RESOURCE ECONOMICS AND ENVIRONMENTAL SOCIOLOGY

Social Impact Assessment of
Alternative Energy Production in Alberta

Cathryn Sprague and John R. Parkins
(Editors)

Project Report # 12-01

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UNIVERSITY OF ALBERTA
DEPARTMENT OF RESOURCE ECONOMICS
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Editors and Authors

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Contents

Abstract

Energy production is a large part of Alberta's economy, with direct impacts on rural landscapes and host communities across the province. This report provides an analysis of social impacts from alternative energy production, with a focus on biofuels, solar, geothermal and wind power technologies. Using comparative case study methods, research includes key informant interviews, published literature and other sources of available data from project proponents and rural community sources. The report utilizes a common assessment framework that draws a connection between social impact assessment methods and a conceptual framework that is based in community capacity and adaptation. Results point to the ways in which alternative energy can enhance community capacities through contributions to economic infrastructure, alternative sources of employment, human capital development and social mobilization. Research also notes the importance of public participation as a key aspect of project development, especially in the early planning and implementation phase of the project. Finally, research indicates that although renewable energy has great potential in Alberta, conventional sources of energy production are perceived to be adequate and cost effective in many ways, resulting in a reluctance to invest over the short term in somewhat expensive and controversial technologies.

JEL codes: O21, O22, Q01, Q42

Keywords: Community capacity, local impacts, local benefits, rural development, energy futures, comparative case study

Chapter One – Linking Concepts of Community Capacity with Social Impact Assessment

John R Parkins

Social impact assessment has emerged from several legislative and policy initiatives in countries around the world. In the United States, the National Environmental Protection Act (1969) provided strong legislative impetus for the development of procedures for environmental impact assessment and early references to social impact assessment from the 1970s focused on pipeline development and indigenous cultural impacts in particular (Burdge 2004). In Canada, an equally significant impetus in the development of social impact assessment came in 1974 through a federal government inquiry into the proposed Mackenzie Valley Pipeline. Headed by Justice Thomas Berger, the so-called Berger Inquiry developed a template for social impact assessment that remains influential in the published literature (Gamble 1978; Torgerson 1986; O'Faircheallaigh 1999). According to Gamble (1978), the Berger Inquiry was influential as a template for impact assessment because of the autonomy of the process (particularly the ways in which data gathering took place at arm's length from project proponents) and the ways in which local expertise was privileged and integrated with technical information and external expertise.

Extending from these important advances in the 1970s, which focused on holistic and comprehensive assessments, contemporary approaches to environmental assessment in North America have become more technical and procedural in their basic orientation (Vanclay 2002). These procedural approaches are undertaken predominately by consultants who work on behalf of project proponents, they are focused on measurable and quantifiable indicators, and they rely on technical procedures such as cost-benefit analysis.

This trend toward technical and expert-based assessment is also evident in recent scholarship on social impact assessment, within North America in particular. As an example, in the early 1990s the U.S. Government commissioned a set of guidelines and principles for social impact assessment. Published in 1994 (and updated in 2003), this document provided refinements and rigor with regard to specific methods for social impact assessment. Social impacts are defined as "the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs and generally cope as members of society" (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment 1994:1). Accordingly, the document defines social impact assessment "in terms of efforts to assess or estimate, in advance, the social consequences that are likely to follow from specific policy actions (including programs and the adoption of new policies), and specific government actions (including buildings, large projects and leasing large tracts of land for resource extraction)" (1994:1).

This document was influential in forging an approach to social impact assessment that involves quantitative and technical elements of indicator identification, baseline assessment and research approaches that generally dovetail with bio-physical elements of environmental assessment. One theme in this technical approach to social impact assessment is the identification of indicators that cover a broad set of social domains. Burdge's (2004) list of 28 indicators is arguably the most common and contested (Vanclay 2002) list of indicators in the literature. Indicator domains within this list include population impacts (e.g., population change and relocation of individuals and families), community and institutional arrangements (e.g., interest group activity, changes to local government structure, enhanced economic inequalities), communities in transition, (e.g., presence of an outside agency, introduction of new social classes), individual and family level impacts (e.g., disruption in daily living and movement patterns, disruption in social networks, change in leisure opportunities), and community infrastructure needs (e.g., land acquisition and disposal, effects on known cultural, historical, sacred and archaeological resources).

One critique of the highly technical and expert-based orientation to social impact assessment (SIA) as described above is the frequent lack of clarity around theoretical and conceptual frameworks to guide this work. Social impact assessments typically consist of indicators and variables, with little attention to why these indicators are relevant and how they relate to each other. Sometimes these indicators are developed by outsiders from the top down, based on opinions about what matters most within a given context. Sometimes these indicators are developed in conjunction with local people from the bottom up, based on insights about local values and interests that are reflected in the list of indicators. At the end of the process, however, there are lists of indicators that are not well grounded in any particular theory of community development, quality of life, or conceptualization of social sustainability.

The basic claim here is that much of our work on social impact assessment lacks theoretical and conceptual clarity. If we don't know why we are identifying indicators and measuring things, how do we know what to identify and measure? This is a critical shortcoming in the current practice of impact assessment.

This shortcoming is addressed in this report by imposing more conceptual rigor onto the practice of social impact assessment. Although conventional SIA processes such as scoping and identifying social indicators remains relevant here, an added component to this process involves a conceptual lens through which the research and analysis takes place.

There are a numerous areas of conceptual and theoretical work that connect to social impact assessment. For instance, the livelihoods approach to community development offers important conceptual insights (van Dijk 2011). Similarly the concept of community resilience has a strong connection to social impact assessment in terms of helping communities become more resilient through project design (Colussi and Rowcliffe 2000). The conceptual framework that is taken up in this report is broadly defined as a community capitals framework or a community capacity model. This model offers a way to overlay the development of social indicators for impact assessment with a conceptual basis that is focussed on enhancing community capacity. If social impact assessment is about assessing the consequence to human communities from project interventions, then community capacity assessment is about more than assessing consequences. It is about assessing the consequences of project activities or policy changes on the capacity of communities to persist and thrive into the future. Moreover, scholars have developed a solid basis for understanding the key dimensions of community capacity.

According to Beckley et al. (2008), community capacity is "the collective ability of a group (the community) to combine various forms of capital within institutional and relational contexts to produce desired results or outcomes" (p. 60). This definition includes aspects of community assets (i.e., capital or resources), a catalyst for change, the mobilization of resources (i.e., turning stocks of capital into flows of capital), and the achievement of certain outcomes. Within a community development context, this community capacity model offers insight into the strengths and weaknesses of community based assets and how certain development actions can impact community capacity. Although we draw on Beckley's work in particular, there are other important contributors to this literature that offer a strong foundation for empirical work (e.g., Machlis et al. 1997; Emory and Flora 2006).

Within a social impact assessment context, this same conceptual framework can be used to assess how certain projects, or aspects of projects, might impact the capacity of a community. If a pipeline is built adjacent to a community, how will it impact community capacity? If a pulp mill is constructed in a community, what is the impact on community capacity? These questions are similar, but more precise than what is normally asked in these situations. We are not simply interested in a list of social indicators and social impacts. We are interested in knowing more precisely about the impact a project might have on the collective abilities of a group (a community) to combine forms of capital (local resources) in order to achieve desired outcomes.

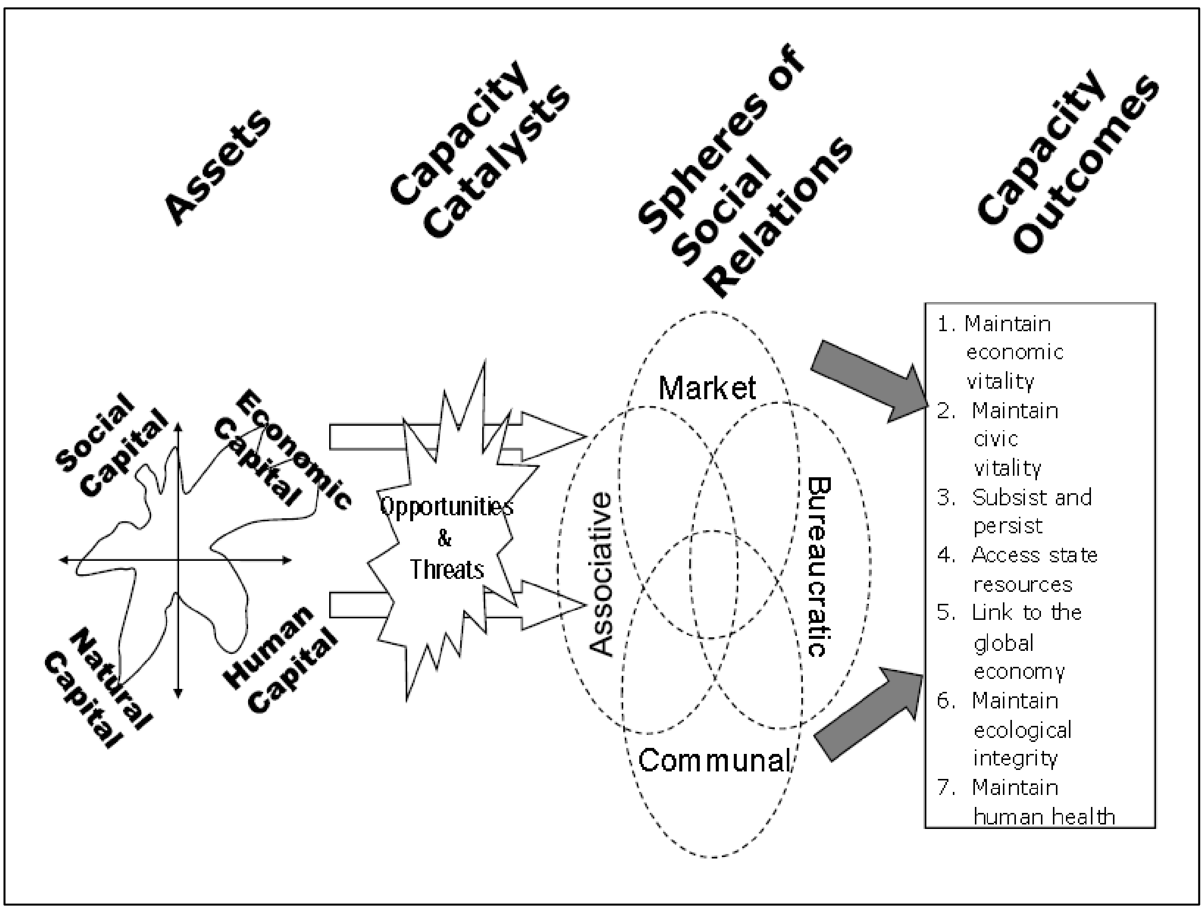

Figure 1. Community capacity model for social impact assessment (Beckley et al. 2008).

Figure 1 provides a conceptual basis for research and data collection. One of the basic components of this diagram is the list of assets, in this case social, natural, economic and human capital. This set of capitals forms the basis through which community capacity is derived – these are the starting conditions. But in order to mobilize these capitals, a catalyst is often involved, and in the case of social impact assessment, this catalyst is a large-scale project such as a hydro-electric dam. These capitals are then mobilized through spheres of social relations to produce capacity outcomes. Within Figure 1, these outcomes are listed generically (e.g., maintain economic vitality), but a community might have much more specific outcomes that are defined within community strategic plans or other planning documents at the community or region level. These community level plans can then be linked more explicitly with this conceptual approach to social impact assessment.

Another example of this community capacity approach is provided in Figure 2, but this time the focus is more specifically on the diverse forms of capital that are associated with healthy and vibrant communities. With these community capacity frameworks, a goal of this report is to add a layer of conceptual clarity to social impact assessments in comparison to current practice within Alberta.

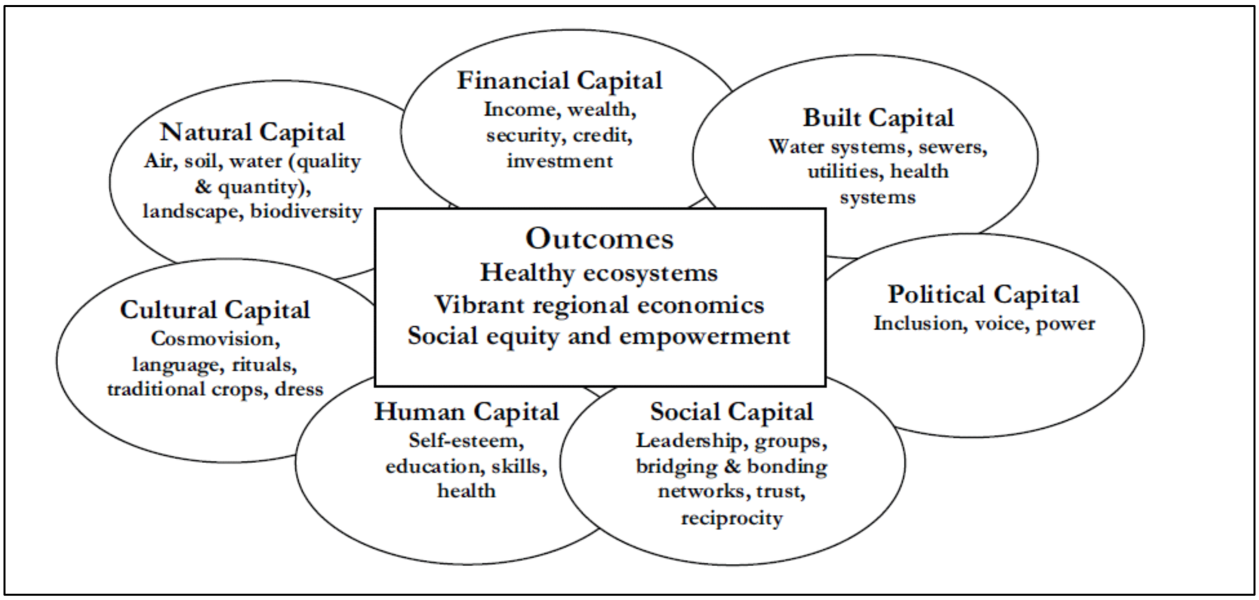

Figure 2. Community capitals framework for social impact assessment (Olson 2006).

In the chapters of this report, authors take up this concept of community capacity in several ways. For instance in Chapter Two, the authors utilize the domains of social, economic and human capital to discuss impacts from biofuel developments.

> *The increase in employment and economic opportunities associated with the development of a biofuel industry provides investment into human and economic capitals within a local community* (p. 17).

These specific insights are clearly linked to the broader concept of community capacity as an overarching focus within the research. In Chapter Three the authors focus more directly on the community outcome statements that are listed in Figure 1 (i.e., Maintain civic vitality, etc.). In this case the authors make a connection between community activities that supports solar power development and this particular capacity outcome.

> *In Medicine Hat, one example of civic vitality was that 10 percent of homeowners showed up to attend energy efficiency seminars organized by the City. The level of participation at events related to the installation of a solar project is a good indicator of the projects contributions to civic vitality* (p. 42).

In summary, the practice of social impact assessment in North America is commonly associated with technical and expert-based approaches to indicator identification and measurement. There is a lack of conceptual clarity to this work that can be remedied with closer attention to theories and concepts in community development, resilience, livelihoods, and vulnerability studies. One such concept, community capacity, is utilized in this report and is taken up by chapter authors as a way to provide conceptual clarity in the research and practice of social impact assessment. Moreover, these conceptual ideas can lead to specific insights and strategies to enhance the capacities of communities in ways that contribute to specific community goals and outcomes.

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Chapter Two – Social Impacts of Biofuel Processing in Alberta

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Introduction: Biofuels as an Alternative Energy Source for Alberta

Given the growing pressure to search for alternatives to petroleum-based sources of energy, biofuel production is of increasing interest to energy producers worldwide. In Canada, five percent of gasoline must originate from renewable sources, which include biofuels such as ethanol and biodiesel (Agriculture and Agri-Food Canada 2008). These sources of fuel are being promoted as a means of reducing the carbon footprint of transportation (Hozing 2008), which accounted for 24 percent of Canada's carbon dioxide equivalent emissions in 2010 (Environment Canada 2012). The domestic biofuel industry is expanding as demand grows and new biofuel processing plants are being proposed throughout Canada. A variety of economic, social and environmental impacts are all associated with biofuel production and processing, and must be evaluated to ensure a project is in the best interest of Canadians. Given the potential diversion of resources away from food production, biofuel production can also have significant implications at the global scale.

It is important to understand the social implications of proposed biofuel plants, to ensure they have a positive long term impact on the surrounding communities. Including a strong, participatory Social Impact Assessment (SIA) component in the Environmental Assessment (EA) of proposed projects can determine the potential impacts of a project and assess the alternatives, to determine if a project is in the public interest in a given location. This chapter compares the social impacts of ethanol processing in two Canadian locations: Minnedosa, Manitoba, where an existing Husky Ethanol Plant is located and Hanna, Alberta, the site of a proposed ethanol processing facility. This inquiry demonstrates that although ethanol production has short term, positive socio-economic impacts in our comparison communities, it is important to consider the long term effects on community resilience and global sustainability.

This chapter begins by providing insight into biofuel production and processing. A review of relevant literature is presented, with insight into the controversy over biofuel production in our comparison communities and beyond. Subsequently, the comparison communities are introduced and the impact domains identified in the literature review are explored and analysed within the local context. This report provides guidance regarding which impact domains are key to understanding the social impacts of ethanol production in Alberta and develops methods for improving the SIA process. Finally, we end the discussion on a broader note, with an overview of the global implications of biofuel production and processing.

Background: Biofuels and Approaches to Assessing their Social Impacts

Biofuels are a unique alternative to conventional fossil fuels because they are renewable. They originate from biomass, which can be sourced from a number of different plant based materials including sugarcane, wheat, corn, canola and other oilseeds. Biofuels are created through a chemical process that converts starches into sugars, which are then fermented to produce ethanol. The ethanol is distilled and dried to produce anhydrous ethanol, which is then mixed with gasoline and can be used to fuel vehicles (Balat and Balat 2009). Second generation biofuel technology is also being rapidly developed. This technology uses agricultural wastes, such as the stalks of grain crops, or biomass from algae, meaning food production is not diverted for their development (Havlik et al. 2011). In Canada, the most common types of biofuels are biodiesel, sourced from canola and ethanol, derived from wheat, corn, or a combination of the two (Cheminfo 2000). Large areas of land are needed to produce these grains, which are grown in intensive monocultures (Danielson et al. 2007; Gustavo 2008).

Although all sources of ethanol are renewable and their direct carbon footprint is lower than that of conventional fuels (Holzman 2008), much controversy remains over the production and processing of biofuels. The UN’s Special Rapporteur on the Right to Food, Jean Ziegler, has called biofuels a human rights violation and a crime against humanity (Steiman 2007). In 2006, he recommended a 5-year global moratorium on biofuels until second generation technology was improved, so that food crops are not being used in the production process (Steiman 2007). Despite significant technological advances since his recommendation, cropland that could be used to grow food is still being used to create fuel, using first generation biofuel technology. The environmental impacts of this input intensive cultivation are numerous, which has serious implications for social and economic well being. These issues are explored in depth throughout this chapter and methods for assessing the social impacts of biofuels are analysed.

