RESOURCE ECONOMICS AND ENVIRONMENTAL SOCIOLOGY

Analysis of the Potential for Expansion of Renewable Electricity in the Province of Alberta

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Abstract

This report represents the culmination of the final capstone team research project conducted by the undergraduate students of the University of Alberta's Environmental and Conservation Sciences Program, Human Dimensions Majors, and Environmental Studies major. The research project was supervised by Dr. Debra J. Davidson, Professor in the Department of resource Economics and Environmental Sociology, and the project took place during the Winter Term, January through April, 2015. Students met weekly for a three-hour class period, as well as in smaller working groups. The students worked collaboratively on a research team, with responsibility for identifying research questions, conducting literature reviews, developing a methodology, pursuing original research, and presenting oral and written summaries of their work. All students expressed enthusiasm for exploring the potential for expansion of the use of renewable energy sources in Alberta's electricity grid, while bringing unique perspectives and skills to the project. The students were divided into three working groups according to their interests: one focused on science and engineering aspects of renewable energy technologies, one focused on policymaking and politics, and one focused on the role of consumers and civil society.

The team concluded that there is significant potential for Alberta to transition towards a pathway of renewable energy development, particularly in the electricity sector. Doing so would have several benefits, including a more diversified economy and energy supply, job creation, and significant ecological and environmental health benefits. Student-led research was conducted to assess the potential for renewable energy expansion in Albertan's electricity sector. According to this study, many experts agree that Alberta has access to the biophysical and technological capacity that would support a 100% renewable energy-based electricity grid. This potential is constrained, however, by infrastructure limitations, a relatively tepid political enthusiasm, and a well-entrenched fossil-fuel sector. Overcoming these constraints will require a combination of policies to support the renewable energy sector, as well as public dialogues that highlight a constructive, futures orientation toward renewable energy, emphasize the economic competitiveness and social and environmental benefits of renewables, while avoiding negative framing of the fossil fuels sector.

It is worth noting that, over the course of the Winter term, the Province of Alberta experienced an unprecedented shift in electoral politics, as the reigning Progressive Conservative Party was replaced by the New Democratic Party, with Rachel Notley as Premier. The new ruling party entered with a climate change and energy platform that departed notably from its predecessor, and therefore the political landscape governing energy in the Province shifted significantly during the preparation of this report.

While the Instructor assumed responsibility for the final editing and dissemination of this report, every effort was made to present the original work of the student research team with a minimal amount of editorial revision as necessary.

Introduction

Why Renewable Energy?

Our complex, modern social systems require high levels of energy inputs for heat, transportation, and electricity. For much of the past century this energy has been derived primarily from fossil fuels: coal, oil and natural gas. While these resources have appeared cheap and plentiful, today we increasingly recognize that they are not as plentiful as we once thought, and they come with heavy costs, in the form of air, land and water pollution, health impacts, and most notably, climate change. Coal—Alberta's main resource for electricity—is the dirtiest of the three. These impacts affect everyone regardless of race, gender, class, ethnicity and nationality, but particularly the poor.

In contrast, renewable energy sources have lower ecological footprints, lower carbon emissions, and are by definition non-depleting. The prospects for renewable energy adoption in Alberta, a major fossil fuel supplier nationally and internationally, may seem anathema. As Alberta is the largest oil and natural gas producer in Canada (Canadian Association of Petroleum Producers, 2015), many Albertans rely on these sectors for their livelihoods, and renewable energy is often conceived as a threat to this Province's economic mainstay. To the contrary, as stated by Jeff Rubin, Canadian economist and author, "it does not matter if there are billions of barrels of oil waiting to be tapped from oil sands or oil shale, if the prices to extract them are beyond our economies' capacity to pay" (The Globe and Mail, 2012). In other words, our abundant fossil fuel reserves do not guarantee economic prosperity and fulfillment of energy demand. There is another side of the Alberta Advantage, however; Alberta is home not only to vast riches in fossil fuels, we are also the beneficiaries of an incredible wealth of renewable energy potential, including favourable conditions for wind, solar, and geothermal power. Diversifying our sources of energy would allow for a more stable and reliable energy supply, expand upon our economic opportunities, and enhance our environmental wellbeing, with direct implications for human health and quality of life (Langrish, 2015).

