public involvement during the zoning process and throughout project siting is crucial to help appease qualified supporters.

My final conclusion is that decision-making strategies make a difference in community acceptance (Gross 2007; Jobert et al., 2008; Firestone et al, 2012; Lienhoop, 2018; Jami & Walsh, 2017). Though they are not the only factor that matter—indeed, organized opposition also plays an important role—but government officials and developers have at least a modicum of control over these processes. Decision-makers in my study communities used three effective strategies, including expanded measures to collect public input, adopting proactive planning where the solar ordinance was formed prior to developer interest, and zoning at the township level rather than at the county level. However, not all of these practices were used to the fullest extent and several recommendations I describe above were not implemented at all, such as aggressive awareness raising or descriptive information sharing. Therefore, it remains difficult to compare the outcomes of a comprehensive and collaborative approach with a business-as-usual approach. Practitioners must deploy best practices for community engagement in solar farm siting, not only to improve the development process and maximize community well-being, but also to provide opportunities for researchers to confirm the effects of those practices using empirical studies. These initiatives are necessary next steps for closing the solar social gap.

APPENDICES

APPENDIX A

Interview Guides

Government Officials

- Please tell me about your work at (insert township/county)
  - What are your responsibilities?
  - How long have you worked in (insert township/county) community?
- Could you describe what living in your community is like?
- What prompted the township to consider hosting a solar project?
- Can you describe the steps that were taken so far in the decision-making process for this solar project?
- What was the community's initial reaction to this solar project?
  - How did the township respond to this reaction?
- What was done to engage or incorporate community members in the decision-making process?
  - Who showed up?/Who did you talk to?
  - How did you know what opinion was most representative of the community?
- How did you know if this project was or was not a "good fit" for the community?
- In your opinion, under what conditions, if any, would this project be accepted by the people of (insert township)? **OR** Why do you think the people of (insert township) were accepting of this solar project?
- What advice would you give to another (insert official's role) that is thinking about hosting a large-scale solar project?
- Do you know of any individuals in the community that would be willing to talk to me about this solar project?

Developers

- Please tell me about your work at (insert company)
  - What are your responsibilities?
- What prompted your company to propose a solar project in (insert township/county)?
- Can you describe the steps that were taken so far to get (insert township/county) to consider your project?
- What was the community's initial reaction to this solar project?
  - How did you respond to this reaction?
- What was done to engage or incorporate community members in the decision-making process?
  - Who showed up?/Who did you talk to?
  - How did you know what opinion was most representative of the community?
- How did you know if this project was or was not a "good fit" for the community?
- In your opinion, under what conditions, if any, would this project be accepted by the people of (insert township)? **OR** Why do you think the people of (insert township) were accepting of this solar project?
- What advice would you give to another developer that is thinking about pursuing a utility-scale solar project in rural Michigan?
- Do you know of any individuals in the community that would be willing to talk to me about this solar project?

Citizens

- Please tell me about yourself.
    - What is your profession?
    - How long have you lived in (insert township)?
- Could you describe what living in this community is like?
- What do you like about living here?
- How did you first become aware of the possibility of a solar project being built in your community?
- Did you participate in any government or developer-held sessions related to this solar project?
    - What is the reason you did or did not participate?
    - What was the mood of these meetings?
        - What was the public saying?
        - How were the decision-makers responding?
        - Do you think that those who showed up were representative of the county's overall sentiment?
- Do you feel that the government officials and/or developers did enough to involve the citizens when making decisions about this solar project (insert township)?
    - What is the reason you say that?
    - What, if anything, did they do well?
    - What, if anything, could they have improved?
    - Did the way they approached these decisions affect your opinions of this solar project?
- What do you think about this solar project?
    - What, if anything, do you think is good about this solar project?
    - What, if anything, concerns you about this solar project?
- Do you think others feel the same way you do?
- Can the government officials and/or developers do anything to alleviate your concerns?
    - Any suggestions for how they might?
    - Do you think if they would have come to you sooner to ask you to participate, you'd be more willing to look past these concerns?
    - How would actively engaging in the technical planning and development of this project affect your opinion of it?
- Under what conditions, if any, would you accept this solar project in your community? **OR** Why are you accepting of this solar project in your community?
- What is your opinion on solar energy in general?
- Where, if anywhere, do you think these mega solar projects should be housed?
- Do you know of any other individuals in the community that would be willing to talk to me about this solar project?