Literature Review

Controversy and debate continues to surround the direct and indirect social, economic and environmental impacts of biofuel production. Given the variability in project design, size and location, it is important to assess biofuel projects on an individual basis to determine the social impacts. The following literature review provides insight into this controversy and provides a basis for understanding the important social impact domains in relation to ethanol processing in Alberta.

The Roundtable on Sustainable Biofuels (2011) is an international initiative that has developed a third-party certification system for biofuel sustainability standards, encompassing environmental, social and economic criteria through an “open, transparent and multi-stakeholder process”. They identify nine impact domains for SIA of biofuel production and suggest conducting a full EA if one or more of the impact domains are affected by the project (RSB 2011). A complete list and description of these impact domains is provided in Table 1.

Table 1. Roundtable on Sustainable Biofuels Social Impact Domains

Impact Domain	Description
Economic Benefits	- Increased employment income earning opportunities - Increased cash for consumption and saving/investment
Economic Losses	- Loss of labour for other existing livelihood activities - Loss of land and natural resources - Reduced access to land

	- Tenure security/Insecurity
Resettlement (Physical or Economic)	- Loss of land, dwellings and other physical resources - Loss of crops and cleared arable land - Loss of natural resources and grazing land - Loss of land rights and entitlements - Compensation - Disruption of social networks and relationships - Disruption of the relationship land/natural resources
Food Insecurity	- Ability to maintain household food production (depends on labour, productivity and cash) - Ability to purchase food (depends on availability of food prices and income)
In-Migration and Population Growth/Concentration	- Densification and concentration of settlement - Social tensions related to competition and differences between locals and in-migrants - Less compliance with local norms and regulations
Social Conflicts	- Due to competition between groups for employment and other economic benefits - Due to competition and differences between locals and in-migrants - Due to tensions between resettles household and residents in host areas and neighbouring areas - Due to increased pressure on land and natural resources and tensions around land administration and land use management - Due to increased crime
Disturbance and/or Loss of Cultural Heritage Sites and Resources	- Impacts on graves, sacred sites and important cultural heritage sites and resources - Moving of graves
Health and Welfare	- Access to sufficient potable water - Increased risk of HIV/AIDS and other diseases - Increased crime - Access to natural resources for traditional medicines - Education - Increased traffic safety risks - Health risks from employment, pollution and sanitation problems - Health risks associated with introduction of vectors, especially water-borne vectors due to irrigation - Increasing need for basic infrastructure and services
Governance Impacts	- Management of resettlement - Changes in administrations of land rights and use - Increased pressure on land and natural resources - Tensions around land administration and land use management - Development of concentrated villages and urban

	centres - Increased demand for basic infrastructure and services - Maintenance of roads and other basic infrastructure and services - Management of increased social tensions

Source: Roundtable on Sustainable Biofuels 2011

The impact domains identified by the Roundtable on Sustainable Biofuels cover all the impacts discussed in the literature described throughout this section. Subsequently, we used these domains as the basis for our analysis; a complete evaluation of these impact domains, with respect to our comparison communities, is provided in Table 2.

Currently, EA's are not typically triggered for biofuel projects within provincial regulation; however the inclusion of federal funding for the Minnedosa Husky plant expansion was sufficient to trigger an assessment, which did include a small section considering socio-economic impacts (Agriculture and Agri-Food Canada 2011). The EA pointed out that with the construction of the ethanol plant, there would be three key areas of benefit: ethanol production optimization and improved energy efficiency, socio-economic benefits to the local area, and the positive environmental benefits of ethanol use. The SIA section focussed exclusively on the employment and economic benefits, failing to explore other important impact domains (Husky Oil Limited 2005).

At a local scale, the citizens of Minnedosa expressed concerns regarding the impact of ethanol production on local water supplies and quality. The "Summary of Comments/ Recommendations" report addresses the concerns of the citizens that arose when the town needed to upgrade their water supply, potentially lowering water levels in Lake Minnedosa (Webb 2006). The summary included by Webb (2006), details quotations and letters of concern from local cottagers and community members. It was based on a public consultation held for the Minnedosa water upgrading facility and reveals sources of social and environmental concern within the community.

Selfa (2010) examined the views and concerns of residents in three communities with biofuel plants. Noting the role of government in subsidizing the industry, she examines the lack of concern the state and residents have indicated for the social and environmental impacts of such projects. Using sociological data including interviews and focus groups, she argues that the economic benefit of biofuels projects overshadows concern for the negative local impacts of biofuel production. Declining levels of natural capital were associated with the projects she studied, however residents demonstrated positive views towards the plants overall. She makes the case that economic vulnerability is the primary reason why residents in these communities are willing to overlook and downplay the negative impacts of the projects. This insight raises concerns about governance and community control.

Not all farmers and community members are pro-biofuels however, and one particular group, the Beyond Factory Farming Coalition, has raised concerns about biofuel production in Canada. Their petition to the Auditor General of Canada in July 2007 argues that the economic, social and environmental impacts of biofuels have not been adequately assessed and details concerns about agricultural land use and food security (Koroluk 2007). The group makes the case that if we were to meet 100 percent of Canada's ethanol requirements for gasoline domestically, it would take six percent of Canada's farmland to grow the feedstock (Beyond Factory Farming N.d.). This raises both environmental and social concerns, as land is diverted away from growing food crops.

There are many concerns about the economic impacts of ethanol development on the global food supply. Banerjee (2008) explains that the production of ethanol has widespread global implications; however the negative impacts are concentrated in the Global South, where hunger is an everyday reality of life. Farmers all over the world must decide whether to grow food or energy crops and the shift from the former to the latter has created major problems related to the price and availability of food (Molony 2010). As food prices increase, the most vulnerable people will be hit the hardest and some researchers argue that biofuel production directly increases prices of global agricultural commodities (Rossett 2009).

The Canadian Renewable Fuels Association dismisses the social, environmental and economic concerns associated with biofuel production. Their report, titled "Food vs. Fuel: The Debate is Over", counters the claim that biofuel production influences rates of hunger and malnutrition at local and global levels. Citing falling rates of "hungry people" worldwide, they allude to obesity and food waste in the Global North and insufficient local production in the Global South as causes of food insecurity (p.ii). The controversial report was funded by the Grain Farmers of Ontario, a group with significant lobby power and influence within the sphere of Canadian politics. They argue that exports of grain from developed countries have no impact on local food security in developing countries. They also make the case that biofuel production has supported domestic corn prices, providing benefits for both farmers and communities as a whole (Daynard and Daynard 2011). Numerous other groups, including the Alberta Biodiesel Association (2011) promote the benefits of biofuels. These powerful lobby groups pressure governments to provide supports for biofuel production, including subsidies and policy.

Laan, Litma and Steenblik (2009) reviewed the role of government support for biofuels in Canada in a report for the Global Subsidies Initiative, an organization that analyses government subsidies and their impacts on the environment, the economy and governance. Their report concluded that the biofuels industry might not be profitable without these supports, which total $1.5 billion over seven years (Agriculture and Agri-Food Canada 2008). They reveal the lack of evaluation done prior to implementing the program, emphasizing the fact that the social and environmental implications of the subsidy were not examined. This paper indicates that subsidies have skewed the market, making grain artificially more expensive and providing little direct benefit to farmers (Laan et al. 2009). The impacts these subsidies have on governance and community control will be explored in detail in the discussion section.

Study Setting

Impact Community: Hanna, Alberta

Hanna is a rural community located in southeast Alberta. In 2006, the population was 2,847 and the town provided services for up to 12,000 people. The major industries in this community are agriculture and coal, including mining and power generation (ATCO Power 2012). The average age of the population in 2006 was 42.4 (Statistics Canada 2006). Out-migration in Hanna has been high, with a population decrease of four percent from 2001 to 2006 (Statistics Canada 2006). Hanna provides an interesting case study, as many residents are searching for new economic opportunities, given the dominance of only two industries and declining population.

Comparison Community: Minnedosa, Manitoba

Located in southwest Manitoba, Minnedosa is a good comparison community for Hanna because of its similarity in size, resources and economic basis. Minnedosa had a population of 2,472 in 2006 and provided services for up to 9,000. The main industry in Minnedosa is agriculture, with a rapidly growing tourism sector. The population is aging, with an average age of 42.6 in 2006 (Statistics Canada 2006). The population grew over six percent from 2001 to 2011 (Statistics Canada 2011); however it is difficult to pinpoint the source of this increase. The expansion of industry in the community may be one cause of this growth. Husky Oil has had an ethanol plant in the community since 1980. The plant underwent a major expansion in 2005, which triggered an EA (Husky Oil Limited 2005). The plant now has the capacity to produce 130 million litres of ethanol per annum (Husky Energy 2008).

Methods

To determine the social impacts in our comparison communities and gain insight into the controversy surrounding ethanol production, we collected data from primary sources within the comparison communities and reviewed a variety of secondary academic sources. Our primary contact in Minnedosa was a member of a local agricultural society. To gather information about the proposed plant in Hanna, we discussed the project with a local farmer and entrepreneur. These contacts provided us with key insights into local issues, community assets and perceptions of ethanol projects, directing our inquiry into the potential impacts. Secondary data included the EAs of similar projects and a variety of research on the impacts of biofuel production, as outlined in the literature review. The internationally accepted guidelines for SIA of biofuels, developed by the Roundtable on Sustainable Biofuels (2011) provided direction for this research.

Study Results

A complete summary of the social impact domains and indicators we found in our comparison community scoping report is contained in Table 2. These findings can be used to direct the SIA of the proposed plant in Hanna as well as impact assessments of future biofuel projects throughout Canada. A number of possible social impacts are identified which may impact community capacity. These impacts are analysed and discussed throughout the next sections. The role of public participation in SIA is also explored in detail as a way to balance scientific inquiry with public perspectives on the issue.

Table 2. Summary of Social Impacts Associated with Biofuel Development

Issue	Impact
Economic Benefits	**Minnedosa**: - 30 full-time employees - 40 man-years of engineering during construction - 200 man-hours of construction employment - Increase in demand for services (job creation and increased income) - $100 million/ year spent on grain purchases and operating costs - 70 percent of revenue is estimated to remain within 150 km radius of plant - Purchase 350,000 tonnes of wheat/year (locally) - Local market for grain surpluses - Reduced transportation costs) - $200 million construction plan - Distillers grain can be fed to cattle - Increased demand for local grain (commodities) - Increased employment income earning opportunities - Increased cash for consumption and saving/investment **Hanna:** - Similar economic benefits are expected - A higher proportion of economic benefits may remain within community and be more equitably distributed, due to cooperative model
Economic Losses	**Minnedosa:** - Loss of labour for other existing livelihood activities - Loss of land and natural resources - Reduced access to land - Tenure security/Insecurity - Loss of water - Degradation of recreation sites **Hanna:** - Similar losses may be associated with declining natural capital
Resettlement (Physical or Economic)	**Minnedosa:** - Loss of land, dwellings and other physical resources - Loss of natural resources and grazing land is probable - Disruption of social networks and relationships may occur - Disruption of the relationship land/natural resources - Husky plant was built on existing industrial land - No observed human resettlement **Hanna:** - Similar impacts expected - It is important to evaluate the impacts on human resettlement on a case by case basis, evaluating alternative locations to ensure the least

	impact on local community members
Food Insecurity	**Minnedosa:** - No direct effect on local communities - Local purchasing power could potentially increase in the short term - Long term escalation of food prices is possible - Potential for global impacts **Hanna:** -Similar impacts expected
In-Migration and Population Growth/Concentration	**Minnedosa:** - Difficult to pinpoint the cause of population increases, the growth may be cause be commuter or the plant expansion - Social tensions related to competition and differences between locals and in-migrants - Less compliance with local norms and regulations **Hanna:** - Construction labour may be locally or externally sourced, potential for in-migration - Existing housing stock should be sufficient to support in-migration
Social Conflicts	**Minnedosa:** - There may be competition between groups (between locals or between locals and in-migrants) for employment and other economic benefits - Tensions may arise in the long term due to increased pressure on land and natural resources and tensions around land administration and land use management - No perceived impact on local crime rates - Concerns over industrial water pollution - Concerns over water use from lake Minnedosa, which could potentially impact local recreational and domestic use **Hanna:** - Town does not currently support the idea - Relationships are strained because some support it and some don't - Similar conflict may arise from natural resource/land use - Crime rates or social tensions may arise if in-migration for employment opportunities arises
Disturbance and/or Loss of Cultural Heritage Sites and Resources	**Minnedosa:** - No effects observed or expected graves, sacred sites and important cultural heritage sites and resources **Hanna:** - No effects observed or expected graves, sacred sites and important cultural heritage sites and resources - This would have to be evaluated on a project by project basis

Health and Welfare	**Minnedosa:** - No increased risk of disease expected - No increased crime rates were expected; however the possibility of crime during in-migration for the construction phase remains - Some health risks are associated with employment, water use and pollution - Increasing need for basic infrastructure and services - Husky gave $50,000 to a community childcare cooperative and education centre - Husky gave $50,000 to the Minnedosa seniors Association - Waste-Heat Recovery System reduces energy use; highlighting the importance of evaluating available technologies for least impact - Minimal impact on air quality - Increased noise (not a large population located near the plant) - Increased dust (not a large population located near the plant) - Contributed $1 million to the local University in 2005 - Committed an additional $1.625 million for research and development - Husky donates to the Ag Society and the Ag fair every year - Husky donates to the local hockey rinks and provides jerseys - Temporary increase of traffic during construction (18 months) - Moderate increase in traffic overall **Hanna:** - No increased risk of disease expected - No increased crime rates were expected; however the possibility of crime during in-migration for the construction phase remains - Some health risks are associated with employment, water use and pollution - Increasing need for basic infrastructure and services - Cooperative model may promote investment in local services - It is important to consider most efficient and least impact technology to reduce negative health and welfare impacts
Governance Impacts	**Minnedosa:** - Increased pressure on land and natural resources may be observed in the long term, as high-input production is unsustainable - Development of concentrated villages and urban centres - Increased demand for basic infrastructure and services - Maintenance of roads and other basic infrastructure and services - Some roads would need to be widened - Increased need for energy - Increased need for water - Management of increased social tensions due to in-migration during construction phases or because of outsiders filling local jobs **Hanna:** - Tensions are possible around land administration and land use

	management, which is highlighted by lack of consensus

Sources: Cheminfo 2000, Ethanol Advisory Panel 2002, Government of Manitoba N.d., Husky Energy 2008, Husky Oil Limited 2000, Primary interviews with local residents, Roundtable on Sustainable Biofuels 2011, Webb 2006

Through a comparison of the two communities we demonstrate the diverse social impacts associated with biofuel development. Although there are many similar potential impacts in Minnedosa and Hanna, the differences summarized in Table 2 demonstrate the importance of assessing the impacts of each project on an individual basis. Each community has a unique social, environmental and economic setting, which presents unique opportunities and challenges for biofuel development. The implications of these findings are discussed in detail and analysed throughout the next section. The potential controversy surrounding the issues identified by this analysis reveal the importance of including stakeholders throughout the planning and execution of new projects, by providing meaningful opportunities for public participation.

Public Participation, Stakeholders and the Social Impact Assessment of Biofuels

Although public participation is key to ensuring communities are on-board with new projects and provide adequate assessment of potential impacts, little public consultation was undertaken during the Minnedosa EA (2005). Public participation is a central aspect of community capacity as it can help build skills and create opportunities to build community assets (Beckley et al. 2008). The initial consultation with the community of Minnedosa became the only consultation with the community and valuable local knowledge and insights may have been excluded from the EA as a result. The EA prepared for Husky Oil (2005) indicated that only one open house was used to inform the public prior to construction. This led to the preparation of letters by residents to members of parliament, as well as to a local NGO, Manitoba Wildlands, seeking further advice on how to express their concerns (Webb 2006). Input from locals may provide insight into local risk perceptions and help develop ways to mitigate these concerns. We recommend approaching an ethanol SIA using Dietz’s (1987) pragmatist approach, which integrates scientific analysis with public values and consultation.

Including adequate public participation in SIA can reduce these types of social conflicts and develop community capacity to improve local outcomes of proposed projects. We echo Sinclar and Diduck’s (2004) concerns that EA/SIA in Canada does not provide an adequate forum for shared decision making. Public participation can be incorporated into SIA using a variety of methods and throughout multiple stages of the process. Further public involvement in the normative and planning phases of projects may also reduce conflict and use valuable community assets to assist decision-making (Sinclar and Diduck 2004). Including participation throughout all phases of the project, from initial consultation and scoping through to monitoring and enforcement of mitigation measures can help ensure companies remain accountable to local communities. Public participation can provide rich sources of data for SIAs and improve local perceptions.

Adequately defining who the stakeholders are and who to include in the public participation component of a project can be challenging. As Machlis et al. (1997) points out, stakeholders can include the project proponent and some or all community members within a geographic or political boundary, depending on the project. Residents of Minnedosa and local farmers were included as stakeholders in Husky Oil's initial EA (2005); however, cottagers and all those in the Little Saskatchewan River Watershed area were not included. This led to conflict between the company and some residents, which resulted in more detailed requirements for studying the plant's water use and ultimately delayed construction (Husky Oil 2005). This could have potentially been avoided, had all the affected community members been included in the EA to begin with. Potential conflicts can also arise as not all impacted groups can represent themselves. For instance, both the natural environment and future generations lack a voice to express their concerns about the impacts of a proposed project and controversy over who speaks for these stakeholders arises in many SIAs.

Although stakeholders are often defined as local residents and only those living nearby a proposed project are included in public consultation, it is important to remember that using food for fuel has far reaching implications. Biofuel production affects global food production, availability and prices. Given the inclusion of access to food in the UN Declaration of Human Rights (1948), everyone can be considered a stakeholder in issues about access to food. Biofuel production can be linked to global food trade issues, environmental justice and social conflicts, which increases the breadth of the stakeholders involved. Global issues are further explored in the following section.

Discussion

Although minimal social impacts were identified in the Minnedosa EA (2005), the potential for significant social impacts from a similar project remain and the Minnedosa EA failed to provide an in depth analysis of these issues. Further exploring the Roundtable on Sustainable Biofuels (2011) list of social indicators and Beckley et al.'s (2008) community capacity framework provides insight into the potential impact of future ethanol projects in Hanna and throughout Canada. With a thorough list of indicators and potential impacts, we discuss and analyse the social impacts of ethanol production in Minnedosa. The economic, demographic, environmental and health impacts of biofuels, along with the potential for social conflicts and implications for governance are analysed throughout this section. These impact domains provide the basis for our discussion of the potential impacts in Hanna and future ethanol projects throughout Alberta.

Economics Benefits and Losses

The increase in employment and economic opportunities associated with the development of a biofuel industry provides investment into human and economic capitals within a local community. The construction and operation of the expanded plant had several significant social impacts on the community of Minnedosa. According to Husky Oil Limited (2005), five to 10 new jobs were created to add to the 15 or so permanent positions that already existed at the plant. The proposed plant in Hanna will be based on a feedlot relationship, resulting overall in higher employment than other types of ethanol projects (Cheminfo 2000).

Local farmers will benefit from the purchase of approximately 350,000 tonnes of wheat per annum for feedstock. In addition, 126,000 tonnes of distiller's grain with solubles (DDGS) will be produced as a by-product of ethanol production, which can be used to feed cattle.