Renewable energy can offer job creation, stimulation of local economies, and stabilization of electricity costs (Union of Concerned Scientists, 2013). Indeed, many places in Europe, Asia, and even parts of Africa have already adopted aggressive renewable energy expansion plans. Employment trends in other countries show that job opportunities in conventional energy are declining while those in renewable energy sectors are increasing (Renner, 2008). In Germany, for example, "green jobs" increased by 75% between 2004 and 2009 (Bell & Weis, 2009). Similarly, the US has seen rapid increases in employment in the wind and solar industries (Union of Concerned Scientists, 2013). This is partly attributed to the higher labour intensity of renewable energy development compared to fossil fuels. Renewable energy adoption requires workers to design, engineer, manufacture, install, construct, and maintain renewable energy systems, providing long-term job security (Renner, 2008). The contrast between this emerging, dynamic marketplace and the recent economic downturn in Alberta induced by the precipitous drop in oil prices could not be more stark. If this economic downturn is to serve a positive purpose, perhaps it is the perfect opportunity to re-imagine Alberta's energy future.

Most importantly, achieving the scale of global greenhouse gas reductions necessary to avoid dangerous climate change will require virtually all energy systems—Canada's included—to transition to low CO_2 emission energy sources and technologies. Canada's contributions to global greenhouse gas emissions are substantial. Canada is the 9th largest emitter out of 214 economies in terms of total CO_2 emissions (World Bank, 2015). Canada has set national CO_2 emission reduction targets four times since 1988, but has yet to achieve any of these targets, in no small part due to the rapid expansion of greenhouse gas intensive fossil fuel development in Alberta. The National Energy Board expects energy demand in Alberta to grow by approximately 50% between 2012 and 2035 in comparison to a 28% increase for Canada overall (NEB, 2013), and the greenhouse gas intensity of Alberta's electricity sector in particular is the highest in the country. In 2012, Alberta generated 43% of its electricity from coal and 40% from natural gas, constituting a significant source of Alberta's greenhouse gas (GHG) emissions. On the other hand, Alberta has abundant renewable energy resources, due to our diverse geography and climate. Alberta has among the highest solar power potential in the world, and southern Alberta also has excellent wind power potential, upon which a number of companies have already capitalized, with wind farms in Taber, Fort Macleod and Pincher Creek. There are also other alternatives with potential for development in Alberta, such as geothermal energy and biomass. With our high levels of human and financial capital, combined with abundant renewable energy resources, Alberta is well-positioned to become a world leader in renewable energy development.

Alberta not only has an ethical responsibility, but also the capacity, to do our share to reduce greenhouse gas emissions, and the electricity sector is one of the key sectors in which substantial reductions can be achieved in a relatively short time period. We have all the necessary ingredients to transform our oil economy into a diversified *Energy Economy*, offering Albertans a more diversified and stable source of economic well-being, enhanced energy security, a cleaner environment, and a leadership position in a growing global movement toward green, low carbon societies.

Research Methods and Outline of Report

Literature reviews, web-based documentary research, key informant interviews, and focus groups were the main research methods used for this study. Background research was first conducted by reviewing academic publications on the topic of renewable energy adoption, including the advantages and disadvantages of different sources, the feasibility of a renewable energy transition, policy options, and the economic, social, and environmental effects of renewable energy operation. Case studies of successful renewable energy adoption in other jurisdictions were also reviewed. Based on this secondary research, we distilled our project into three main components: the technical feasibility of renewable energy in Alberta, the role of policy and the political context in a renewable energy transition, and consumer behaviours and attitudes towards renewable energy.

Each study area was delegated to a research group comprising four to five students who designed research instruments for use in key informant interviews and focus groups. The technical feasibility group interviewed five key informants, and the political context group seven. Key informants were identified based on existing network connections of classmates and professors as well as internet searches to locate informants with relevant expertise. Efforts were made to diversify the samples by reaching out to academics, government employees, environmental advocacy groups, and business professionals. Potential participants were contacted by email and invited to participate in an interview. Pending their acceptance to participate, students arranged to speak with key informant interviewees in person or over the phone. Before participation began, all interviewees were given an “Information Sheet” and “Consent to Participate” form, which described the purpose of the study and their rights. Interviews were audio-recorded and comprehensive notes were also taken. For the consumer behaviour and attitudes study, research was informed by three focus groups, each comprised of six to nine participants. Participants were recruited using posters, and through existing social networks of classmates, friends, colleagues, and other acquaintances of various ages, ethnicities, employment status, and education levels. As with key informant interviews, focus group participants were briefed on the purpose of the study and participant rights. Following this, focus groups were asked a series of questions regarding attitudes and behaviours towards renewable energy. They were then asked to provide feedback on a diverse sampling of advertisements and messages promoting renewable energy. After completing data collection, students analyzed the data to identify key themes.