APPENDIX B

Codebook 1

Table 3: Codebook 1 used to guide thematic analysis.

Code	Definition	Rule	Example
Community Benefit Agreements	The direct compensation a developer provides to non-leasing individuals, groups, or government bodies for hosting the solar project; this is any additional reward that is granted beyond the standard economic benefits (e.g., tax revenues, jobs) associated with the project.	Apply to statements about any type of CBA associated with the solar project.	"You know, it's [community benefits] always a tricky thing. You know, like I guess I equate it to somebody comes and builds a Target in my town, nobody pays me any money, right? "
Decommissioning	The take down of the solar project.	Apply to statements about the decommissioning of the solar project.	"If they don't fix it, you know, all this junk is laid on the field. Who's gonna clean this mess up?"
Democratic Deficit	An indication that there is a minority of people who oppose solar energy and they are the ones that dominate the community’s stance on a solar project.	Apply to statements about the misrepresentation of the community's opinion or the influence of passionate individuals in small numbers.	"If you were to look at the actual vote of yes of people that voted for a charter township, which would be … the anti solar group, which they were organized, it really represents twelve percent of the voting public."

Table 3 (cont'd)

Disconnect	The disparity between the people who make decisions about the solar project and the people who have to live with the decisions.	Apply to statements about the disconnect between solar project decision-makers (including leasers) and the host community.	" most of the land which they are putting this on is owned by absentee landowners. They don't even live in the area. … they don't care the neighbors are pissed off."
Economic	The economic impact affiliated with the solar project.	Apply to statements about the financial corollaries of the solar project.	I picked up another fifty thousand dollars on the 80 acres of mine and I still got my farm at 400 acres. Its money that we just can't make a more."
Electricity	Access, supply, or distribution of the electricity produced by the solar project.	Apply to statements about the electricity associated with the solar project.	"Well it's not going to be part of the local grid. So... there's no actual benefit to the solar power being there." OR "Everybody likes electricity. They like it when they turn the switch and the light comes on. And this is going to make a way to do this."
Environmental	The effect the solar project has on abiotic or biotic components of nature.	Apply to statements about the environmental effects of the solar project.	"What happens when a deer gets in there? How does it get out, you know?" OR "The drainage issues, they give you they give you all kinds of issues."

Table 3 (cont'd)

False Consensus	The overestimation of opposition regarding the solar project.	Apply to statements about how an individual think their view is the universal view.	"I know where there's another one there off of St. Joe. I used to live over there and I mean, it's an eyesore. … Who would want to live there? Not nobody that I know."
Financial Assistance	The action of a developer to limit or offset their taxes or use government funding to aid in the finance of the solar project.	Apply to statements about the use of tax abatements or subsidies for the solar project.	The only way this is feasible even is by government subsidy. It's kind of a boondoggle.
Flip	The change of ownership of the solar project.	Apply to statements about the change of ownership of the solar project affecting social acceptance.	"And, you know, in there, again, we know very well that the developer doesn't usually end up being the end owner of the project. So they walk away from it, leave all the problems to somebody else eventually."
Health/Safety	The physical or mental human health or safety ramifications caused by the solar project.	Apply to statements about the health or safety of the solar project.	"We don't need any more drilling holes in our bedrock because it opens up to, well contamination."
Imported Materials	The foreign supply of products for the solar project.	Apply to statements about the non-domestic materials of the solar project.	"The other thing that's really frustrating is all of these semi trailers that come in that have China on the side."

Table 3 (cont'd)

Land Use	The preferences for the land use and how that relates to the solar project.	Apply to statements about the land use for the solar project.	"They grew up around the corner on another farm and you know, (they're) just really devastated about the change in landscape."
Noise/Disturbance	The commotion or audible disruption associated with the solar project.	Apply to statements about the disturbance associated with the solar project.	"They're gonna follow the sun, so they're gonna be motorized. So there's gonna be noise to it. You know, ... it's going to be quite intrusive to people that actually have to live in the middle of it."
Organized Opposition	The things opponents do to kill a solar project.	Apply to statements about organized opposition tactics against the solar project	"These people never cared about aesthetics, but they use that for purposes, you know, to kill these things. So Shiawassee County's been like that."
Procedural	Any government or developer sanctioned action that informs, notifies, involves, accommodates, neglects, or evades the public regarding the solar project or associated zone.	Apply to statements about the decision-makers or the decision-making process related to the solar project; this does not apply to any financial procedures.	"I mean, as a community member, I never had the opportunity to vote on it."