Employment benefits were also seen during construction, with Husky Oil estimating 40 man-years of engineering during construction and over 200 man-hours of construction employment in Minnedosa. There will also be an indirect increase in employment from the project, due to an increased demand for local services (Husky Oil Limited 2000).

Farmers will also receive additional economic benefits, as they will be able to grow Canadian Prairie Spring wheat and Winter wheat, which provides a yield increase of up to 30 percent. Having a wheat product that can be sold at a higher price also encourages farmers to have a more diverse cropping rotation, which can be beneficial in the prairies, where canola is normally the highest value crop. The creation of a local market for grain is also beneficial. Grain terminals have been closing throughout the prairies, so having a more centrally located depot for grain would reduce transportation and marketing costs. The Manitoba government (2002) calculated that up to 35 dollars per tonne could be saved in shipping costs. Reduced transportation costs and local markets means more economic capital is retained within the region. Both agricultural and employment benefits should arise from new ethanol developments (Ethanol Advisory Panel 2002). Subsequent increases in local income provide local benefits, as an estimated 70 percent of revenue from an ethanol production facility is spent within 150 kilometre radius of the plant site (Ethanol Advisory Panel 2002). The resulting development of economic and human capital can create a capacity catalyst, potentially promoting positive change within a community.

Despite potential gains in economic opportunities in Hanna, the data on employment in Minnedosa indicates that there are few direct, long term jobs associated with ethanol processing. Only 30 long term positions were created as a result of the existing plant operations and expansion (Husky Energy 2008) and there are no guarantees that these positions can be filled locally. There are also no guarantees that economic benefits will remain local over the long term and the possibility that the plant will import grain remains. Calculations of economic benefits are also notoriously overestimated.

Demographic Impacts

Neither Minnedosa, nor the proposed plant in Hanna, will see any resettlement. The Husky plant in Minnedosa was expanded next to their original plant and on existing industrial zoned areas. In Hanna there is adequate industrial zoned land to provide for the three acres that the plant would use. Evaluating proposed locations for this type of project is important because of the dust, noise and pollution associated with the development. More important considerations of land and land use, particularly as it relates to food production, are discussed later in this chapter.

With the potential increase for demand in skilled labour, the impact communities may experience some temporary in-migration or permanent settlement. New arrivals could be welcomed to the town, potentially contributing to community cohesion. New community members may provide new sources of social, human and economic capital, contributing to community capacity and providing catalysts for community change. They can also provide renewed demand for existing, underused human and social capital, including housing stocks, infrastructure and services. According to local residents in Hanna, there is a large availability of housing due to the out-migration from the community, which could serve incoming populations (Statistics Canada 2006).

It is challenging to measure the perceived impact of incoming community members; however it is important to recognize the potential for conflict. The local population could potentially lack qualifications for new employment opportunities, therefore the promise of local job creation may be overstated and outside professionals may be employed instead of existing community members. Further, the influx of new people and their families may threaten the job security of the citizens in other fields and industries as well. Even if that is not the case, negative feelings towards newcomers may cause social tensions and conflicts, reducing social cohesion and minimizing positive impacts on human capital.

Implications for Health and Welfare

There was a temporary increase in traffic during the 18 months of construction and a moderate increase overall in Minnedosa. Up to 40 trucks of wheat feedstock may be transported per day; however, most ethanol produced will be transported via rail (Husky Oil Limited 2005). With the increase in traffic there is the potential for an increase in traffic related accidents. This has not been documented in Minnedosa. As the transportation infrastructure in Hanna is similar, we anticipate minimal impact from increased traffic.

Large plants require energy and natural gas. The community of Minnedosa had to increase its natural gas and electrical production capabilities as a result of the plant expansion. According to Husky Oil (2005), the community experienced little disturbance and was able to meet these increased infrastructure demands. Hanna has significant stocks of natural gas, an important form of natural capital. Local residents indicated that the town could benefit from a new way to employ this resource.

Air quality and pollution are a major concern with the construction of any new facility; however Husky (2005) maintained that there would be minimal impacts on air quality. Noise and dust will increase but this should have minimal effects on the community (Husky Oil Limited 2005). Ethanol reduces particulate emissions during fuel combustion, especially fine particulates that pose a health threat to children, senior citizens and individuals suffering from respiratory ailments (Ethanol Advisory Panel 2002). Health is an important component of human capital. Use of improved technology and processes can also reduce emissions, which limits the negative impacts on human capital (Husky Oil Limited 2005).

Potential for Social Conflicts

The EA found very little overall impact from the plant's construction in the community of Minnedosa. Conflict over land remained minimal as no aboriginal lands were impacted in Minnedosa. The proposed plant in Hanna will also have no impacts on traditional lands. Tensions did arise during the Minnedosa water supply upgrade, with concerns over industrial water pollution (Webb 2006). Some also worried that water level drawdowns on Lake Minnedosa could negatively impact recreation and tourism (Webb 2006). Initially, Husky Oil's EA failed to consider these impacts. After further study and a screening into water use, it became apparent that drawdowns on Lake Minnedosa would occur between September and March, with the largest magnitude each year occurring just before spring inflows to the lake began. Therefore, significant water level changes would not occur during the recreation season and changes during the open water season would be minimal (Webb 2006). The concerns of community members and seasonal cottagers were addressed by this investigation. The conflict over water use eventually led to the preparation of an integrated watershed management plan for the Little Saskatchewan River in 2011(Webb 2006). This conflict indicates that there are very few venues for the public to voice their concerns over use of energy and resources. This highlights a significant gap in our current assessment system.

Hanna currently has a good water supply, however the ethanol process requires significant amounts of water and there is the potential for future difficulties in this area. Public consultation and participation in this process will help to mitigate any areas of concern with water availability. The proposed plant in Hanna will be community run and supported by local economic, social and human capital. It will therefore be important to education the community and local farmers on the potential benefits of ethanol, production, especially as it relates to rural revitalization. Community participation and communication will have serious impacts on relationships within the community and this needs to be addressed.

Environmental Impacts

The need to reduce emissions, including particulate matter, carbon dioxide, nitrogen oxide and volatile organic compounds, is evident in the prevalence of environmental and human health problems such as climate change and respiratory issues. A major contributor to pollution is transportation, which accounts for 70 percent of total anthropogenic carbon monoxide and 19 percent of total anthropogenic carbon dioxide emissions. Use of ethanol for fuel reduces direct exhaust and greenhouse gas emissions. Ethanol also contains 35 percent oxygen, which results in fewer particulate emissions and less nitrogen oxides compared with the combustion of fossil fuels (Balat and Balat 2009).

Although the direct carbon footprint of ethanol may be lower than that of gasoline, there are other environmental impacts to consider. A full life cycle analysis of biofuels indicates that their environmental footprint is higher than that of fossil fuels. Natural capital may be reduced by ethanol production and processing, as large amounts of resources are required. Concerns about soil fertility, biodiversity losses, water use and pollution are also widespread (Danielson et al. 2007; Selfa 2010).

Ethanol crops such as wheat and corn are grown in monocultures, which require extensive inputs. Unsustainable amounts of water, fertilizer, other agricultural chemicals and energy are required to cultivate in this manner. Iowa, a significant source of the United State's ethanol production, has experienced water pollution and soil erosion in fields where corn is grown for ethanol processing (Beeman 2007). Others have demonstrated the biodiversity and soil nutrient losses associated with monocultures (Danielson et al. 2007; Gustavo 2008). Deforestation has also been associated with ethanol production, resulting in the loss of carbon sinks and other important ecosystem services (Danielson et al. 2007; Gustavo 2008). Although they can technically be considered renewable, Executive Director of Food First, Dr. Eric Holt-Gimenez, argues that biofuel production is still unsustainable (Steinman 2007). The inputs used to grow these crops including fuel for machinery and petroleum based chemicals are non-renewable. The head of the National Farmers Union in Canada reached a similar conclusion, pointing out that Whale Oil was also considered a renewable source of fuel, until whales were harvested to near extinction (Steinman 2007). The sustainability of the industry has important implications for long term community resilience, as this industry may dwindle once natural capital is depleted or government subsidies run out, leaving little capacity to adapt or develop alternative sources of capital. In addition to these anticipated sources of depletion of natural capital, other unanticipated impacts have occurred in some communities.

Numerous compliance issues have arisen in Iowa, including wastewater treatment, excess water use, emissions and illegal dumping (Beeman 2007). These concerns were not raised during the plant proposal (Beeman 2007). Although there are no indications of similar violations at the Minnedosa plant, it is important to recognize the possibility that operators will not comply with environmental regulation. To ensure these violations do not occur in our impact community, follow up monitoring and enforcement is necessary to ensure the mitigation measures promised in the EA are undertaken. Including the public in this process and ensuring monitoring data is publicly available is one way to ensure transparency, compliance and maintain legitimacy within the community. Involving community members in the process is important and may help develop human and social capital, increasing community capacity.

Implications for Governance

Issues of community control and corporate or federal influence are important considerations with ethanol projects. Most projects rely on funding from federal and provincial sources and some argue the projects would not be economically feasible without subsidies (Laan et al. 2009). In addition to economic supports such as subsidies, biofuels are also supported by policies such as renewable fuel content regulations. To fulfill the five percent minimum ethanol content mandated in Canadian gasoline, approximately three billion litres of ethanol are required annually (Laan et al. 2009). Despite this, no national biofuels strategy has been created and ethanol can be freely imported under an agreement with Brazil and the United States (Iaan et al. 2009). To increase domestic production, the Federal government has created a $1.5 billion ecoEnergy for biofuels program, with the goal of producing two billion litres annually (Agriculture and Agri-Food Canada 2008; Laan et al. 2009). This program includes grants and low interest loans for research and development, grants to support business planning, low interest loans for construction, distribution and consumption grants and fuel tax breaks (Laan et al. 2009). Some states, including Minnesota, have experienced negative impacts on local infrastructure due to fuel tax exemptions (Government of Manitoba N.d.). Considering the impact of government subsidies, concerns have arisen over the fact that the ecoEnergy program was undertaken without formal inquiry into the social, economic and environmental implications and transparency regarding how the funds are allocated is low (Laan et al. 2009). It is estimated that support levels were between 50 and 54 cents per litre in 2006, confirming suspicions that the industry may not be viable without government support (Laan et al. 2009).

Although these subsidies have created a new demand for grain, the benefits are unevenly distributed. Growing demand may translate into rising prices for grain crops, however these price increases are rarely capitalized into farm values and have little impact on farmer income (Iaan et al. 2006). Rising grain prices also impact other producers, who rely on grain for animal feed. The distribution of benefits is dictated by who controls the project. National and provincial governments have played a large role in producing incentives for biofuel production, yet they have done little to ensure mitigation of negative environmental and social outcomes.

Inequitable distribution of power and lack of community control are also common issues with biofuel processing. If a large transnational corporation takes on an ethanol project in Hanna, it is likely that more of the benefits will flow outside of the community. The increased infrastructure requirements associated with new projects are also a concern for local governance. Communities require human, economics, natural and social capital to create the capacity to respond to increasing demands on infrastructure. Although they may be expected to meet these new infrastructure demands, the benefits of a project initiated by a large company may not all flow into the community.

Alternatively, if the project is undertaken by local developers or by a cooperative initiative, a much higher portion of the benefits are likely to remain within the local region. Resources and relationships work together to create community capacity (Beckley et al. 2008) and cooperative ownership can be a good way to develop these resources. Despite the potential for community led projects to increase the local benefits and acceptance of new biofuels projects throughout Canada, it is unlikely demand can be met domestically, putting significant pressure on the Global South (Steinman 2007).

Local Decisions, Global Implications

Although this report has demonstrated that the individual communities who decide to engage in biofuel production may receive benefits, it is important to consider that those directly linked to the project are not the only stakeholders. Rising world food prices combined with doubts about sustainability of biofuels has led to a backlash against their use (Laursen 2007). In fact, biofuel production can have significant global implications with regards to food security, world food prices, trade relations and politics. Studies by the UN’s Special Rapporteur on the Right to Food, Jean Ziegler, reveal that 50 litres of pure ethanol, the size of an average gas tank, requires 232 kg of corn. This, he explains, is enough to feed one child for a year in a country where corn is the staple crop (Steinman 2007). Keeping these issues in mind, this section explores some of the major impacts that biofuel production has on the world as a whole.

We are in the midst of a global food crisis and climate change is already putting food production growth in jeopardy by increasing incidents of drought, flooding and other weather anomalies (Gustavo 2009). Given the present and future challenges to worldwide food production, many call into question the use of over 100 million tonnes of valuable crop used to produce biofuels every year (Gustavo 2009). The continued development of second-generation biofuel technology means ethanol can now be sourced from agricultural wastes or from algae; meaning land is not diverted from food crops (Havlik et al. 2011). Given the upward pressure on global food prices, investing in this newer technology makes more sense in the long term. These considerations were not included in the Minnedosa EA (2005) and we recommend considering the alternatives provided by second generation biofuel technologies when developing the biofuel industry in Hanna and throughout the world.

Although biofuels currently consume only 1.2 percent of total grain production in Alberta (Government of Alberta 2012) and no immediate food security issues arise locally as a result of their cultivation, this is not the case for other parts of the world. The most direct effect of biofuel production is the diversion of land, which could be used to produce food for human consumption. Silva's (2008) analysis of biofuels reveals there is not adequate land to grow all of our fuel and still cultivate sufficient food crops. In underdeveloped countries, converting food cropland in favour of biofuel production for export is very dangerous. Less food is planted as farmers go to work on biofuel plantations in anticipation of jobs and better incomes. Lower income countries try to cash in on this new industry, which further threatens access to food. The use of marginal lands for biofuel production threatens small scale food production for families who may have uncertain or unrecognized land tenure rights (Dauvergne 2009). Further, as farmers who cannot compete are forced off of their land, they move to cities seeking better opportunities. Many people arrive, only to find unemployment and poor conditions (Magdoff 2008).

In addition, growing crops for fuel can also drive up the prices of agricultural commodities (Rosset 2009). The inaccessibility of food due to increasing prices has resulted in demonstrations and riots worldwide (Magdoff 2008). As Josette Sheeran, the head of the UN's World Food Program, said in February, "this is the new face of hunger... there is food on shelves but people are priced out of the market. There is vulnerability in urban areas we have not seen before. There are food riots in countries where we have not seen them before" (Magdoff 2008:8). Given the ties between energy prices, biofuel production and food prices, this is a significant concern (Rossett 2009).

Local farmers are driven out of business or robbed of their subsistence lifestyles as transnational companies intervene. Shifting what little land is left to produce fuel instead of food creates an even bigger disadvantage for these countries, as they no longer have control over their own food systems (Rosset 2009). Increasing investment in biofuels has significant global implications, in many respects. It is important to consider that impacts of rising food prices and access to food are not felt equally throughout the world. It is often the world's most vulnerable people who are hit the hardest and who have the most to lose. Given these dire implications, we must remember to consider the global, long term implications of encouraging biofuels and look beyond the short term economic benefits that make them attractive.

Conclusion

Given the complex nature of potential social impacts, EA of ethanol projects needs to include a stronger SIA component. Current EAs focus on economic and environmental impacts, failing to consider the complex social implications of proposed projects. The SIA components of most EAs lack depth and do not consider important impact domains such as governance, social conflicts, economic losses and food security. The impacts ethanol projects have on economic, human, natural and capital resources play a key role in the future capacity and resilience of a community. Ensuring communities have the capacity to undertake sustainable, long term development should become a key part of SIA in Alberta. Integrating a model of community capacity, such as Beckley et al.'s (2008) may improve EA, providing broader insight into the long term effects of projects.

Using this model, we discovered that despite the short term positive socio-economic impacts of ethanol production in our comparison communities, there are other critical issues to consider. The long term effects of ethanol production on community capacity and global sustainability are negative and focussing solely on the economic benefits of a project ignores the long term implications for community resilience. A short term gain in economic and human capitals does not guarantee long term investment in community assets. The comparison case study approach used in this study indicated the need for local assessment of each biofuel project, as impacts vary depending on location and type of project. Given the complex and widespread global impacts of biofuel production, we also recommend that alternative, second generation biofuel technologies be explored.

Although EA in Canada is undertaken on a project-by-project basis, defining stakeholders as local residents, it remains important to consider the global and long term implications of large energy projects including biofuels. Everyone is a stakeholder in the environment and the effects of world food prices are felt globally. In addition to improving the assessment of the social impacts of energy projects, we need to consider Canada's energy future and recognize the wide reaching effects of our actions. Although the participation component of EA often raises important questions about Canada's energy future, EA provides no forum for discussion of the broader, global issues. Perhaps we need a national forum for discussing normative issues and Canada's energy future, which could guide future EA and explore the broader, long term implications of energy development.

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Chapter Three – Analysis of Social Impact Assessment for Solar Energy Projects

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Introduction

Environmental pressures are at the heart of the push for solar energy, which is gaining popularity worldwide as a clean alternative energy source. With conventional oil production expected to decline in the near future, it becomes increasingly urgent to identify alternative sources to meet the world's growing energy needs. Concerns about climate change and greenhouse gas emissions are also strong push factors towards cleaner energy sources such as solar power. The resulting social and political pressures are a significant driver of the search for alternative energy sources (Legget 2009).

With a promising future for solar power, there is growing interest in the tools, skills and knowledge necessary to measure the environmental and social impacts of solar developments. The purpose of this study is to contribute to this body of knowledge, with particular emphasis on social impact assessment (SIA). Our analysis of a proposed solar project in Medicine Hat, Alberta, provides a basis for understanding the most important social impact domains of solar energy development in Alberta.

The first section of this chapter provides an overview of solar energy in relation to SIA and provides insight into our impact community, Medicine Hat as well as our comparison case studies. In the following section, we explore the social impacts of solar energy using Beckley et al.'s (2008) community capacity framework as a guide. Next, we describe our results for Medicine Hat and each of the case studies. In the final discussion section, we compile a list of relevant social indicators for solar projects using Beckley et al.'s (2008) community capacity outcomes.

Background

Canada has a relatively short history of studying the impacts of solar energy projects and domestic management tools for solar projects; particularly large-scale solar farms are underdeveloped. This is especially true in Alberta, where solar energy is not used widely and currently only takes form in small-scale developments such as rooftop panels. To date, there are no formal environmental assessments on social power development in Alberta.

There are a variety of solar technologies available, including passive thermal systems such as solar hot water heaters and active solar collectors such as photovoltaic panels. At a large scale, flat plate photovoltaic panels, parabolic troughs and concentrating solar thermal energy can be used. For instance, the BSPP utilizes solar parabolic trough technology to generate electricity. The California Energy Commission (2011), describes how the technology works:

> With this technology, arrays of parabolic mirrors collect heat energy from the sun and refocus the radiation on a receiver tube located at the focal point of the parabola. A heat transfer fluid (HTF) is heated to high temperature (750°F) as it circulates through the receiver tubes. The heated HTF is then piped through a series of heat exchangers where it releases its stored heat to generate high-pressure steam. The steam is then fed to a traditional steam turbine generator where electricity is produced.

In Amherstburg, Ontario, (a site where large scale solar production is underway) photovoltaic (PV) panels with non-ground penetrating SunPower trackers are used. Each Tracker unit consists of a primary and secondary precast concrete base positioned above-grade on-site, with a series of tilting solar panels attached. The Trackers will face south in rows running east and west and will be spaced about four metres apart (CEAA 2011).