The remainder of the report is broken into four sections. The first gives an overview of renewable energy case studies in jurisdictions outside of Alberta, identifying common factors contributing to success, as well as barriers. This is followed by a discussion of the technical feasibility of renewable energy in Alberta, including the types of resources available and their viability. The role of policies and the political context in Alberta is described next, and finally, consumer behaviours and attitudes towards renewable energy are analyzed. The report concludes with a number of tools and strategies to achieve an effective renewable energy transition in Alberta.

Renewable Energy Adoption Around the World

Renewable energy support is increasing rapidly across the globe, as developers in many countries acknowledge its valuable role in sustainable development, and the economic advantages many renewable energy initiatives can offer. The past decade has seen spectacular growth in renewable energy adoption: in 2014, renewable energy sources constituted 58.5% of net additions to global power capacity, culminating in nearly 28% of the world's power generating capacity (REN21, 2015). Not only is the cumulative global percentage of renewable energy increasing, but the number of countries that have adopted renewable energy technologies and set targets is also on the rise. Countries within Europe, like Germany, Spain, Sweden, Norway, Italy, and Switzerland have all adopted renewable energy initiatives intended to reduce their reliance on fossil fuels. Germany in particular is a global leader in renewable energy adoption. Currently, renewable electricity is on the verge of a transition from niche status to becoming the main provider of electricity in Germany (Wassermann et al., 2015), with the help of the national 'Energieweinde' program, the most extensive plan for adopting wind and solar energy in the world (Schiermeier, 2013). Spain ranks fourth for non-hydro renewable power capacity due to rapid recent expansion over the past decade. Wind and solar power are prevalent in Italy and Denmark as well.

Many Asian countries, due to growing populations and rapidly depleting natural resources, have had little choice but to increase their use of renewable energies. Utilizing alternative energies has become important in China because of limited sources of conventional energy and increasing environmental concerns (Yuan et al, 2013). China has also become a leader in the production and consumption of solar water heaters. Japan, South Korea, and Taiwan all began to support renewable energies after the 1970s oil shock, to increase energy security (Chen et al, 2014). There is also high potential for many countries in Latin America to develop renewable energies (Dolezal et al, 2013). Mexico's government has been receptive to new strategies to reduce dependence on fossil fuels and greenhouse gas emissions (Cancino-Solorzano et al, nd), where 13.5% of electricity currently comes from hydro-power, and 3% from geothermal (Santayo-Castelazo et al, 2011). Brazil has focused on biofuel production, which now fuels the majority of its vehicle fleet (Janssen & Rutz, 2011).

Many regions in Africa have the ideal climate for some renewable energies, particularly solar. The year-long solar exposure yield ideal conditions for solar energy capture, and the continent is becoming one of the world's most promising renewable energy markets, particularly for decentralized and micro-scale electricity. Several challenges constrain renewable energy adoption, including high poverty and limited capital and expertise. Despite these challenges, markets within Africa are shifting rapidly. Many African countries have experienced expansion of small, off-grid systems, and in some locations adoption has expanded to support large-scale systems and infrastructure.

The U.S. has also been expanding its renewable energy portfolio. In the U.S., renewables accounted for 13% of net electricity generation in 2014 (www.eia.gov). In 2008, there were 26 states with mandatory renewable portfolio standards (RPS) and six states with non-binding renewable energy goals (Rickerson et al, 2008). California has the most ambitious targets in the country, with a goal of 50% renewable energy generation by 2030. A number of Canadian provinces have also made significant strides, most notably Ontario, discussed below.