Table 3 (cont'd)

Qualified Support	An indication that the interviewee supports solar energy as long as certain standards are met in order to limit impacts on the landscape, wildlife, humans; if a solar project does not meet those standards, then a qualified supporter would be opposed to it.	Apply to statements where support is contingent on meeting certain criteria to reduce impacts on landscape, wildlife, or humans.	"So that's the biggest thing, is quit trying to do this under the table. Be open and transparent. Transparent. Like I said, if solar is so amazing and wonderful, feed to us. Tell us how amazing a wonderful it is and we'll buy into it."
Recommendation	Suggestions for how the subject could have been improved to mitigate concerns/close the social gap.	Apply to statements that propose a recommendation for anything that the existing project did not do.	Give me free electricity for as long as the house is there, you know. … I mean, if they would do something like that, I'd put a yard sign out.
Representation	General estimation of the make-up of supporters or opponents of the solar project and their tendency to get involved in the decision-making process.	Apply to statements about the representation of local acceptance and their involvement as it relates to the solar project.	"I mean, when I clearly say the public up in that corner, there weren't a lot of people and the "no" people severely outweighed the "yes" people."
Self-Interest	An indication that the interviewee supports solar energy in a general sense but has selfish reasons for opposing a solar project in their own community.	Apply to statements where an individual is only concerned for their own well-being; they would be ok with the project if it affected someone else and not them. Only apply to first-person perspective.	"I think if I were not personally invested, you know, this would be the perfect place."

Table 3 (cont'd)

Size	The area or capacity of growth of the solar project.	Apply to statements about the size of the solar project.	"We are concerned that the solar will keep coming our direction"
Social Conflict	Social tension between community members caused by the solar project.	Apply to statements about the social conflict associated with the solar project.	"The community is really divided." OR
Social Diffusion	The spread and uptake of opinions about the solar project from very passionate individuals to other members of the community.	Apply to statements about the influence of vocal individuals on others pertaining to the solar project.	"I think sometimes it's if you get that one or two influential people that are against it and they're going to kind of rally the anti crowd. Big difference. You know, and it just cascades."
Technical	The ability of the solar project to sustain operation effectively and efficiently.	Apply to statements about the technical viability of the solar project.	"Well, you know, I'm just not sure the solar panels in Michigan are smart thing to do. Because of the fact that, you know, as I look out the window right now, it's cloudy, overcast right now."
Visual/Aesthetic	The aesthetics of the solar project and associated attributes (e.g., buffers).	Apply to statements about the aesthetic impact of the solar project.	"I still don't really want to look out my backyard at a solar farm."
Wind	Anything about wind projects (e.g., procedures, physical attributes, impacts, etc.).	Apply to statements about wind projects or the comparison of wind projects to solar projects.	"At least it's solar, it's not, windmills, it's not something else."

Table 3 (cont'd)

Category	Definition	Rule	Example
Negative Attitude	Feelings about the subject are negative.	Each code from the above codebook will have this category. This category is intended to house statements where there is dissatisfaction/discontent associated with the subject.	"You know, ... it's going to be quite intrusive to people that actually have to live in the middle of it."
Neutral/No Attitude	Feelings about the subject are non-existent; the statement is descriptive rather than opinionated.	Each code from the above codebook will have this category. This category is intended to house statements where there is no obvious emotional connection associated with the subject.	"A letter in the mail. … I think it was from the developer. … They were notifying me because, yeah, I am directly in the middle of the project."
Positive Attitude	Feelings about the subject are positive.	Each code from the above codebook will have this category. This category is intended to house statements where there is satisfaction/content associated with the subject.	"So, you know that to me, that's where the advantage they have of being out in the farmland where ... there will be relatively few people whose homes are directly adjacent to it."

APPENDIX C

Codebook 2

Table 4: Codebook 2 used to guide thematic analysis.