For the purposes of our study, we examine a hypothetical project site with potential for large-scale photovoltaic solar power generation just outside of Medicine Hat, Alberta. The plant would use PV panels and non-ground penetrating SunPower tracker technology. We estimate this project will cover approximately 650 acres of land and produce 40 MW, a scale large enough to trigger an environmental assessment under provincial regulation. A project of this size could generate nearly half of the residential electrical demand of Medicine Hat.

Literature Review

Concerns have been raised over the health impacts of solar technology, including noise and glare. Acoustic Assessments were completed in Amherstburg, Ontario, sites demonstrating that solar farms are found to have a considerably quiet "hum" that often does not reach nearby residential communities (First Solar 2011). As far as visual impacts, the concerns pertaining to glare off the panels were found to be a misconception, as solar panels are designed to absorb sunlight and not to reflect it (First Solar 2011). Contrastingly, an Environmental Impact Assessment (EIS) conducted by the U.S. Bureau of Land Management (BLM 2010) did report visual disturbance and glare as impacts. Because solar is a relatively new technology, there is little research on the long term health implications available. The specific type of technology used also has an effect on the sensory and health impacts.

Although no EAs of solar projects have been conducted in Alberta, the Amherstburg Ontario project did require an Environmental Impact Statement (EIS), which was completed by the project proponent. The company performed a demographic analysis to determine if there were any potential concerns over social justice issues and held a public consultation to determine the perceptions of citizens. This report details the potential impacts that solar development may have on aesthetics, property values, land use, health and the economy (First Solar 2011).

Wamboldt (2009) conducted a survey of 52 houses in the Drake Solar Landing Community (DLSC) of Okotoks, Alberta and received nine responses. His survey provided insight into the motivations of residents, community cohesion and economic impacts of the project. Wamboldt (2009) identified the key elements of the success of the DLSC project and explored each household's willingness to pay for solar installations. Because of the small sample size, Wamboldt (2009) warned against drawing specific conclusions from the information, however the data does provide a basis for further research and discussion.

Study Setting

We have selected the city of Medicine Hat, Alberta as our impact community because it is a sunny location in southern Alberta, which has consistent and high solar potential. Furthermore, Medicine Hat's size and electricity demands would favour a large scale solar project, making it more likely to trigger an Environment Assessment. In comparison, we examine the existing solar projects located in Okotoks, Alberta, Amherstburg, Ontario and Blythe, California. Each of these cases present a variety of implementation practices and approaches unique to their geographical, political and social contexts.

Impact Community, Medicine Hat, Alberta

Medicine Hat is located in south western Alberta and is the province's sixth largest city, with a population of approximately 61,097 (City Census 2009). With a thriving natural resourced based economy, Medicine Hat is one of Canada's most affordable places to live. Medicine Hat is also commonly known as the "sunniest city in Canada" since it has more hours of sunlight than any other Canadian city, with 2,500 hours a year (Environment Canada 2012). Given its high sun exposure, we see Medicine Hat as being a geographical fit for a large-scale solar farm development in the future.

Socio-economic environment of Medicine Hat

Medicine Hat is often known as "Gas City" because of its predominant reliance on the natural gas industry. It is one of the only cities in the world that operates and manages its own electric and natural gas system (City of Medicine Hat N.d.). The majority of Medicine Hat's working population is employed in local business and services centered predominantly on the industries of oil and gas, agriculture, clay, mining and manufacturing. Many citizens have chosen Medicine Hat as their retirement city; according to the city's 2009 census, 41 percent of the population was over the age 65, 28 percent between the ages of 25 and 45, and 31 percent below the age of 25 (City of Medicine Hat 2009).

Sustainable initiatives in Medicine Hat

The City of Medicine Hat has a number of sustainable initiatives in place, including the HAT Smart program, created in 2007. The program provides financial incentives to homeowners, community groups and businesses that invest in alternative energy projects. Within the first few years of the program, 10 percent of utility payers had attended the energy efficiency seminars hosted by the municipality. The program placed particular emphasis on the adoption of solar energy projects, providing a subsidy for half the cost of solar panel installation to both homeowners and businesses. The success of the program has earned Medicine Hat an Emerald Award for environmental excellence and a national award from the Federation of Urban Municipalities (Green Energy Futures 2011). Additionally, Medicine Hat is implementing a commercial scale concentrating solar thermal energy project, which "will be the first in Canada to add a solar-powered steam generation system to an existing power plant, allowing the plant's turbines to generate a portion of its electricity from a renewable energy source" (Government of Alberta 2010). In light of the city's renewable energy initiatives, the prospect of installing a community scale solar farm could be a feasible and appropriate addition to the municipality.

Comparison Case Study One: Drake Landing, Okotoks, Alberta

The Town of Okotoks is located in the Sheep River valley approximately 20 kilometres south of Calgary, Alberta. Okotoks was home to a population of 24,511 people in 2011 and is considered the tenth fastest growing community in Canada. The population tends to be younger than the national average, with 72 percent of the population below the age of 45. Residents of Okotoks are predominantly employed in the sectors of agriculture, education, construction, home-based business and municipal government (Okotoks Fact File 2011).

The Drake Landing Solar Community (DLSC) is a master planned neighbourhood located on the north eastern edge of Okotoks, that has successfully integrated solar energy generation on a community scale. The project is the first of its kind in North America, with "a district system designed to store abundant solar energy underground during the summer months and distribute the energy to each home for space heating needs during winter months" (Okotoks 2009). Solar energy is collected using 800 flat plate solar panels, which are mounted on the detached garages behind the homes (Drake Landing Solar Community Nd.). The system provides "90 percent of space heating needs for the community's 52 single-detached homes are met by solar thermal energy" (Drake Landing Solar Community N.d.).

An understanding of how a community might benefit from reliance on solar energy is provided by the DLSC example. Though the project is a considerably smaller than the one proposed for Medicine Hat, Okotoks is the only case, of all our selected case studies, that is located in the same geographic region as Medicine Hat. Thus, it provided a useful benchmark that can potentially demonstrate the strengths and weaknesses in realizing a community based solar project in southern Alberta.

Comparison Case Study Two: Amherstburg, Ontario

Located near the mouth of the Detroit River in the south western corner of Ontario, the Town of Amherstburg is home to a steady growing population of 21,748 (City Census 2006). Water sports, boating and water-based recreation are key recreational activities in the area, with the Detroit River and Lake Erie forming two of Amherstburg's boundaries. Furthermore, marshes around River Canard also provide an abundance of duck hunting and fishing opportunities (Windsor Essex Development Commission 2009). The primary employment sectors for the town are manufacturing and sales and the average household income is approximately 16 percent above the national average. Recently, changes to provincial legislation have created incentives for solar development in the area.

The Ontario provincial government has created several policies to encourage renewable energy development. In 2006, the Renewable Energy Standard Offer Program (RESOP) was introduced, making it easier for small renewable energy facilities to participate in the electricity supply system (International Energy Agency 2012). Later, in 2009, the Ontario Green Energy Act was implemented, with the primary goals of expanding renewable energy production, encouraging energy conservation and creating green jobs. Under the Act, RESOP was later replaced with a Feed in Tariffs (FIT) program, which offers long term contracts and provides additional support to renewable energy producers. Government support for renewable energy in Ontario is a significant political contrast to the situation of our Albertan comparison communities (Green Energy Act N.d.). The incentives for renewable energy have resulted in the development of alternative energy projects throughout the province, including the Amherstburg solar park.

The Amherstburg solar park is a crystalline solar photovoltaic power project that is divided into three sites around the town of Amherstburg. The combined capacity of the three sites, covering a total of approximately 300 acres, will be 35 MW. This capacity is estimated to be enough to provide power for 5000 homes (Windsor Essex Development Commission 2009).

Comparison Case Study Three: Blythe Solar Power Plant, Blythe, California

The Blythe Solar Power Plant (BSPP) is one of the many large solar farms in the sunny state of California. Solar Millennium, LLC, and Chevron Energy Solutions, are the joint developers of the BSPP, responsible for construction, ownership and operations of the plant. The solar farm is a concentrated solar thermal electric generating facility. It consists of four identical, adjacent, but independent 250 MW plants, which combine to give a total nominal capacity of 1000 MW. The BSPP utilizes solar parabolic trough technology to generate electricity.

The BSPP is found in an unincorporated area of Riverside County, California. The development is located on flat dessert terrain roughly two miles north of Interstate-10 and eight miles west of the City of Blythe. A mile south of the plant lays the Blythe Airport. The project proponents have a right-of-way grant from the U.S. Bureau of Land Management for 9,400 acres of land and the total area disturbed by construction and operation is around 7,030 acres. The plant’s facilities occupy approximately 5,950 acres of land (California Energy Commission 2011).

Methods

In this study, the case comparison method was an effective way to evaluate the benefits and barriers associated with a variety of approaches to implementing community level solar development. To provide insight into our comparison case studies, we attempted to contact local community members for interviews and explored a variety of secondary research. We spoke with an advisor for the Energy Division of the City of Medicine Hat, who provided first hand information about the current state of renewable energy in Medicine Hat and the potential for a solar farm. He relayed his personal experiences working with the HAT Smart II program and offered insight into the program’s successes and challenges. A number of secondary sources were also analysed, including the US Bureau of Land Management’s (2010) Environment Impact Statement for the Blythe Solar Power Plant, a survey conducted by Wambolt (2009) regarding the Drake Solar Landing Community, and a variety of other research regarding the impacts of solar power.

Study Results

The following section relays the information that was gained about the social impacts of solar energy in our comparison communities from our primary and secondary sources. Wamboldt's (2009) survey of the Drake Landing Solar Community was used to determine the key factors in social acceptance of the project in Okotoks, Alberta. The social impacts identified by First Solar (2010), in Amherstburg, Ontario, provide a useful comparison. Next, the EIS conducted by U.S. Bureau of Land Management (BLM 2010), is explored to provide further contrast to these examples. Finally, the potential social impacts in Medicine Hat, Alberta, are examined using insights from the comparison communities and our primary contact.

Social Impacts in the Drake Landing Solar Community, Okotoks, Alberta

Using Wamboldt's (2009) research on the Drake Landing Solar Community (DLSC), we explored the social impacts of the Drake Landing Solar Community. His survey of the DLSC provided a firsthand account of the opinions and motivations of the people who supported this type of project, which could potentially shed light into the motivations of people that might support a solar project in Medicine Hat. Wamboldt (2009) also explores the economic drivers of the DLSC, which can play an important role in the development and acceptance of new technology and projects.

Shared environmental values and community cohesion

Wamboldt (2009) examined community cohesion and the ways in which the creation of the DLSC fostered it. The DLSC was developed in two sets, one set of homes in early 2006 and the second in 2007. The first occupants were more excited about the solar technology and were keen to be early adopters. These first occupants expressed a slightly greater feeling of community cohesion than the second group, likely because they had been there longer. Most respondents stated that they met people more quickly and with greater ease in DSLC, than in previous neighbourhoods in Alberta or British Columbia. Wamboldt proposed that this tendency might be caused by a shared environmental concern and value among DLSC owners. He suggested that this shared value provided a common ground for building community. Other members suggest that the urban design also contributes to the social nature of the neighbourhood, as the design ensures that neighbours encounter each other outside more often. Another bonding point for community members might be that they are all early adopters, and enjoyed quite a bit of media coverage, which reaffirms to homeowners "they are embarking on something out-of-the-ordinary" (p. 68).

One survey participant suggested that Albertans have a "very strong connection to the land" and another suggested that this was a way to act against the local and global economies that are "growing too quickly and lack future thought" (Wambolt 2009:61). People moved to the community for a variety of reasons as well, some felt there was "nothing else going on in Canada" expressing the feeling that there is a lack of environmental initiatives that people with a concern for the environment can support (Wambolt 2009:62). These quotes demonstrate the personal values associated with community and the environment, providing a basis for understanding why people may be attracted to communities with alternative energy projects.

Economic capacity and willingness to pay

Wamboldt (2009) identified economics as a key element of success in the DLSC. Federal, provincial and municipal governments heavily subsidized the project; each of the 52 houses received $127,000. All respondents were aware that the project was heavily subsidized, but were less aware of what each body contributed. Based on his knowledge of the price paid by several homeowners, Wamboldt discovered that the second set of purchasers paid a much higher price than the first set of owners. From this, Wamboldt determined that homeowners are willing to provide much of the funding for alternative energy, which reduces the need for heavy subsidies. Because of the small sample size however, Wamboldt warns against drawing too many conclusions from the information.

Economically speaking, a community's receptiveness to a solar project is perhaps best captured in their willingness to pay for a new technology. For some DLSC homeowners, their willingness to pay arose out of their desire to invest in solar technology as a means of "bringing down the price for others" and help further the technology (p. 75). One aspect that seems to differentiate renewable from non-renewable sources of power like gas and oil, is that using renewable power is something that seems to resonate with people's values in a way that non-renewable sources do not. There seems to be a general consciousness with non-renewable sources that there is a timeline for their use, and that using less is better for the environment. The resonance that renewable energy has with the values and consciences' of people lends itself well to the promotion of the technology, as people will have a greater willingness to pay. However, in addition to altruism, many DLSC homeowners were delighted to invest in a stable form of energy that would insulate them from fluctuating oil and gas prices.

In Medicine Hat, the HAT Smart program refunds homeowners half of the cost of the installation of solar. Given Wamboldt's (2009) conclusions, perhaps homeowners would be willing to install solar with less of a subsidy now. If a large solar installation outside of the city were to provide some of the electrical capacity of the city, perhaps residents would be willing to pay an additional charge on their power bills to facilitate the project. Wamboldt's (2009) exploration of the economic, social and environmental value of the DLSC provides key insights into the social acceptance of solar projects. This data can be applied to derive appropriate subsidy levels and determine the best way to encourage adoption of solar technology. Ensuring the appropriate social, economic and environmental incentives are in place can help a project be successful.

Social Impacts in Amherstburg, Ontario

Since the Amherstburg solar project is a solar farm, it has different social implications than the DLSC project in Okotoks. The Municipal and Public Consultation Report conducted by First Solar (2010) details the perceptions of citizens and identifies potential project impacts. Residents living near the solar park expressed concerns surrounding the effects of the park on their property values, the aesthetics of the landscape and the "newness" of the technology. Other key social impacts related to a solar farm include the effects of associated infrastructure, the creation of jobs and the building of interest groups (First Solar 2011).

Scenic views and property values

Much like wind turbines, covering a large expanse of land with solar panels alters the landscape, which can make residents living nearby a proposed solar farm less supportive of the project. To address this, berms and additional landscaping with trees and shrubs were constructed in Amherstburg to create visual barriers for nearby residents. Based on this report, there is little evidence to support the claim that solar farms decrease property values (First Solar 2011), assuming that concerns of nearby residents can be mitigated through planning and construction.

Use of prime farmland

The concern was raised during the public consultation process that the Amherstburg Solar Farms were being built on primary agricultural land and not on more industrial sites (First Solar 2011). Although, the sites were chosen primarily based on their proximity to power transformer stations. A second key factor was to avoid landscapes with important heritage features. However, the issue of how a stretch of land might alternatively be used does play an important role in public acceptance. A solar farm, with the seemingly good intentions of generating renewable energy, still faces more resistance from community members when it is placed on valuable farmland, than if it is placed over a contaminated site. Thus, solar farm proponents are increasingly looking into the feasibility of building solar farms over brownfields and contaminated sites to avoid such opposition.

Health and wellbeing

Some residents expressed concern over living near a relatively new technology with little study history of the possible impacts. Among their primary concerns were the issues of noise and the reflective glare from the solar panels. Acoustic Assessments were completed for the Amherstburg sites and the results were posted for community members to examine. The assessment revealed that the impact to noise levels would be minimal. It was also noted that the concern pertaining to solar panel reflection is largely a misconception, as the solar panels are designed to absorb sunlight and not reflect it. In spite of this assessment by First Solar (2011) these concerns are frequently identified by residents and will continue to be a point of discussion and debate in future developments of this kind.

Employment

The Amherstburg solar farm required 50 person years of employment for its construction and local contractors were hired for this purpose (First Solar 2011). The operations phase of the project, however, only requires between one and two people for maintenance (First Solar 2011), so the project has negligible long term impact on employment.

The land use, health and employment impacts identified in the Amherstburg solar project highlight the importance of community perceptions. To mitigate community concerns about health and aesthetic impacts, it is important to ensure information about new developments is widely distributed and explained to stakeholders. Provisions for public participation in EA can help alleviate such concerns as proponents and residents work to common understandings and common solutions. This report also demonstrates that the location of new developments should be carefully chosen to minimize the potential for negative impacts.

Blythe Solar Power Project, Blythe, California

The Environmental Impact Statement (EIS) undertaken by the U.S. Bureau of Land Management (BLM) for the Blythe Solar Power Project investigated the social, economic and environmental impacts of the project. The EIS explored environmental and social concerns associated with the project, including land use and recreation as well as employment and economic impacts. The report revealed no significant impacts, however it did identify some concerns that could be mitigated through careful planning (BLM 2010).

Environmental and social justice

Although there were some initial concerns over environmental justice, given the relatively low income level of the area, no significant air or water quality impacts were predicted and no displacement was associated with the project. The report concluded no environmental justice impacts. As such, no short or long term adverse human health effects are expected to be associated with the project. However, some risks were associated with construction and the temporary increase in construction related traffic (BLM 2010).

Land use and recreation

The EIS reported that there would be minimal impacts to on offsite land uses, including recreation. During construction these included impacts from noise, fugitive dust and vehicle ingress and egress. The short term impacts were primarily from lighting and visible dust plumes, as well as adverse effects due to the large-scale visual disturbance of the landscape. During operations, the site itself could not be used for recreation or other uses. The impacts of operations were reported to be adverse and unavoidable impacts from glint and glare off the solar panels, as well as visual disturbance for recreational users in the surrounding areas. The EIS reported decommissioning impacts would include similar dust and noise effects as during construction, yet provide positive impacts of reclaimed land for recreational use (BLM 2010).

Although the EIS concluded that the BSPP would have no impacts on existing land uses, they did find that 5,952 acres would be affected during construction and that operations would restrict multiple use opportunities on the project site to a single dominant use. The EIS reported that only a handful of existing rights-of-ways would be affected by the BSPP, therefore the applicant was required to mitigate any potential impacts to existing users. The EIS also predicted minimal and easily mitigated impacts to the corridors from the overhead gen-tie power line, fibre optic line and the underground pipeline. Information on known cultural resources within a one mile radius of the proposed BSPP site and within a 0.25 mile radius of all the proposed linear infrastructure was collected. The EIS reported 210 known sites including 30 prehistoric and 180 historic sites. The primary impacts identified were the impact on the integrity of place and the impact of knowledge of the built environment resources that would be in the area (BLM 2010).

Employment and economic impacts

Positive economic benefits were expected throughout the project. The EIS reports benefits including the employment of 1,004 people at peak time and 604 jobs on average. The large majority, 75 percent, were expected to live within two hours of the project site, while temporary lodging needs could likely be met by existing residences. The direct spending benefits were calculated at $406 million on labour and $60 million on materials, approximately $9.4 million annually. Indirect and induced spending would be $330 million over the life of the project, $9.2 million annually. Indirect employment would be approximately 74 jobs per year, 462 jobs in total. The EIS also anticipates temporary spending and employment benefits from deconstruction and restoration, with long term adverse impact from lost jobs and spending (BLM 2010).