Selected Success Stories

Germany

With Parliamentary groups that are very receptive to renewable energies and relatively less influenced by fossil fuel lobby groups, in 2000 Germany passed the Renewable Energy Sources Act, considered to be among the most successful and groundbreaking in the world (Jacobsson & Lauber, 2006; 2005; 2004). The Act committed the country to doubling its renewable energy supply by the year 2010. The European Union's commitment to the Kyoto Protocol served as an additional source of impetus for the Act. Germany adopted a Feed-In-Tariff as its primary legislative vehicle for enabling renewable electricity expansion, which simply guarantees a price for anyone who sells renewable power, in the form of a long-term contract (Stokes, 2013). Although not without their problems, to be discussed further in this report, the success of this program has been attributed largely to the feed-in tariff, particularly its role in accommodating the high price of solar cell installation. As of last year, Germany generated 26% of its elecrtricity from renewables, and there are some regions in Germany, such as Feldheim, that rely solely on renewable energy. Germany is committed to continuing its implementation of Energiewende, or energy transition, with the goal of obtaining 45% of its electricity from renewables by 2030. Since the Act's passage, Germany has also become a leader in technological innovations in the wind turbine manufacturing industry, creating an estimated 370,000 jobs in the process by 2013.

Ontario

Ontario offers another success story worthy of note. In 2004, the Ontario government established the goal of phasing out all coal-fired electricity, an ambitious target they ultimately achieved, and with no significant negative economic impacts. As with Germany, Ontario chose the feed-in-tariff as its policy of choice, becoming at the time the largest feed-in-tariff program within North America (Stokes, 2013). The policy has experienced some political hiccups, and adjustments have been made to contract periods and prices, and finding ways to enable small investors (Stokes, 2013). Nonetheless, Ontario's aggressive approach enabled a rapid transition toward renewable electricity, illustrating the potential for substantial transitions in relatively short periods of time.

Kenya

Kenya offers another success story, with the federal government taking bold steps to electrify the country through the adoption of renewable energy sources, particularly wind. Steps taken include extensive federally-supported research on the location of regions with the highest potential for wind power, and federal assistance in the financing of a 365-turbine wind farm in the Lake Turkana District, which is expected to increase the nations' power capacity by 17% (Jacobs, 2014). Meanwhile, small-scale solar production is on the rise, supported by the 2009 Rural Electrification Master Plan (ibid.; see also the Renewable Energy Portal, http://www.renewableenergy.go.ke).

Summary

In all cases reviewed (not all of which are discussed here), significant expansion of renewable energy adoption was enabled by the introduction of new policies. Successful implementation of these policies in turn required strong public support, and sufficient levels of investment capacity and expertise. In contrast, common barriers included high start-up costs, which can be exacerbated when lenders are hesitant to provide loans for renewable energy technologies, because renewable energy is a relatively new market compared to conventional energy. Infrastructure constraints define a second key barrier. Existing energy infrastructure, particularly transmission infrastructure enabling the marketing of renewable electricity, can limit the expansion of renewable energy.

Solar and Wind Power Compared

This section compares the attributes of solar and wind power, as two renewable energy types with the greatest potential to contribute to Alberta's electricity grid. We begin with an overview of literature pertaining to the environmental, social, and economic attributes of two renewable energy sources: solar and wind, as these appear to be most pertinent in the Albertan context at this time, although geothermal and small-scale hydro offer additional opportunities in selected regions. Biofuels also represent an emerging opportunity in Alberta. Following this we report on the findings of our interview-based research. We carried out interviews with two Albertan academics with a background in engineering and renewable energy technologies, and three businesses leaders in the solar and wind industries in Alberta. The interviews focused on four key themes: biophysical and technological viability; recent trends in adoption in Alberta; the state of current research and knowledge; and the importance of the regulatory structure in Alberta. Several common perspectives emerged, including strong agreement that the Albertan grid could be powered by 100% renewable energy given existing commercial technologies (although upgrades may be necessary); continued production of conventional oil and gas does not necessarily conflict with the expansion of renewable energy; the Albertan economy would benefit from the diversification that renewable energy can provide; and inefficiencies in storage and distribution pose major constraints on expansion.

Literature Review

Wind

Wind power has been described as one of the most efficient forms of renewable energy (Eichhorn & Drechsler, 2010), and can be utilized nearly all over the world. Wind energy is generated through the use of turbines designed to mechanically turn a generator motor through force of wind. Primary constraints include the capacity of electricity transmission networks, and local atmospheric conditions.