Parent Code	Child Code	Definition	Rule	Example
Economic	Community Impacts	The financial aspects of the solar project that are relevant to the entire community, including jobs, taxes, etc.	Apply to statements that are categorized as "Economics" that are particularly related to the financial impacts on the community.	"Well, like I said, you know, its going to save on our taxes. This could help the police, fire department. "
	Personal Impacts	The financial aspects of the solar project that are relevant to the land-leaser.	Apply to statements that are categorized as "Economics" that are particularly related to the financial impacts on the land-leasers.	"But, you know, I mean, they offered me ... eleven hundred bucks an acre rent. So I'm sitting there looking at forty four thousand dollars a year to do nothing."
	Property Value	The impact the solar project has on nearby property value.	Apply to statements that are categorized as "Economics" that are particularly about property value.	"Again, personally, I don't think it's going to improve my home value. I think it's going to adversely affect it."
Environmental	Clean Energy	The consideration of the solar project as a clean energy source.	Apply to statements that are categorized as "Environment" that are particularly about clean energy.	"It's good for renewable energy. And I think cause I'm a climate change believer."
	Drainage	The impact the solar project has on runoff and drainage.	Apply to statements that are categorized as "Environment" that are particularly about drainage.	"The water run off from the panels would flood the thornapple river"

Table 4 (cont'd)

	Wildlife	The impacts the solar project has on wildlife.	Apply to statements that are categorized as "Environment" that are particularly about wildlife.	"it's got to have fence around it … I mean, the deer will be pushed in other areas."
Health/Safety	Groundwater	The impact the solar project has on groundwater.	Apply to statements that are categorized as "Health/Safety" that are particularly about groundwater contamination.	"And there is some thought that when it rains on these things, there might be chemical residues produced which… could eventually get into the drinking water."
	Safety	The human safety hazards of the solar project.	Apply to statements that are categorized as "Health/Safety" that are particularly about safety hazards; this does not apply to anything about groundwater.	"but what are the EMFs that are being generated from this field that we live so close to? Is that going to cause cancer like it does with transmission lines…"
Land Use	Agriculture	Land that is primarily used for the agricultural production.	Apply to statements that are categorized as "Land" that are particularly about agriculture land.	"It's taking prime ag land out of production. And, you know, it's not what farmland should be used for."

Table 4 (cont'd)

	Industrial	Land that is primarily used for industrial operations or is not being used for anything.	Apply to statements that are categorized as "Land" that are particularly about industrial land or grayfields.	"Well, you know, we thought, you know, in in the Flint area, this General Motors demolished a number of factories. And there are large areas that are just, you know, there's nothing there. … They could put it there."
Procedural	Accommodation	Instances where the government or developer adjusted solar project attributes in response to the public.	Apply to statements that are categorized as "Procedure" that are particularly about the project leaders accommodating the solar project for the public.	"A lot of times it was for landscape screening, people saying, like, yeah, I want this area to be screened ... we can kind of address that concern pretty easily."
	Awareness	Extent the public was made aware of the solar project.	Apply to statements that are categorized as "Procedure" that are particularly about public awareness.	"Them were very hush hush when they'd have them. You might find out like a day before. Or the day after. Or the day of."
	Information sharing	Opportunities that the government or developer made to share information about the solar project.	Apply to statements that are categorized as "Procedure" that are particularly about information sharing.	"And that's where we will set up a project website that has some of that information."

Table 4 (cont'd)

	Notice	Instances where the government or developer notified the public about the solar project.	Apply to statements that are categorized as "Procedure" that are particularly about the project leaders noticing the public.	"But with this project, it was primarily just door knocking."
	Trust	Extent of trust the public held in the government or developer as it pertained to the solar project.	Apply to statements that are categorized as "Procedure" that are particularly about the public's trust in project leaders.	"But..., when [the developer] opens their mouth, we don't believe them because you shouldn't have been doing this under the table for so long without us trying to know about it. "
	Voice	Extent the public had a chance to influence the decision-making about the solar project.	Apply to statements that are categorized as "Procedure" that are particularly about public voice in decision-making.	"It was a done deal before anybody said anything."

Table 4 (cont'd)

	Category	Definition	Rule	Example
	Negative Attitude	Feelings about the subject are negative.	Each code from the above codebook will have this category. This category is intended to house statements where there is dissatisfaction/discontent associated with the subject.	"You know, ... it's going to be quite intrusive to people that actually have to live in the middle of it."
	Neutral/No Attitude	Feelings about the subject are non-existent; the statement is descriptive rather than opinionated.	Each code from the above codebook will have this category. This category is intended to house statements where there is no obvious emotional connection associated with the subject.	"A letter in the mail. … I think it was from the developer. … They were notifying me because, yeah, I am directly in the middle of the project."
	Positive Attitude	Feelings about the subject are positive.	Each code from the above codebook will have this category. This category is intended to house statements where there is satisfaction/content associated with the subject.	"So, you know that to me, that's where the advantage they have of being out in the farmland where ... there will be relatively few people whose homes are directly adjacent to it."

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