The concerns about social justice, land use, recreation, employment and economics, identified in the Blythe EIS, demonstrates the complex nature of potential impacts associated with solar development. Ensuring thorough evaluation of such impacts can help mitigate the negative social impacts that may be associated with solar development.

Medicine Hat, Alberta

Our discussion with our primary contact provided insight into the current state of renewable energy in Medicine Hat. This section will use this primary interview data to identify and explain the key aspects of the project's success and analyse opportunities for growth and improvement. Our contacts involvement with the HAT Smart programs provided details about the current use and acceptance of renewable energy in Medicine Hat. He also reveals insight into the solar potential within the region.

Aesthetics of solar projects

Approximately 70 applications were received for the HAT Smart II program for rebates for with solar electric systems and solar hot water systems. Payback is about 35 years for a solar electric system and 28 years for the solar hot water systems. Despite the shorter payback, fewer applications were received for solar hot water systems. Our contact suggested a possible reason for fewer applications for solar hot water systems is that they are unsightly compared to solar panels, indicating some people valued the aesthetics of solar panels.

Community economic capacity

Our contact felt the program was successful in that many people took advantage of the funding which allowed citizens to participate in solar technology and disseminate it through Medicine Hat. His main critique of the HAT Smart program was that despite providing financial assistance to citizens to install solar technology in their homes, it is still financially inaccessible to some people. This highlights equity issues, as solar is a very expensive technology that is not financially accessible to everyone. Our contact was disappointed that it appeared only a certain group of people who were financially secure applied for the program; generally those who were not too concerned about the payback of the system.

Community leadership

One example of a well-known solar installation in Medicine Hat that received significant media attention is Ridge Professional Centre. The centre hosts a doctor's clinic, sports clinic and prosthetic clinic. The Ridge project is a large 30 KW solar array system, which is the largest roof mounted solar system east of Toronto. This project cost $300,000, which was split equally between the City of Medicine Hat and the Ridge Professional Centre (Goose Creek Renewable Inc 2012). After the Ridge gained significant media attention, the Energy Department was flooded with phone calls from other professional complexes in the area that also wanted solar panels installed. Other businesses saw the positive media spin off from having the technology, and thought they should pursue it themselves to stay competitive. This anecdote depicts the fashionable aspect of solar technology and the role community leaders can play.

Proposed site: Box Springs, Medicine Hat

Box Springs is a site that was identified by the municipality as a potential area for a wind farm (City of Medicine Hat 2011). In 2011, after seven years of research and feasibility studies, the City voted to defer the Box Springs Wind Farm due to a drop in gas prices, which made the wind farm uneconomical for Medicine Hat. This project did not trigger an EA, however public consultations, noise assessments and a vegetation and wildlife overview were conducted in preparation for the wind farm, which provided helpful preliminary information for predicting the impacts of a solar farm on the location. Some residents expressed concern about the noise of the turbines, the sight from their properties and the effects on migratory birds, but overall many residents expressed support for renewable energy (Alberta Utilities Commission 2008). When asked about the predicted social impact of substituting a solar project for the wind project, our primary contact extrapolated that the community would more easily accept the solar project because solar panels would not be noisy and would be less visible than wind turbines. He also mentioned that land use was not an issue brought up at the meeting. Wind was chosen for the Box Springs location however, because it has a much quicker payback than solar.

Potential area for growth: capacity to access resources from the state

Our contact indicated that a large solar farm would require funding from other bodies, such as the provincial or federal government, because the project would be much too expensive for the municipality to fund by itself. Medicine Hat is in an enviable position, as control over local natural gas and electricity supplies is a source of income for the city. However, when gas prices go down, they have less money to spend on alternative projects such as solar. Ironically as they try and move away from dependence on natural gas, they are still dependent on the price of natural gas to fund renewable energy projects.

Proposed solar farm details

Figure 1 outlines the theoretical locations for solar panels in the Box Springs area and the potential amount of electricity that an area of solar panels such as this could create. The figure is based on the proposed location of the Box Springs wind development (City of Medicine Hat 2011). The energy potential of the solar farm is extrapolated from the Amherstburg, Ontario site

(Windsor Essex Development Commission 2009). Many other factors would affect the productivity of solar panels in Medicine Hat, which receives significantly more sunlight than Amherstburg (Environment Canada 2012). The same technology would be used in Medicine Hat as Amherstburg: solar power-producing photovoltaic (PV) panel rows and non-ground penetrating SunPower Trackers.

Figure 1. Proposed solar farm location based on an aerial view of Box Spring Wind farm (City of Medicine Hat 2011, Windsor Essex Development Commission 2009).

Energy potential of solar farm

The proposed Medicine Hat site could generate an estimated 40 MW of power, similar in size to the 35 MW site in Amherstburg. The proposed Box Springs Wind Farm provides an estimated 16.5 MW of energy, approximately 20 percent of residential annual electrical need. The proposed solar farm at Box Springs would provide almost 50 percent of residential electric need, which would help the City of Medicine Hat reach their goal of supplying 25 percent of residential energy with renewable energy by 2025 (City of Medicine Hat 2008). This scale of project is more likely to trigger an EA as well, which would make a SIA possible.

Current state of renewable energy in Medicine Hat

Despite the delay in the Box Springs Wind Farm project, “Hatters” already consume wind power. Wind power is purchased on behalf of Hatters through Vision Quest, which supplies wind energy from the Pincher Creek wind farm. In 2004 the City of Medicine Hat entered into an agreement with Vision Quest to annually produce and deliver 13,050 megawatt hours of EcoLogo Certified wind power to Alberta’s energy grid. This came about with overwhelming support from constituents; in 2001 over 4,100 Electric Utility customers participated in a survey about wind power, and 90 percent of respondents supported the City's pursuit of wind power (City of Medicine Hat 2012). The greenhouse gas emissions saved each year by supporting wind power is the equivalent of taking 2,725 cars off the road.

Given the favourable location and community support for alternative energy, Medicine Hat would make an excellent location for solar development. Economic constraints would have to be addressed to make the project feasible. The concerns identified in our comparison communities would also have to be addressed.

Discussion

Beckley et al.'s (2008) Community Capacity framework is a useful and flexible tool that provides guidance in analysing the ability of a project to contribute to community capacity. Our study used Beckley et al.'s framework and explored several case study communities in an attempt to identify important social indicators for solar technology. These indicators have been linked to capacity outcomes in an attempt to further refine and specialize the framework for solar projects. This work may be helpful for future attempts at delineating the potential social impacts of new solar projects.

Relevant Social Indicators

This section uses the primary and secondary data collected about potential impacts from a hypothetical project in Medicine Hat, Alberta. These impacts are studied in comparison to other solar energy projects around North America. Ensuring new solar projects contribute to economic vitality for all community members is an important consideration. Civic vitality is also important and developing community engagement by providing opportunities for participation is key. New projects should also help ensure communities can subsist and persist within the global economy and continue to access state resources. Finally, new solar developments must ensure human health is maintained, keeping in mind the links between environmental and human health. These five goals and related social indicators are analysed and discussed throughout this section.

Maintain economic vitality

Beckley et al. (2008) identifies that economic vitality is traditionally focussed upon in community development and can contribute to quality of life; however, they argue that it is not the only area that deserves attention. We found that this area was well attended to by all case studies. In relation to labour and employment, solar farms have the potential to create jobs in a new field that can provide more meaningful work to people than traditional energy jobs associated with so called 'dirty oil' and climate change. Employment potential was identified repeatedly by both the Blythe and the Amherstburg case studies, but the differences between work and meaningful work requires more attention in future studies. Roessler (2012) explored meaningful work in our political economic structure and argued that if people are required to work, then meaningful work should be available and adequately understood. Work related to solar energy has the potential to provide meaningful work and this idea warrants further investigation. Creating jobs that provide workers with a sense of purpose, pride and sustainability presumably has more positive social impacts than work that contributes to current environmental problems like climate change.

A common concern throughout the case studies was the impact of solar development on property values; however there seemed to be a split in opinion on the aesthetic value of solar panels. The impact on property values in relation to the aesthetics of solar panels requires more research and the actual and perceived impacts on property values would be an interesting indicator in measuring the perception of the technology by both residents and purchasers. As seen in the Okotoks Case Study and small scale installations through the HAT Smart Program, having solar panels is seen as an asset, which would enhance the value of a property. At larger scales of installation however, the worry remains that property values will decrease. This is an important factor to address with solar development projects of this kind.

Another important indicator related to economic vitality is that of economic accessibility. This raises the issue of equity and whether participation in solar technology and renewable energy is something which all residents can access. With the HAT Smart project, a main regret of the Sustainable Energy Advisor was that despite the rebates, the technology was still not affordable to everyone. In the case of the Drake Landing Solar Community there was only one price level and a single style of house available, with no options for people of lower income. Solar farm projects like Amherstburg and Blythe produce large amounts of electricity that is sold on the energy market, but often at a premium to environmentally conscious consumers. Medicine Hat already purchases wind power on behalf of all Hatters, and another way to provide access to renewable energy to all income levels could be through the installation of a city owned and operated solar farm. In the same way that unhealthy food is often the cheapest form of food that is financially accessible to all, non-renewable energy resources are currently cheaper than cleaner and more sustainable energy sources. By measuring the income levels of the people participating in solar technology and by considering ways to make it more accessible, perhaps the important issue of equity can be addressed.

Maintain civic vitality

Civic vitality is a measure of how much community activity is taking place and what portion of the community is engaged (Beckley et al. 2008). In relation to the equity issues mentioned previously, participation at community events is a good indicator of civic vitality. In Medicine Hat, one example of civic vitality was that 10 percent of homeowners showed up to attend energy efficiency seminars organized by the City. The level of participation at events related to the installation of a solar project is a good indicator of the project's contribution to civic vitality. Local attitudes towards solar technology are also a good indicator of the potential for the technology to contribute to civic vitality and attain community acceptance. In the case of Amherstburg, the media reflected mixed views of people's attitudes towards solar. Regardless of whether they approved of the solar farm or not, the project facilitated the coming together of the community to discuss sustainable energy production. Community cohesion is an indicator demonstrated by the Okotoks project, in that solar technology allowed a group of like-minded people to come together and live in a community with others who share common values. A solar farm could serve a similar purpose in uniting a community or a city. The impact of a solar farm on recreation, transportation and public access is an important indicator to examine in some detail. If the solar farm impacts any of these three categories negatively or isolates groups of people, there could be a negative impact on the activity level and engagement of the community, which would decrease civic vitality.

Subsist and persist/link to global economy

The capacity to subsist or persist is described by Beckley et al. (2008) as the ability to provide for oneself outside of the market economy. The natural gas reserves of Medicine Hat allows the community some degree of self-sufficiency in terms of energy dependence, as the price they pay for gas and electricity is unaffected by market prices. The ability of a municipality to provide stable energy prices reflects on the ability to subsist and persist on a macro scale. The contribution of solar energy to the stability of energy prices is an important indicator of a municipality's ability to subsist and persist in terms of its energy needs.

Beckley et al. (2008) did not outline the capacity outcome "link to the global economy" but in the case of solar energy and the stability of energy prices, a decreased link to the global economy in terms of energy might be favourable. Solar energy is naturally a local resource because it is less transportable than coal or natural gas due to the losses associated with transporting electricity long distances. The more localized and less dependent a place can be on the global economy and purchase of energy from the global economy, the less susceptible they will be to global market forces. A major reason Medicine Hat pursues renewable energy projects is so that when natural gas reserves are depleted in the future, they will be less dependent on purchasing energy at global market prices.

Access state resources

The ability of a municipality to access state resources such as tax revenue to build infrastructure is also an important reflection of community capacity. The Drake Solar Landing Project was heavily subsidized by federal, provincial and municipal incentives, and the project was ultimately offered to the municipal manager of the town. The town of Okotoks was selected to host this cutting edge project because the great solar potential in the area and the sustainability initiatives already present in the town (Wamboldt 2008). Medicine Hat has a lot in common with Okotoks in these respects, but the ability of Medicine Hat to access the provincial and federal funding that would be required to make this project feasible is the question.

Maintain human health

Maintaining human health is an important social impact that was largely absent in the literature and case studies involving solar technology. Several articles from community newspaper in Amherstburg indicated that people worried what the health impacts to people might be from a large solar project. Information about the impact of solar technology on human health is rare as it is a fairly new technology that has not been around very long. Several people from the Box Springs Wind Farm Public Consultation we concerned about the health impacts of the wind turbines because it is a newer technology, which indicates there might be worry about the health impacts of a solar installation as well. Perceived and real health impacts from the technology should be indicators included in future assessment of solar farms. Perceived health impacts can influence mental health and the perception of individual well being, even if there are no physical health impacts. Additional research in this area would benefit solar projects as it would identify possible health impacts, and help relay information to impacted people.

In this section we have covered five capacity outcomes and the related social indicators. Through the examples provided in our case study communities, we demonstrate potential social impacts of solar development and how to measure them. We also outline the links between economic and civic vitality and provide insight into the role solar energy could play in building community capacity. With our analysis of the health impacts of solar development, we demonstrated the important role of perceptions and the important effect of public opinion of project developments. The areas identified in this section are likely to be key considerations in the SIA of solar energy projects.

Conclusion

Solar power is one of the many alternative energy generation techniques that we expect will continue to grow in popularity in the future. Therefore, Canada needs to work to develop effective assessment and management tools to ensure the benefits of solar development are maximized. Social impact assessment is one tool that can be applied to do so. In this chapter we used a comparison case study method to identify the social impacts of existing solar projects. We used the knowledge gained from studying the social implications in our case studies: Drake Landing Solar Community, Okotoks, Alberta; Amherstburg Solar Farm, Ontario; and the Blythe Solar Power Project, Blythe, California, to predict what impacts a large solar farm in Medicine Hat, Alberta may have on the local community.

Medicine Hat is a place that is open to embracing renewable energy technologies, especially as local natural gas reserves dwindle. Solar power is an appropriate technology for Medicine Hat given the amount of sunlight it receives and the willingness of its residents and municipal administration to pilot new technology. This is demonstrated through the variety of renewable energy projects Medicine Hat has invested in. Given its natural gas resources, Medicine Hat can be considered a prosperous city with low utility prices and property taxes. However, solar energy is still an expensive technology for the city to embrace on the scale we are suggesting. Currently, the HAT Smart program provides incentives for willing homeowners to install the technology on their homes. In this way, those that want to support the technology and who have the financial capability to do so can, with little worry about the payback period. However, due to its high costs, solar energy is not currently a financially feasible option for all homeowners to undertake. Therein lies the issue of equity, and the financial accessibility of solar technology. A solar farm in Medicine Hat would be one way to provide clean, renewable energy to all Hatters, but would likely require financial support from federal and provincial levels to make it a financial possibility for the city.

Our analysis was facilitated by drawing upon the community capacity framework developed by Beckley et al. (2008), which provided a structured means by which to organize the assets inherent in our each of our case study communities. The flexible nature of the framework allowed us to capture a basic understanding of the respective social environments represented by each community. It furthermore highlights the dynamic nature of communities and their ability to adapt to threats and opportunities that allow them to adopt new practices and ideas. This concept is particularly important to the realisation of large-scale solar projects since it is still a relatively new technology and would require communities to adapt to new policies and developments. Our case studies demonstrate that, though they are not without their challenges, these large-scale solar projects can be implemented and embraced by communities in a way that does enhance community capacity.

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Chapter Four – Geothermal as an Alternative Energy Source

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Introduction

Resource extraction makes significant contributions to the Canadian economy and energy demands are steadily increasing. When considering our dependency on finite energy sources, incorporating new sources of alternative energy may have benefits for both the environment and local economies. Because alternative energy sources have the potential to impose both negative and positive impacts on the environment, local communities and economies, it is important to consider these impacts prior to development. In order to evaluate the potential impacts of development, communities, industry and government work collaboratively within the Environment Assessment (EA) Framework to address and mitigate such impacts. One component of this process focuses specifically on the assessment of social impacts. This chapter uses the Social Impact Assessment (SIA) process as a tool to assess the relevant social indicators of geothermal energy.

Given the variance of geothermal resources from location to location, examining the potential impacts in communities with potential development is important. Increasing concerns over the impacts of geothermal were recently discussed at the World Geothermal Congress. Some of the discussion surrounded surface disturbances, gray water brine contamination, noise pollution, thermal effects and emissions of chemicals (Ketilsson et al. 2010; Baba 2003). Given these concerns, this chapter demonstrates that SIA must be conducted in order to predict how a geothermal energy development will impact a community. Using a comparative analysis, we provide insight by examining case studies and identifying the potential impacts of geothermal energy development in the community of Lac La Biche, based on the international experiences of Turkey, Iceland, Hawaii and El Salvador.

First, background on geothermal will be provided. Next, our impact community of Lac La Biche, Alberta will be introduced along with our comparison communities. Then, we explore the regulatory framework for geothermal development in each region and examine the role of public participation. Finally, we identify the key impact domains that should be explored in an SIA of geothermal energy and discuss the potential links to community capacity.

Background

Geothermal energy is generally accepted in the literature as an environmentally benign source of energy (Baba 2003). This energy can be captured in two different ways. At a smaller scale, the temperature differential between the surface and underground can be use to heat or cool buildings. This form of geothermal energy is captured using a heat pump, which brings heat from below the earth's surface into a building to heat it, or pumps hot air out of a building to cool it. The pump moves fluid around pipes that run under the earth and through the building, absorbing or emitting heat as needed. At a larger scale, underground heat sources, including hot water and steam can be used to directly drive turbines to generate electricity. The case studies examined in this report all use this type of larger scale technology (Pembina Institute 2012).

Literature Review

Geothermal energy development has yet to be implemented at a large scale in Canada. At present, EAs are not required for geothermal energy projects prior to development. However, the proponent is required to consult the public and conduct a screening report prior to the commencement of the project (CGCC 2010). To date, Canadian geothermal projects have not been large enough to trigger an SIA, so there is a little data on the social impacts of domestic geothermal development. The Canadian Geothermal Code for public reporting (2010) acts as the industry self-regulation, which is done on a voluntary compliance basis.

Geothermal resource extraction legislation and international legislation are based upon the "Geothermal Resources Operational Orders" mandated by the United States Department of the Interior (1976), Geological Survey Conservation Division. This document outlines how the use and sampling of water can be conducted, outlining specific guidelines for the drilling of shallow holes and remedies for dealing with post drilling. The document also provides a framework for consultation; it outlines the process for notification to the Federal Government that developers must follow. This model of legislation created by the United States Department of the Interior in 1970 is the current international framework and it has been moulded and built upon to fit each nation, as no two countries explore impacts the same way (Baba 2003). The different ways our comparison communities have applied this legislation are explored in the results section of this chapter.

The development of geothermal energy throughout the world provides us with insight into the impacts. In Hawaii, Edelstein and Kleese (1995) explained the important role local belief systems play in determining perceptions and acceptance of geothermal development. Baba (2003) discovered a similar belief system in Turkey, however these values did not prevent the resource from being developed and Turkey's framework for EA broadly emphasizes social, political and economic considerations. Ketilsson et al. (2010) presented findings about sustainable geothermal development in Iceland, documenting the history of development and the benefits the country has experienced as a result. Finally, Arevalo (2006) explored the energy resource in El Salvador, outlining the important social responsibility industry has to fulfill if it is to undertake development.

Study Setting

Four communities were used in this comparative analysis to address the limitations associated with singular comparative approaches. This ensures diversity in the scenarios presented in terms of scale, timing and resource availability. This multi-community approach allowed us to draw from the strengths of each study and recognize potential limitations. This chapter draws from geothermal energy research in Turkey, Iceland, Hawaii and El Salvador. Each one of these examples offers insights and provides a solid, inclusive framework for critical examination of the strengths and weaknesses to support the implementation of a comprehensive SIA for the proposed site at Lac La Biche, Alberta.

Impact Community: Lac La Biche

The Lac La Biche Region is located in the heart of the boreal mixed wood forest, approximately 220 kilometres northeast of Edmonton, Alberta (Lac La Biche Region 2011). Lac La Biche is home to large water bodies, wetlands and rolling hills. Trembling aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*) and white spruce (*Picea glauca*) dominate the landscape, with the low lands being comprised of tamarack (*Larix laricina*) and black spruce (*Picea mariana*) (Lac La Biche Region 2011).

The county population is approximately 10,000 people, made up of a diverse culture including French, White Russian, Italian, Lebanese, Aboriginal and Ukrainian. The Lac La Biche area has a variety of industrial development including oil and gas, forestry, agriculture and tourism. Oil and gas is a significant contributor to the local economy as the region is situated near two of the provinces major oil producing areas, Fort McMurray and Cold Lake. Drilling, seismic and pipeline construction as well as the opportunity for expansion with steam assisted gravity drainage (SAGD) developments. In previous years the development of a major pulp mill by Alberta Pacific Forest Industries as well as the increasing demand for wood products has substantially increased and diversified the forest sector. The northern lake country attracts outdoor enthusiasts that are interested in the experience and scenic views of the surrounding lakes and forests. The tourism industry has grown with the rising demand for new services and wilderness experiences; over 175,000 visit annually. Cattle operations make up approximately 70 percent of the agricultural revenue in the region and major crops include hay, pasture, oats, barley and canola. The community has two housing manufacturers, a truss manufacturing plant and several fabrication shops (Lac La Biche Region 2011).

Population and labour force

The population of Lac La Biche has experienced a steady increase. From 2004 to 2006 the population increased by 13 percent, with a 21 percent increase of private dwellings from 2001 to 2006. The agricultural labour force increased by six percent from 2001 to 2006 and the construction labour force increased by four percent. This increase in population is greater than the provincial average and is driven by immigration (EnCana FCCL Ltd. 2009). The immigration rate can be attributed to employment opportunities in areas that support the growing Athabasca oil sands development, retirement, as well as second home real-estate near the lake area (EnCana FCCL Ltd. 2009).

Traditional land use and culture

Traditional land use and culture in the Lac La Biche region is under increasing pressure from oils sands development. As development expands, more land is occupied by oil sands facilities and the population increases as migrant workers come to the region for the growing wage opportunities. As project development and population increases it is expected that traditional pursuits will not be a primary goal (EnCana FCCL Ltd. 2009).

Comparison Communities

We explored a comparative case study of geothermal projects in four distinct international settings. No two spaces in this comparison are identical in landmass, population, culture, or geography. This variance offers insights into how we can learn from each of these spaces. This report draws on the strengths and weaknesses of geothermal projects in each location and applies what we derive as a possible working framework to the Lac La Biche example. In Turkey, the total capacity using direct geothermal energy is 992 MW. The equivalence of heating 61,000 residences, this includes district heating, thermal facilities and greenhouse heating (Baba 2006). All of this energy is sourced from a single generation plant, which has the capacity of 20.4 MW (Baba 2006). Iceland has approximately 30 GW of available geothermal energy (Ketilsson et al. 2010). In El Salvador, the total capacity of geothermal energy is 90 MW (Arevalo 2006). Finally, in Hawaii total capacity of geothermal energy is between 100 and 500 MW (Edelstein and Kleese 1995).

Methods

The comparative analysis approach is implemented by anticipating social impacts in Lac La Biche in relation to comparative case studies in other parts of the world. Using Berge's comparative Diachronic model of comparative cases for impact assessment (Vanclay 2003), we can better define social impacts by evaluating impacted communities and compare them to our community of interest Lac La Biche, Alberta (Asselin and Parkins 2009). For the geothermal development in the community of Lac La Biche, AB, social indicators were chosen based on comparison community experiences. Government Environmental Impact Assessment documents were not always available, instead information from Statistics Canada, community development guides and other secondary sources were compiled and considered in order to choose appropriate social indicators (Arevalo 2006; Baba 2003; CGCC 2010; Edelstein and Kleese 1995; Ketilsson et al. 2010).

Study Results

The following sections explore legislative and international policy on geothermal development within our four case study communities. First, an exploration of the regulatory context for geothermal development in each community is presented. Subsequently, the relevant social impact domains are identified and the stakeholders in each community identified. The role of public participation is also examined throughout this section.

International Legislative Context for Environmental Assessment

An examination of the legislation in each of our comparison communities provides insight into the different ways to approach geothermal development and assessment. Given the lack of EA requirements in Canada, this comparison data will offer insight into the potential changes that could be made to EA legislation in Canada. This section details geothermal legislation and policy in each of our comparison communities, detailing how each country assesses the development of the resource.

Turkey

Based on the U.S. Department of Interior's (1976) legislation, the Mediterranean country of Turkey has created domestic environmental legislation and a national Ministry of Environment (Baba 2003). This governing body is responsible for the mitigation of impacts and coordination of EA. The laws set out by this ministry identify which projects may have significant effects on the environment and subject them to this assessment process (Baba 2003).

Iceland

Iceland is a leader in environmental legislation and has incorporated EA into the monitoring of their geothermal development. Iceland's framework is based upon sustainable development as defined by the World Commission on Environment and Development. This country is the only one that has created a program that includes professionals from power companies, the regulator, research institutions and universities (Ketilsson et al. 2010). This clear mandate of including a broad community is integral to what Icelanders describe as part of sustainable development. Approximately 66 percent of the electricity is provided by geothermal power plants (Keitilsson 2010). The belief in Iceland is that effective policy making and legislation contributes to a sustainable and long term lifespan of their geothermal resource (Keitilsson 2010). Iceland's Principle of Declaration is based on the United Nations Rio Declaration on Environment and Development (Ketilsson et al. 2010).

Hawaii

The U.S. National Environmental Policy Act (NEPA) of 1969 is the foundation of EA, a tool created to explore the social, environmental and economic impacts of development (Edelstein and Kleese 1995). The United States was also the first nation to legislate EA (Baba 2006). According to Edelstein and Kleese (1995) these assessment tools were created to support rational decision-making. These tools would facilitate an exploration of the proposed project and provide unbiased rational decisions, by exploring all identifiable aspects of possible impacts. Furthermore, assessment tools have the capacity to mitigate possible impacts, strive for sustainable development and minimize potential damage during the development of geothermal resource development (Edelstein and Kleese 1995).

El Salvador

El Salvador first developed a mandate to create environmental and socially responsible policies at the World Summit for Sustainable Development in Johannesburg 2002. The Kyoto and Rio conventions have also contributed significantly to El Salvador's legal framework. Arevelo (2006) argued that the nations focus is on protection of the environment and improvement to standards of living. El Salvador has established laws and regulations around their geothermal projects, however Arevalo (2006) suggests that these have often become the root of conflict.

Domains of Impacts, Who's Involved and Participatory Challenges

This section identifies important social impact domains and explores the participatory challenges associated with EA. A variety of impact domains are identified in each of our comparison communities, providing a rich source of data regarding the important domains to explore when considering geothermal development in Lac La Biche. The important role that stakeholders play in the acceptance of geothermal development is demonstrated throughout this section.

Turkey

The Turkish government has implemented laws regarding the assessment of geothermal impacts, which aim to maintain harmony, according Baba (2003). The Turkey EA framework draws from the United States Department of the Interior (1976), Geological Survey Conservation Division, which was previously discussed (Baba 2003). Recently, this framework has been used to fulfill the goals of sustainable development, which the government defines as being in "harmony with the environment" (Baba 2003:75). This in itself is an ambitious marker of terms for negotiating impacts on the environment. This geothermal impact assessment framework demonstrates more clearly than other models the concept of risk assessment (Baba 2003). Although Baba's (2003) assessment did not explicitly identify social impacts or indicators, one might draw on their conclusions. Baba (2003) discussed the assessment of acute and broader chronic health concerns and they explicitly linked these problems to environmental pollutants. In the risk assessment they did not explain what would be considered a determinant of health or pollutants. This terminology is used very loosely, with no guidelines for measurement or evaluation of the impacts on health or the environment in direct relationship to the geothermal development.

Baba (2003) suggested that Turkey's mandate is to also explore what social changes might be instigated by the project. He suggests this by proposing to examine if benefits and burdens from the project are equitably distributed (Baba 2003). This particular framework for impact assessment also explored how the local people reacted to the project. In this case it was negatively, as their social construct and cosmology demands a respect for non-disturbance of the land, similar to the values expressed in the Hawaii case (Baba 2003; Edelstein 1995). This negative perception is related to local volcanic stories and relationships between people and the land. Political, social and economic considerations make up part of the framework to determine decisions about this particular geothermal development. Important to note from this example is that the input from the public was valued equally to that of the professionals and that the political, social and economic impacts were considered. Renewable energy in Turkey is an important component of sustainable development; although it was not made explicit, this case study suggests that the Turkish people are concerned with future energy patterns. If we fully investigate the framework used, we can draw connections to what indicators would reflect a particular outcome. The EA framework from Turkey provides a comprehensive review of the potential impacts of development including a history of land tenure, cultural resources, geological history and noise, to name a few. Compared with subsequent examples that are discussed in this chapter, this approach identifies a broader range of potential impacts.

Iceland

After many decades of geothermal use and development, the government of Iceland has found that there are positive long term effects associated with the resource and any negative effects are likely reversible (Ketilson 2010). Iceland has been drawing 66 percent of their total energy source from geothermal for over two decades and the average geothermal energy potential was estimated to be 30 GW in 1982 (Ketilsson et al. 2010). For each geothermal system, there is a certain level of maximum energy production available that is required to maintain a constant energy flow from the system in the long term, about 100 to 300 years (Ketilsson et al. 2010). Research on Iceland's geothermal resources argues that if there are any impacts, they are mostly reversible (Ketilsson et al. 2010). This argument initially appears broad and ambiguous; however it is important to note that Iceland has a much larger focus on the political responsibility and sustainability (Ketilsson et al. 2010). Insofar as economic recovery, it has taken up to 30 years of production in order to recoup the initial investment costs. If there were to be any large environmental impacts, they likely would have been noticed or documented within their 30 years of experience in geothermal production. Iceland's framework focuses on sustainable production, using strategies that maximize use of all the heat and energy produced (Ketilsson et al. 2010). In this example, Iceland's emphasis on social aspects involved exploring the use of geothermal resource and how it generates net positive social impacts (Ketilsson et al. 2010). Ketilsson et al. et al. (2010) further discussed creating indicators based on broad themes including environmental, social, economic and institutional impacts.

Hawaii

Edelstein and Kleese (1995) explored cultural relativity in relation to the outcome of an impact assessment. Development of geothermal energy could ensure economic prosperity, low environmental impacts and a sustainable source of energy for the island of Hawaii; however, cultural impacts play a much more significant role within a Polynesian cosmology (Baba 2003; Edelstein and Kleese 1995). For the indigenous peoples of Hawaii the goddess Pele ensures balance and harmony with volcanoes and the people's ability to cohabitate the island space without disruption (Edelstein and Kleese 1995). In this cosmology Pele is allocated agency, which means she has just as much autonomy and right to exist without infringement as human beings (Borrows 2010). In this particular case a "Pele Defense Fund" was created and the traditional values of the native Hawaiians were asserted with support from outside non-governmental organizations (Edelstein and Kleese 1995). Regardless of economic prosperity or the possibility of a sustainable energy source, a cultural narrative dictated the outcomes of this assessment. In this case no development was undertaken due to the cultural conflict it created.

El Salvador

Like many of the other case studies, research on the impacts of geothermal development in El Salvador was undertaken by industry. In El Salvador, a company is obligated to fulfill assessment requirements as part of the legal framework for development within national boundaries (Arevalo 2006). As such, it is the geothermal developer that is responsible to fulfill honest socially responsible policy and respect the environment. Project proponents are also required to develop occupational health and safety policies for all stakeholders (Arevalo 2006).

The irony of the El Salvador example is that their research is industry controlled. Arevalo (2006) explicitly describes potential physical, chemical, biological, social, economic and cultural impacts. These categories are further explored and possible mitigation measurements are provided.

Arevalo (2006) described industries role of being a responsible neighbour and detailed how industry has explicit social obligations to fulfill with the development of geothermal power plants. Industry is clearly required to contribute to seven thematic areas: education, infrastructure, health, sport, culture, production (eg., fish farms, horticulture) and the economics of El Salvador. According to Arevalo (2006), industry in El Salvador values good relationships with the people. Arevalo (2006) argued that sustainable development is only possible when social and environmental plans are made. However, it is not clear in this assessment who holds industry accountable to these measures and if there is recourse if they are not meeting their mandate of being a "responsible neighbour" (Arevalo 2006:4).

Discussion

Utilizing this framework, we make a comprehensive comparison exploring how communities demonstrated superior capacity to develop geothermal resources in a sustainable manner. We also analyse the weaknesses demonstrated by the case examples. Based on examination of the four case studies presented here, we recommend an SIA of a geothermal development in the Lac La Biche region of Alberta. The following Social Impact Domains are identified based on the comparative case studies and the specific conditions at Lac la Biche. Broad categories including cultural, socio-economic, political and land based factors, as well as human-health indicators, are detailed in Table 1. The examples provided in the table are discussed in detail with relation to our impact community of Lac La Biche.

Table 1. Social impact domains, potential impacts and benefits, mitigation measures and examples from case studies for geothermal development in Lac la Biche, AB

Social Impact Domain	Potential Impacts /Benefits	Mitigation Measures	Example from Case Studies
Cultural Factors	Conceptual cosmological frameworks of local peoples must be considered – impacts will be perceived differently by different groups	Preliminary dialogue exploring place-based names, land tenure history and how each group perceives the development	Illustrated by the agency of the goddess Pele, overruled a decision to go forward with development (Edelstein and Kleese 1995)
	Infringement on autonomy and right to exist within a particular cultural paradigm.	Identify agency of non-human spaces and places	

Socio-economic Factors	Provision of Jobs	Determine how many jobs will be provided in the long term	Ketilsson et al.’s (2010) Iceland example showcased the economic benefit of investing in geothermal, even though it took 30 years to recoup the initial investment. Arevalo’s (2006) El Salvador example of the requirement of industry to provide funds for social programs
	Long term renewable energy source	Subsidies for initial investment	
	Provision of social programs	Require industry to contribute to funding of social programs	
Political Factors	Potential political resistance due to competition with conventional oil and gas	Education for local communities about the long term benefits of geothermal and emphasizing that both industries can operate at the same time	United Nations framework implemented in El Salvador (Arevalo 2006) and Iceland emphasizing sustainability and reducing pollutants that are associated with conventional energy development (Ketilsson et al. 2010)
Human-Health Factors	Worker health & safety risks – initial drilling is similar to oil and gas	Training and implementation of existing health and safety regulations	Turkey example discusses the risk assessment process and identifies worker health and safety as important (Baba 2003)
Land-based Factors	Ecological footprint	Planning should be done to minimize the extent of the development	El Salvador requires industry to be a ‘responsible neighbour’ (Arevalo 2006)
	Water impacts – brine leak into groundwater	Drillers need to be prepared to contain any contamination immediately	
	Habitat fragmentation	Industry should be required to put funding toward habitat protection and reclamation at other locations in the region as part of a ‘responsible neighbour’ policy	

Insofar as shared values, the comparison community of Hawaii clearly demonstrates the imperativeness of a community values system that is consistent with a proposed development. The lack of congruence in cultural belief systems resulted in no development (Edelstein and

Kleese 1995). This example demonstrates the importance of exploring culture within a social impact assessment. Another example of shared values is in El Salvador, where industry holds itself independently accountable to being a respectful neighbour (Arevalo 2006). The capacity for El Salvador to hold industry accountable to this standard appears to be non-existent. It is also unclear with this example if community members and industry hold the same ideological constructs around the notions of what it means to be a responsible neighbour.

In terms of public participation and engagement, Iceland appears to be quintessentially definitive in who is invited to participate in the assessment. There, all professionals with a vested interest can participate (Ketilsson et al. 2010). In contrast, Turkey encourages an explicit investigation into local setting, history, culture and a long list of other indicators to determine the stakeholders (Baba 2003). However the literature neglects to explain if the public are simply informed of project activities, or if they are fully engaged in participation. In the Hawaiian case, public participation is what determined the outcome of the proposed geothermal development (Edelstein and Kleese 1995).

Exploring the relationship between the proposed comparison community of Lac La Biche and other communities where geothermal development assessments have occurred provides a framework in which the Alberta model can draw from international examples. These cases provide the opportunity to explore cultural relevance and approaches to accountability, illustrating how EA can be used to ensure that projects contribute to social and environment sustainability. Drawing on the responsible neighbour example, Alberta could take measure to ensure industry accountability and engagement in activities that will benefit local residents. The United Nations accords of Kyoto and Rio play vital roles in establishing universal guidelines for the global community to follow sustainability practices. The case study of Turkey is similar to Hawaii, as narratives about spaces do not coincide with geothermal development; however, unlike Hawaii, Turkey was able to undertake some geothermal development by providing assurance that specific spaces were not developed. It is important to note that the public ensured these two particular outcomes.

Geothermal energy is a form of alternative energy that may contribute to community capacity in a way that conventional energy projects do not. Beckley et al.'s (2008) community capacity framework provides guidance to an understanding of whether or not community capacity can be achieved or not. The local economy of Lac La Biche is largely driven by Athabasca oil sands development, weighing a large part of the community's capital as economic capital. By developing alternative energy in a way that involves the community through public participation and building social networks, there could potentially be an increase social capital. Additionally, by developing a form of energy with a reduced environmental footprint compared to conventional oil and gas, long term ecological sustainability could be enhanced. If a local alternative energy source were developed in a way that would increase trade and technical training, education and entrepreneurship, human capital would gain as well (Beckley et al. 2008).

Beckley et al. (2008) also describes community capacity as the "capacity to do what?" (p. 61). That is to say that there is a goal associated with the idea of community capacity. What is it that Lac La Biche as a community is setting out to achieve? The seven outcome areas identified in the regional report "Community Futures", are economic vitality, civic vitality, the ability to subsist, resource access, global economy, ecological integrity and/or maintaining human health (Lac La Biche Region 2011). Geothermal development has the ability to contribute to some of these goals. For instance, geothermal development could diversify the employment sector of Lac La Biche and create local employment, reducing the number of residents who commute to work outside the town. An increase of local employment has positive social implications by decreasing or neutralizing the transient populations and associated social impacts. Public participation at events such as town meetings, where community members meet to exchange and discuss in a public setting, can contribute to civic vitality. Given that geothermal energy development will not significantly affect the employment of oil sands workers and provide local employment, it is likely that this development will be well perceived by the community.

Conclusion

The conclusion of this scoping exercise demonstrates the importance of drawing from multiple case studies to formulate a cohesive and concise framework for assessing the social impacts of geothermal development. The case studies examined a variety of ways that community capacity can be increased through the development of geothermal energy. Through a review of literature, an analytical framework upon which a SIA can be carried out was demonstrated. The legislative framework and politics of a region were highlighted as important factors influencing the outcome of geothermal development. Overall, the social impact domains identified, along with the mitigation approaches detailed provide a model for exploring renewable alternative energy and how its development may affect Albertans.

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Chapter Five – Wind Power in Alberta

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Introduction

Renewable energy developments in Alberta are becoming an important alternative in terms of power generation (Pembina Institute 2012). Wind development in Alberta has existed for more than 15 years and the province has led Canada in wind power utilization, though Ontario and Quebec has exceeded the province in wind use in recent years (Bell and Weis 2009). In addition to being renewable, there are no toxic or greenhouse gases (GHG) emissions once wind turbines are operational, unlike coal-powered plants (Bell and Weis 2009). Wind resources in Alberta are easily accessible, thus many people promote the development of this type of energy (Bell and Weis 2009). The caveat to these renewable energy developments is whether they would require an Environment Assessment (EA). For wind energy developments in Alberta, there are some uncertainties as to whether or not EA is required prior to development.

In this chapter, we describe the best method of conducting an SIA for hypothetical wind development near the township of Beaverlodge. The community is located in the northwest part of Alberta, in the county of Grande Prairie. We chose the Beaverlodge community for the construction of wind farms because of the considerable wind potential in the area.

To determine the relevant social impact domains for EA of wind development in Alberta, we first conduct a review of relevant literature. Background is provided on our study site, Beaverlodge, Alberta and our comparison community, Pincher Creek, Alberta. Next, we overview the results of our study, identifying the relevant impact domains. Finally, we discuss these domains with respect to public participation and community capacity.

Background

One of the renewable energy sources that can be used to decrease dependency on fossil fuels while reducing greenhouse gas emissions is wind (Balat 2011). This energy source creates electric or mechanical energy from the kinetic energy of the wind, through the use of wind turbines (Bilgili et. al 2010). Mechanical energy from wind turbines is employed to generate electricity and transmission lines conduct electricity to users (Government of Alberta 2011). As such, wind energy turbines and plants can be constructed quickly and used as a way to promote investment inexpensively (Bilgili et. al 2010). The Province of Alberta currently produces up to 800 MW of electricity from the wind energy sources, which is enough to power 970,000 homes (Government of Alberta 2011). However, this amount of electricity can only be attained when the wind is blowing and at maximum production capacity. Given the continued development of this resource in Alberta, it will be of growing importance to assess the social impacts associated with wind power development.

The current Alberta legislation on EA does not specify that an EA is required for wind farms (Krivitsky 2010). Under the Environmental Protection and Enhancement Act (EPEA), there is no clear indication whether wind power generation is a mandatory or an exempt activity. Therefore, it is up to the discretion of the Alberta Minister of Environment and Water to determine if an EA is required (Krivitsky 2010). Though an EA is not mandatory for all wind farm development, it may be in the best interest of the proponent to conduct an assessment to determine areas of impact and to address potentially negative impacts with appropriate mitigation plans. The scale of the wind farm we propose for analysis is large enough to trigger an EA in Alberta. More importantly, the wind turbines would be tall and spacious enough to impact the natural and human ecosystems and are somewhat permanent on the landscape. Given these possibilities, assessing the impacts of wind turbine development is important.

Literature Review

As noted in the first chapter of this report, successful project implementation can have important impacts on community capacity, encompassed within four broad categories (Beckley et al. 2008). In order to successfully approximate these capacities in Beaverlodge, Alberta, a comparative examination of wind energy in Europe and eastern Canada is undertaken through major research findings and adaptations of communities to the implementation of wind energy as noted in the published literature.

Public perceptions of wind energy are instrumental to the success of proposed wind projects. Extensive research has been conducted examining attitudes across Europe in an effort to identify how different communities have adapted to the idea and implementation of wind power projects near or within their community. Devine-Wright (2005) proposed a framework to integrate knowledge of these public perceptions, which will allow for the identification of factors that explain or facilitate further insight from these perceptions. He identified six distinct strands of research including: (1) public support for switching from conventional energy sources to wind energy, (2) aspects of turbines associated with negative perceptions, (3) the impact of physical proximity to turbines, (4) acceptance over time of wind farms, (5) NIMBYism as an explanation for negative perceptions and (6) the impact of local involvement on perceptions. The information gathered on wind energy in Europe informed our analysis of potential impacts upon Beaverlodge.

Public support for switching from conventional energy sources to wind energy is a key area of investigation identified by many researchers. Since the 1970s, extensive polling efforts have indicated strong public support for the movement towards alternative energy sources at the national level (House of Lords Select Committee 1988; IRNA 2000); however, more opposition has been noted across different socio-economic and cultural groups at the local level (Devine-Wright 2005). Why and how this occurs is still being explored.

Negative perceptions of wind turbines make up a significant focus in the literature. The majority of research lists visual impacts and noise as the most negatively perceived (Simon 1996). The size of the proposed project, as well as the alignment on landscape, plays a key role in how a community will perceive a particular wind energy project. Smaller farms in clustered formation tend to be better perceived than single scattered turbines or larger arrays in research conducted in

Denmark (Daugarrd 1997). In Ireland, study results showed that smaller and clustered formations of turbines were favoured over large scale installations (Sustainable Energy Ireland 2003). These perceptions clearly contrast with wind energy development policy in many countries, which tends to favour larger scale projects and larger wind turbines (Elliot 1997; U.K. Department of Trade and Industry 2003). Visual impacts are often raised as a point of contention by those opposed to wind development, however there is little research comparing the perceptions of turbines of differing color, size and arrangement on the landscape (Devine-Wright 2005). Most research tends to place a negative stigma upon the visual perceptions of wind turbines by using language that encourages negative perceptions.

In terms of the impact of physical proximity to turbines, there is variation in the literature over whether or not those closest to wind farms have the most negative perceptions and experiences. Some research reports the negative perceptions relating to proximity, but is important to note that the technology involved in studies conducted in the U.S. and U.K has since been upgraded to quieter and less conspicuous designs (Lee et al. 1989; Thayer et al. 1987; British Market Research Bureau 1990). A study conducted by Anderson et al. (1997) in Denmark showed no conclusive link between proximity to turbines and negative perceptions. In fact, those living closer to turbines expressed more positive sentiments compared to those living farther away. Another study conducted in the U.K., discovered that most who could see wind turbines from their residences did not report being bothered by them (Dulas Engineering Ltd. 1995). Recent research suggests that perceptions of wind energy are not just related to the physical attributes of the turbines themselves, but that relational spheres within a community and within households have an impact. Social processes and networks, such as opinions of friends, family and community leaders, play a role in influencing individual opinions (Devine-Wright 2003).

Some studies have addressed the topic of changing acceptance of wind farms over time. A study conducted by Gipe (1995) in the Netherlands, suggested that there is a general pattern of high acceptance prior to construction, followed by lower acceptance during the scoping and construction phase, and finally higher acceptance after the project is established. Another study in the U.K. also found that negative perceptions decreased over time (Exeter Enterprises Ltd. 1993). However, Devine-Wright (2005) argued that this generalized pattern should not be supported, calling for further research on the subject to incorporate and analyse the "multidimensional and socially constructed nature of familiarity with wind turbines and how familiarity shapes perceptions" (p. 131). The concept of NIMBYism as an explanation for negative perceptions is now seen as an out dated and simplistic mode of reasoning. Empirical studies, including those conducted by Hoepman (1998) and Wolsink (2000), have shown that there are multiple dimensions to specific and general perceptions of wind energy and how they are formed. NIMBYism represents an extremely narrow definition as to why people express negative perceptions.

The impact of local involvement on perceptions is multidimensional. Local involvement has social-psychological, political and economic aspects, which are all part of community capacity (Beckley et al. 2008). Examples include public participation in decision-making, local shareholdings and opinions as to how wind energy benefits should be distributed in the community (Devine-Wright 2005). Much of the research in this area has been conducted in Denmark, where local co-operatives are a more common form of development (Devine-Wright

2005). Daugarrd (1997) estimated that approximately one third of the people in Denmark were either directly involved in wind schemes or knew of someone who was. Other studies conducted in Denmark and Germany concluded that local publics wished to be informed of wind farm developments by local authorities; a majority of these publics expressed interest in attending local meetings to discuss the project development (Hoepman 1998; Erp 1997). Devine-Wright et al. (2001) acknowledged that the characteristic model of development in the U.K. was led by the private sector rather than community led, in turn giving little control over development to local peoples. Hinshelwood (2000) concluded that the quality of public consultations conducted by developers and institutions of the private sector was generally poor, which feeds into the loss of local control. This sense of non-control over local development and the processes involved in land use planning likely contributes to the development of negative perceptions towards wind energy projects. In contrast, wind project developments that are conducted with a great deal of meaningful public participation are more likely to have a greater level of planning success and create less social conflict (Devine-Wright et al. 2001). In conclusion, the majority of research on attitudes towards wind energy has been conducted in Europe. Although not entirely comparable, these findings can be used to inform North American wind energy developments.

Despite a significant number of negative attitudes concerning wind development in Ontario, many project proposals have been approved since the Green Energy Act was passed in 2009 (Green Energy Act Alliance 2012). One prominent player involved is Wind Concerns Ontario (WCO), a province wide coalition representing 57 grassroots citizens groups from 34 districts and counties. The group was founded in 2008 and aims to "protect the health, safety and quality of life of the people of Ontario from industrial wind turbines". Many of the communities involved believe that the government has "teamed up" with large industry players in an effort to intensively push wind energy development in the province. The WCO maintains that health, economic, agricultural and environmental concerns are not being heard by the government or industry players. They call for more research on the effects of wind power before more projects are approved.

The formation of this position towards government and industry players pertains to the relational spheres present between community members and those outside the community. As found in the European literature, communities that do not have a sense of involvement in the development of energy sources within and surrounding them tend to develop negative perceptions towards both the technology itself and the players that they deem are in control of the energy source. The approach to wind energy development by the government of Ontario and energy companies involved with wind power is characteristic of "hard energy path" development, which involves development of the energy source, such as oil and gas, at a remote location, with the benefits distributed across large distances (Lovins 1977). Certain communities in Ontario feel that the government and associated industry have yet to realize is that this approach is not applicable to energy sources such as wind power, as turbines are situated adjacent to and within communities. Many feel that they do not have a say in the siting and size of a project and that the benefits are not distributed to their community or enhance it. In terms of community adaptation and capacity, the members of WCO view wind energy primarily as a threat to their communities. They have adapted in the face of wind energy development, but instead of being in favour of the technology, they have rallied in protest. The need for a "soft energy path" that places emphasis on "community aspects" with regards to renewable energy development is apparent (Lovins

1977). The fact that “nested local social identities in a community [and] structuring exposure to different social networks can be important both in explaining how people come to hear about proposed wind farm developments and whom they trust, as well as the eventual perceptions that they choose to adopt”, must be taken into consideration by the government of Ontario and industry players (Devine-Wright 2005:136).

Study Setting

The comparison community in this study is the Municipal District of Pincher Creek, found in the southwest corner of Alberta. Pincher Creek currently offers services to visitors travelling from the two highways, marking it, like Beaverlodge, as a gateway community (Town of Pincher Creek 2012a). In this particular SIA, we examine different social impact indicators to assess relevant impacts in the communities of Beaverlodge and Pincher Creek.

Impact Community: Beaverlodge, Alberta

Beaverlodge is a town of over 2,200 inhabitants (Statistics Canada 2006), located half an hour west of Grande Prairie in the boreal forest region of Alberta, approximately 460 kilometres northwest of Edmonton (Discover Peace Country 2012). Between 2001 and 2006, Beaverlodge experienced a population growth of 7.3 percent, marking it as a quickly growing community. The median age is 35 and 58% of residents are between ages 15 and 65.

According to Statistics Canada (2006), the dominant economic drivers of Beaverlodge are agriculture and other primary industries, with many also employed in the business and retail sectors. It is also called the “Gateway to Monkman Pass” for providing services to travellers going to and coming from British Columbia. At 80m above ground level, the Canadian Wind Atlas (Environment Canada 2003) estimated the wind energy potential at 300 W/m^2, making it an excellent location for wind development. The participation and unemployment rates in Beaverlodge are 72.9 and 5.1 percent, respectively (Statistics Canada 2006).

Comparison Community: Pincher Creek, Alberta

Pincher Creek is a township of roughly 3,625 residents, found in the southern part of the Rocky Mountains in Alberta, about a one hour drive west of Lethbridge. The population of Pincher Creek decreased by 1.1 percent between 2001 and 2006, making it a community in a slight decline. The median age of the population is 42.7, with 53 percent of the population between the ages of 15 and 65. The dominant industry of Pincher Creek is agriculture, with construction, retail, health care, business services and others also strongly represented within the community. The participation rate and unemployment rate, respectively, are 64.5 and 3.8 percent (Statistics Canada, 2006). Pincher Creek is home to 145 wind turbines that produced over 30 percent of Canada’s total wind energy in 2004 (Town of Pincher Creek 2012b). Four new wind developments have been approved for the area, making it a rich source of data and good comparison case for this study (Town of Peace River 2012).

Methods

Our methodology is based on the Human Ecosystem Framework, as proposed by Machilis et al. (1997). To gauge our social indicators, we gathered information from a variety of primary and secondary sources. Personal communications were initiated from various sources to provide a sense of how the communities perceive wind farms. Likewise, these personal communications point out how the communities with existing wind farms are affected. Other sources such as newspaper articles and government documents were investigated to support the claims of the primary sources. Lastly, previous assessment reports were explored to see how the development of wind farms is predicted to affect the community

During the course of the study, we were able to contact several sources for the Beaverlodge community. However, we only had one successful interaction where our questions were answered. Through an e-mail correspondence, one prominent and well-informed resident responded to our questions in mid-March, 2012. We also interviewed a resident of Fairview and an ex-Cargill agronomy assistant who had also worked on a wind development in Minto County, Ontario.

Secondary sources, such as government documents and newspaper articles, provide insight into issues that have or could be raised around potential wind development. They also give us a distilled version of many different people's opinions, which is especially valuable when personal interviews are limited to a few people who may not represent the full spectrum of thought on the topic. For our secondary sources, we reviewed the *Beaverlodge and District News* to get a better understanding of how the town operates and how they have viewed development in the past. We also examined the Alberta Government's regulations on wind power development, as well as other relevant publications that have been distributed to educate people on the impacts and issues surrounding wind farm development in Alberta.

Although much time and energy was expended in attempting to contact people in Pincher Creek for a personal interview, we received no replies from these people. We therefore drew insights about the community from secondary sources, especially articles from the *Pincher Creek Echo*. While not a primary source, these articles do represent a variety of personal opinions that some residents and writers feel about the wind development in Pincher Creek, as well as how the community is able to get involved in the consultation process.

Study Results

Through personal communication and review of secondary sources we were able to determine the potential impacts and perceptions of impacts in Pincher Creek and predict the same for Beaverlodge. This section outlines our findings for each community, demonstrating the social impacts that may be associated with wind development in Alberta. At the conclusion of this section, we tie the social impact domains for Beaverlodge to the potential effects on community capacity.

Beaverlodge, Alberta

When we asked our primary contact whether the local residents would be receptive to wind farm development in the community, he responded that the location is the key aspect that the proponents should consider. If the proponents plan to build the wind turbines where vision of the Rocky Mountains would be disrupted, the townspeople would likely reject the proposal since it is considered to be one of the town's most valuable assets. He also mentioned that there would be no economic justification for the construction of the wind farms because there is an existing oil and gas development in the area.

Our primary contact also informed us that that the effects on the employment sector would play a key role in determining whether the proposal of the wind development would be approved or not. As mentioned previously in this chapter, the oil and gas industry is one of the primary developments in the area of Peace River County. If employment associated with a wind farm conflicted with jobs from the petroleum and related industries, it may not be welcomed. The changes to the job market and potential demand for outside labour could be a concern for the residents of Beaverlodge. Notably, there are already migrant workers from eastern Canada who came to work in the oil and gas industry.

Based on our personal communications, the visual impacts and the employment possibilities seem to be the main concern when proposing this kind of renewable energy in the community. Neither contact mentioned concerns about the environment, health or noise, however one speculated that there was a lack in environmental concern due to most of the residents being temporary workers, who do not plan to live there long term. In the same interview, our contact contrasted the attitudes towards wind farms in the Minto County, explaining that there was more of an environmental push-back there than in Beaverlodge. Though he was only in Minto County for four months, he did witness opposition from community members who tried to stop existing wind farms from operating due concerns over the health effects of living near transmission lines. Our contact also expressed that, though there were some negative effects associated with wind farms, landowners do not mind the wind turbines since it provided Minto County residents with additional revenue from land rentals, of $200 to $250 per acre. Given the economic benefits, wind is an attractive venture during hard economic times, especially in Ontario, where the automobile industry is declining, and the only fall back is the agricultural industry. In a sense, these wind farms are able to diversify the local economy.

The "Landowner's Guide to Wind Power in Alberta" aims to inform the landowners of the potential positive and negative impacts of wind power development and discuses several social indicators (Doukas and Anderson 2010). The social impacts identified were: health and safety issues from wind turbines, visual impacts, local economic development and community impacts (Doukas and Anderson 2010). Weis et al. (2010) identified many health effects that are possibly related to the wind turbines. Sound level was pointed out as a cause for sleeping difficulties, nausea and headaches, as these incidences were higher in those communities near wind farms then in the general population. Based on the Canadian and American wind energy associations, there is no evidence that noise directly affect the residents' health (Weis et al. 2010). There were also concerns about the emission of electromagnetic field from the wind turbine generators and transmission line system (Weis et al. 2010). Health Canada studies show however, that no adverse effect was found with residents living near transmission lines (Weis et al. 2010). Possible risks in infrastructure malfunction are also seen as a safety issue. Ice formation, though uncommon in Alberta, is hazard as falling ice may endanger anyone travelling nearby (Weis et al. 2010). On the flip side, the beneficial health effects of wind farms would be improved public health and safety due to the potential reduction in emission from coal-powered plants (Weis et al. 2010).

Wind farms also create visual impacts, as these structures would be permanently erected. Local residents often expressed concern about declining property values; however, Weis et al. (2010) used three case studies to demonstrate that property values of nearby residents can increase. Weis et al. (2010) also cited that wind development could have a positive impact on the local economy. One of the ways the local economy would be enriched is through job creation from construction, operation and maintenance of the wind turbines. Another economic benefit would be from landowner's rents, as landowners can obtain flat rental payments, royalties or a mixture of both for hosting turbines on their land (Weis et al. 2010). Because there was income generated, taxes from these could be used towards municipal directed projects such as recreation and infrastructure.

Lastly, Weis et al. (2010) specified several community level impacts. As the wind farms he studied are jointly planned and managed, they created opportunities for local residents through the assumption of roles new such as contract negotiations (Weis et al. 2010). Communities that depend on the agriculture industry were able supplement their farming operations via revenue generated with wind farms (Weis et al. 2010) One of the drawbacks however, is that wind turbines can restrict access to oil and gas developments, which could negatively impact the local economy of an oil and gas dependent community such as Beaverlodge.

Pincher Creek, Alberta

The Pincher Creek area currently has 145 wind turbines, with another four major projects recently approved for development (Town of Pincher Creek 2012b). The approval process for wind turbines in the area has become quite streamlined, mainly because the province of Alberta does not require the project proponents to conduct a full EA (Weis et al. 2010). However, the Summerview Wind Farms project (owned by Vision Quest) located near the municipal district of Pincher Creek, completed an impact assessment in order to gain funding from Natural Resources Canada, which provides excellent insight into the requirements of developing a wind power project. The Summerview project will consist of between 65 and 74 wind turbines, which will produce up to 130 MW of electricity (Vision Quest 2003). These turbines will be located on agricultural lands, which require the permission of the landowner. During the Summerview EA, they were required to conduct an assessment of the socio-economic impacts that would potentially affect the township. They examined the socio-economic indicators of land use, population, sound/noise levels, cultural resources, heritage/archaeological sites, reaction, safety issues and traditional land use (Vision Quest 2003).

The Summerview survey, found that the land in question was mostly used for cattle and crop operations, and the sound levels were typical for agricultural regions near a highway. There were no historical or archaeological sites in the region, according to the Archaeological Survey of

Alberta or the Historic Sites Service of Alberta databases. No traditional land uses would be disturbed either. There were also no existing recreational areas and there were no safety issues such as cliffs or major waterways present. Views of the Rocky Mountains were present in the south and southwest directions. Overall, the assessment concluded that there would be financial benefits for the town from facility installations and operations. Land currently being used for the agriculture industry would decrease by two percent after the construction of the wind farm. Sound levels were estimated to become 45 decibels (dBA) in houses close to the highway, which was compared to the sound level in an average home, and close to 40 dBA in houses located farther away from the highway, which the report compared to a quiet library. Safety issues would be addressed through the promotion of a safe operations policy, which mandated that personal protective gear be worn during all on-site operations. The report determined that the turbines would be visible from nearby areas, but would be placed in such a way as to diminish their overall impact on the picturesque landscape. As indicated in Section six of the Environmental Assessment report, Vision Quest conducted a public consultation, which aims to provide information, to receive and suggestions, to act and respond and to report. In particular, these goals aim to improve the relationship with the project proponent and achieve an unbiased and accurate SIA of the wind development proposal (Vision Quest 2003).

Stakeholders were identified during this process through various means. This involved land title searches, review of aerial photographs of the proposed wind farm location and personal discussions with affected residents. Letters of introduction were sent out to those directly affected by the project where the letter outlined the project and the appropriate contact in case of inquiries. Afterwards, representative from the proponents personally visited those within the area directly affected by the wind farms. As a precaution, project information kits were sent out in cases where the representative was not able to meet with the affected resident. The Alberta Energy and Utilities Board (AEUB) also mailed request in the community impacted for responses on the proposed wind farm after the proponent forwarded their application. Where there were objections, Vision Quest provided comments to those parties (Vision Quest 2003). An open house was held, with information on the wind farm readily available. Storyboards were utilized to display information on the project, including the project overview, maps, facility details and project timelines. Two representatives from the Vision Quest were also present to answer questions on the project. Those who attended the event were encouraged to comment relating to the project, using comment cards (Vision Quest 2003).

Aside from landowners affected by the wind farm, Vision Quest was also able to consult the other Aboriginal groups, including the Piikani Nation near the Peigan Reserve, to ensure that no land claims were breached. Consultations with government agencies such as Alberta Energy and Utilities Board (AEUB), Pincher Creek municipal government and Alberta Electric System Operator (AESO) were sought. Letter of Introduction were sent to other non-governmental agencies like the Pembina Institute, the Nature Conservancy of Canada and Beaver Creek Watershed Group, to gauge their interest (Vision Quest 2003).

The news publication, the *Pincher Creek Echo*, provided insight into the municipal process of approving new wind developments within Pincher Creek. A search for wind energy in their archives search engine came up with over 250 articles about wind development in the area. The articles ranged from the time when there were no developments on the horizon, to the present, when Pincher Creek has become a “leader in wind energy development in Canada” (Town of Pincher Creek 2012b). The articles provide an interesting view into the public participation process that took place during this period of rapid development. A letter to the editor, written in 2003, expressed support for an idea proposed by Mayor Art Bonertz at a town council meeting to make Pincher Creek more accessible to the wind energy industry. In 2006, several community meetings were also held around the region to determine citizens’ attitudes towards wind energy after a few years of living with the new developments and if they would like to see them continue (Mercer 2006). These community meetings and a survey sent out to residents reported that roughly 90 percent of the citizens of Pincher Creek were in favour of the wind development in the region, with many supporting further wind development over the next few years. With new project applications coming into Pincher Creek more often now, the Town Council is still encouraging citizens to participate in deciding which projects get approved, and facilitating consultation between the community and project proponents.

Domains of Social Impact and Community Capacity in Beaverlodge

All components of community capacity, including assets, catalysts, relational spheres and outcomes (Beckley et al. 2008), would be impacted by wind energy development in Beaverlodge. The literature suggests that the outcomes for the community of Beaverlodge are dependent on a number of factors, one of the most important being the proposal and consultation process with the community. This initial step is critical in the development of attitudes towards this kind of development, in turn impacting the mobilization of assets through relational spheres and ultimately the outcomes that the community will experience. In terms of Machlis et al.’s (2007) Human Ecosystem Framework, the domains of social impact include: natural resources such as energy, land, flora and fauna; socioeconomic resources including labour, capital and information; and cultural resources of beliefs and organization. The impacts from the development of wind power in the above domains will facilitate impacts in other domains in the social institutions of commerce, education, recreation, government and sustenance; social cycles including physiological, individual, institutional and environmental would be affected; along with social order such as identity, norms and hierarchy.

Discussion

As explained in the literature review section, public perception of wind energy is instrumental in determining the potential success or failure of new development. In Europe, where there is stronger public support for wind development and other renewable energy sources, there has been many more developments proposed and constructed than in areas, such as in Ontario, where public perception of wind developments are more negative. People’s perceptions of wind developments tended to change as they were more exposed to them, with surveys showing that the longer people lived near a wind farm development, the stronger they were in favour of them (Anderson et al. 1997; Gipe 1995). Those who had the lowest approval rates of wind farms are the people who lived farthest away from them (Anderson et al. 1997). The literature seems to suggest that, if a town wanting to develop wind power faces opposition from certain community groups, they may eventually come around to the wind development should it go ahead.

There was also evidence that the public's perception of the project proponents impacts the community's overall opinion of the proposed development. In eastern Ontario, Wind Concerns Ontario (WCO) strongly objected to the Green Energy Act that was passed in 2009, as they saw perceived it as government bullying. Because they did not feel as though they had been adequately consulted, they accused the government of teaming up with big wind power companies to cut them out of the discussion. This has led to significant objection to the proposed wind developments in the Great Lakes region, severely limiting their success in the area. By contrast, Pincher Creek citizens were consulted at every level of the process to ensure that they were involved in the changing structure of their community. Because of this ground-level community consultation, the citizens of Pincher Creek have felt much prouder of the developments going on in their community, and have adopted their wind farms as a symbol of their community's ingenuity.

Public Participation and Stakeholders in Wind Development

Those impacted in Beaverlodge fundamentally includes all the community members and residents. Community leaders who are in charge of making decisions regarding wind energy development are more directly impacted however, in terms of the influence that this decision and subsequent decisions will have upon their public image and careers as community leaders. Other members of the public that are directly affected include those whose property becomes the site of the turbines, as they will experience the most direct impacts in terms of visual and noise disturbance, as well as economic risks and gains from renting out land. Indirectly affected publics experience impacts associated mainly with the production of energy and how the associated benefits are distributed throughout the community. These groups can all be engaged in public consultation through a variety of methods. Throughout this process, it important to note that there is the potential for the effects to be disproportionately distributed among socio-economic groups within the community. Those that are within lower brackets have the most to gain from the potential benefits that wind energy will bring to the community, especially in terms of economic and human capital. The direct and indirect impacts upon community members can be predicted through the public consultation process and used when considering whether or not to go ahead with the project.

Community Capacity and Project Impacts

The potential impacts to community capacity in Beaverlodge as a result of wind energy development are a reflection of the community itself: what levels of capital it possesses and how it functions socially, politically and economically. Wind energy is unique in that it influences multiple categories of Beckley et al.'s (2008) community capacity model. Wind energy would impact all components of Beaverlodge's asset pool. The community's economic capital pool would increase as physical/fixed assets (the turbines and associated infrastructure) and liquid (financial) assets would be boosted from the development. For example, if the electricity generated went back to the community, private household savings on utilities would count as a boost in the financial assets of the community.

Social capital also has the potential to be enhanced from the development of wind energy, as the "norms and networks that facilitate collective action" are impacted significantly (Beckley et al.

2008:63). Links between close friends, family and neighbours, called “bonding capital” (Beckley et al. 2008:63), will likely be affected as differing opinions come into play surrounding the topic of wind energy. As is to be expected with a highly polarizing topic, the bonding capital within a community will see some positive and negative effects. Some people will come together and support each other’s opinions while others who disagree strongly with one another, could find wind energy an erosive topic to their relationships within the community. Somewhat looser links between demographically similar individuals in separate communities are called “bridging capital” (Beckley et al. 2008:63). These will also be affected, for example, when the siting plans for wind turbines will have inter-community affects. Another kind of social capital likely to be affected is called “linking capital” (Beckley et al. 2008:63), which occurs between understanding persons who are in positions of power outside of the community (Naryan 1999; Woolcock 2001). It is likely that community leaders and publics surrounding Beaverlodge will take notice of such development and begin a discourse with leaders in Beaverlodge, potentially spurring further changes to the relationships between Beaverlodge and surrounding communities.

Natural capital within Beaverlodge will be significantly impacted by the development of wind energy and is a vital component when considering outcomes of community capacity. Wealth generation and employment are two areas that are of great interest to communities considering incorporating wind power. Other areas of interest include environmental impacts on pools of natural capital such as clean air, water, productive agricultural land, domestic animals and wildlife.

Human capital is also impacted by wind energy development. Coleman (1988) states that human capital is the result of the formal and informal education that occurs within social circles such as families, workplaces or even entire communities. As renewable energy technologies become prevalent and if wind energy is developed in Beaverlodge, the change in human capital will be reflected in the knowledge that community members will gain as a result. Areas such as education, acquired skills, job experience and individual health will all be impacted (Johnson and Stallman 1994).

Beckley et al. (2008) stated that “observable community capacity becomes manifest when there is a reason to act or to react” (p. 63). Wind energy development could provide one such reason for the community of Beaverlodge, and act as a powerful catalyst for community change. The form that this catalyst takes and the direction it shifts community capacity outcomes is entirely dependent upon whether or not Beaverlodge community members view wind energy as a threat or an opportunity to their community. It is important to note that the community will not have a unanimous opinion on wind energy development, as “one person’s perceived threat is another’s opportunity” (Beckley et al. 2008:63). Opportunities are considered to be proactive actions that seek to achieve a community’s defined goals and objectives. They are characterized by a positive approach to the gathering of financial, physical and social resources that are needed to accomplish goals and objectives. They can also possess longer or shorter term dimensions (Beckley et al. 2008). Threats are similar to opportunities in that they can also be longer (foreseen and subtle) or shorter term (unforeseen and disastrous). Depending upon Beaverlodge’s overall attitude towards wind power development, the types of new and existing community assets that will be mobilized will be different, due to the development and the paths they take. Beckley et al. (2008) stated “catalysts help communities define their desired outcomes and provide reasons for mobilizing assets and relations to produce such outcomes" (p. 64). For example, if Beaverlodge viewed wind power as an opportunity, the natural capital that it possesses could be utilized to enhance the economic power of the community. New businesses or infrastructure has the potential to establish in Beaverlodge. If the community sees wind power as a threat, the result may be something like the one seen in eastern Ontario, where communities and the individuals within them have banded together in protest.

The impact of wind power on relational spheres present within Beaverlodge also plays a large role in the overall capacity of the community. As mentioned previously, the four areas of relational spheres include market, bureaucratic, associative and communal spheres. In Beaverlodge, the market relations sphere will likely be impacted in terms of labour, land and financial capital, as well as social capital. The community has the potential to establish new social networks as a result of wind power development. Informal and formal bureaucratic relations will be impacted within Beaverlodge, as community leaders play a large role in guiding the perceptions of the public. Associate relations, which are characterized by the shared interests, activities and objectives of residents, is the relational sphere through which a great deal of change to Beaverlodge would take place. It is through the associate relations sphere that the mosaic of opinions and resulting actions is developed within the community. The community of Beaverlodge and the communal relations that take place there also have the potential to be impacted as the divide between opinions on the subject of wind energy will change the flow and structure of the communal relations sphere.

Impacts of Wind Development in Pincher Creek

After analyzing the secondary sources from Pincher Creek, summarized in Table 1, we concluded that the biggest issues and impacts within the community were in the local economic sector, the community structure, and aesthetics of the natural landscape surrounding the area. The focus of Pincher Creek's economy has expanded and diversified as a direct result of the wind energy development in that region. Before wind farms, Pincher Creek catered mostly to mountain tourists on their way to Waterton. Today, they have become focused on growing their wind energy industry as much as possible, to the point where the town logo has been redesigned with a wind turbine featured prominently on it (Town of Pincher Creek 2012a). Much of their town website now emphasizes the wind developments and has a special sector dedicated solely to the history of wind development in the region, the projects currently in place, and links to the regulations surrounding wind development in the community.

Table 1. Summary of impacts of wind development in Pincher Creek, AB

Main Impact	Description
Local Economy	- Main industries have become more diversified - New business created
Community Structure	- New groups and organizations created around the wind power development
Aesthetics	- Turbines are now present on the landscape
Health and Safety	- Potential health effects (headaches, etc.)
Recreation	- No effect

The presence of turbines has also created some upheaval in the community structure, with some citizens taking extreme views on the turbines (Pincher Creek Echo 2003). Some feel that wind power should be fully embraced by the town and municipal district (Pincher Creek Echo 2006a), while others seem to be making their strong opposition to more development known (Pincher Creek Echo 2006). This is creating conflict within the community, while also increasing the discussion and interactions people have with each other in their day-to-day lives. This seems to be an issue that many people are interested in and feel strongly about, as evidenced by the over 250 articles that showed up during a search for "wind energy" in the *Pincher Creek Echo* newspaper. The wind development appears to be causing both community harmony and dissent to reach new levels.

The last major impact of wind turbines in the Pincher Creek area is the visual impact of these developments. As Pincher Creek is directly beside the Rocky Mountains, some residents feel very strongly about their scenery and that it should not be impacted by wind turbine development (Pincher Creek Echo 2006). As shown in the Summerview Wind Farm EA, developers are taking these concerns seriously, planning out turbine locations in areas that will be the least visually offensive that they can be (Vision Quest 2003).

Impacts of Wind Development in Beaverlodge

Based on the local economy of Beaverlodge, the wind development may not be perceived as attractive to the residents, as summarized in Table 2. As our primary contact mentioned, it would be hard to justify the establishment of these wind farms based on the economic benefits alone, as the petroleum industry already provides jobs for the residents. Weis et al. (2010) revealed that the presence of these wind turbines might reduce access to potential oil and gas development sites. This may be unappealing to oil and gas companies in the area, which could lower the job prospects and revenue. Our primary contact stated that if jobs from the oil and gas industry would be disrupted, the local residents would not be open to this kind of development. On a positive note, Weis et al. (2010) noted that landowner's would be able to lease their land to generate income through land rents, thereby increasing community capacity. Further, these wind farms require manpower through various stages of the development, which would create jobs for the local residents. Thus, these would encourage a diversified economy for the Beaverlodge community.

Table 2. Summary of potential impacts of wind development in Beaverlodge, AB

Main Impact	Description
Local Economy	- New industry created - Possible effect on oil and gas industry
Community Structure	- Interest groups created - Community differences and potential conflict created
Aesthetics	- Interruption of mountain scenery
Health and Safety	- Potential health effects - Cumulative effects with oil and gas industry
Recreation	- Hunting opportunities would be limited around the turbines
Environmental Awareness	- Impact on migratory birds

Within the community, Weis et al. (2010) identified the different benefits associated with the alternative ownership structures available. They indicated that the local residents would be able to develop skills through contract negotiations and by holding meetings. Not only that, the economic benefits could be appealing to the community, encouraging acceptance of the wind proposal and creating interest groups. Consequently, adjacent landowner's residing next to these wind turbines may not be pleased with the location due to perceived negative impacts. Our primary contact revealed that some community members opposed wind farms in Minto County, fearing that the wind farms causes headaches. The same scenario could happen in Beaverlodge, but the main concern would more likely be towards the job prospects. The community structure would change in a way that fosters disunity.

The "Landowner's Guide for Wind Power in Alberta" showed that building these wind turbines would have impacts on the visual landscape (Weis et al. 2010). If wind farms were built in Beaverlodge, they could disrupt the view of the mountains, considered one of the town's best assets. In such a case, the proposed wind farm would not be accepted, as our primary contact communicated. According to different studies on the health effects of these wind turbines, there was no evidence that illness such headaches were directly caused through noise generation and EMF emissions (Weis et al. 2010). Though these studies were negligible, health concerns still could not be ignored. Safety with respect to wind turbines was also found to be one of the issues that need to be addressed through ice formation (Weis et al. 2010).

In the previous EA for the Summerview Wind farm near the Pincher Creek area, Vision Quest (2003) found that the establishment of wind turbines would have no effect on the recreational activities. In the Beaverlodge area, however, the presence of these wind turbines could prohibit hunting. Landowners can restrict hunters for preventive purposes as landowners are liable if accidents, from wind turbine malfunction or other related safety issues that could harm hunters, do occur (Weis et al. 2010). There may also be considerable impacts on the wildlife with the size of these wind turbines. In addition, migratory birds may impacted as wind turbines could cause numerous bird deaths. As such, this could increase the awareness of the effects of these wind turbines on the bird population and the environment. This could encourage increased environmental awareness on the community of Beaverlodge.

Conclusion

By using the comparison community approach, combined with a literature review, we have been able to assess and evaluate the issues that would likely come into play if a wind farm were to be proposed and developed in vicinity of the town of Beaverlodge, Alberta. Using the comparison community of Pincher Creek, Alberta, we were able to examine what kind of effects large wind developments have had on the area and by extension, what we could expect to see in Beaverlodge. We examine the impact of wind development through the use of the Human Ecosystem Framework (Machilis et al. 1997), which provides an excellent concept map and also a guide for how to focus and assess social impacts in relation to community capacity. The literature review found that new developments like this could have significant effects on the community capacity of towns like Beaverlodge, as it would affect the town's assets, act as a catalyst for town disunity through the debate it engenders, affect the relational spheres through which the town's industries and people react, and affect the outcomes of business and personal endeavours. Attitudes and the ability of communities to adapt to wind developments in other regions also provided us with a very valuable insight: public perception of a development, whether accurate or not, has near absolute power over whether the development will succeed or not. With all of this evidence, we recommend that if a wind development project were to be proposed for the Beaverlodge area, thorough public consultation would be critical, especially on the major issues that we have identified in this study. The public participation process is vital for this kind of development, and every effort should be made to involve the public.

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