Environmental Considerations

A common concern raised about wind turbines is the impacts on bird and wildlife populations, by risk of collision (Kuvleskey et al., 2007; Eichhorn & Drechsler, 2010; Leung & Yang, 2012; and Mahvi & Ardehali, 2014). Kuvleskey et al. (2007) assessed the impacts that wind farms have on migratory birds, resident birds, bats and other wildlife species, concluding that migratory bats, raptor bird species, and sea birds are at greatest risk. The habitat loss and landscape fragmentation associated with the development of wind farms, however, is considered to be a greater risk to birds and bats than collision (Kuvleskey et al., 2007). Throughout the literature, there was a strong emphasis on the importance of optimizing wind farm locations that minimize ecological impacts while maximizing electricity production. Large-scale wind farms may also cause microclimate temperature changes (Leung & Yang, 2012), however, the climatic impact of wind power is negligible in comparison to other anthropogenic sources (Keith et al., 2004).

Social Considerations

Many scholars have analyzed public perceptions of wind power (e.g. Devine-Wright, 2005; Wolsink, 2007; Klick, & Smith, 2010; and Songsore & Buzzelli, 2014). Health related risks of wind energy development, expensive start-up costs, and visual and audio impacts are identified as the primary factors affecting public support (Devine-Wright, 2005; Pedersen & Waye, 2007; Shepherd & Billington, 2011). Klick and Smith's (2010) review of online surveys assessing Americans' understanding and attitudes towards wind power illustrate an overall lack of knowledge, despite an increase in media coverage on the subject. Extensive community engagement, transparency, and communication have all been identified as necessary to improving social perceptions of wind power.

Economic Considerations

Wind power development is capital intensive, and projects are often exposed to fluctuations in the price and availability of necessary building materials. Large start-up costs are the most frequently cited economic concern (Townsend & Rosehart, 2002; Blanco, 2009; and Colak et al., 2014). Although wind power development requires substantial capital investment, wind farms are considered advantageous in comparison to conventional electricity sources due to the fact that wind is not subject to volatile fuel costs (Blanco, 2009, p. 1371 and Colak et al., 2014, p. 1296). Blanco (2009) cautioned that there are difficulties in comparing accurately the cost of wind power development with other sources of power because of the varying elements that are included in cost calculation models. The costs of dismantling and decommissioning projects, for example, are often left out of project cost evaluations for hydro, coal, and nuclear development, yet can be quite significant (Blanco, 2009, p. 1378). Indirect benefits in the form of avoided health costs when polluting sources of energy are replaced with non-polluting sources also rarely enter into cost calculuses.

Solar

Solar photovoltaic power is a clean, silent, and abundant source of energy (Hosenuzzaman et al., 2015). The Southern Alberta Alternative Energy Partnership states that, "Alberta has the potential to be a world leader in the supply of solar energy" (Western Sky, 2009). South-eastern Alberta in particular has an optimal climate for solar power with suitable mean temperatures (Western Sky, 2009), and radiation levels of greater than 4800 MJ/M2 (Western Sky, 2009).

Environmental Considerations

Wu et al. (2014) assessed the potential environmental impacts of large-scale concentrated solar power plants, concluding that concentrated solar power plants consume large volumes of water, and increase soil temperatures. On the other hand, Balcombe et al. (2015) completed a life cycle assessment that simulated daily and seasonal energy demand for various households, and found that the environmental impacts of solar energy are 35-100% lower than conventional energy sources. Poor management of micro-solar systems at the residential level can decrease the environmental benefits of the technology (Balcombe et al. 2015).

Social Considerations

In comparison to wind power, solar power has received relatively less public opposition. One of the advantages of solar power is its scale versatility, with capabilities for small-scale to large-scale, centralized and remote applications. Several hundred households and farms across Alberta have installed solar arrays, and many enjoy the economic benefits of selling their excess supply back to the grid. Solar projects also have the opportunity to provide electricity to remote areas, in place of other costly infrastructure. It has been suggested that involvement of indigenous peoples could also play an important role in the success of solar power projects (Dreveskracht, 2013).

Economic Considerations

As with wind power, capital costs make up the vast majority of costs associated with solar power. The global average cost for solar PV installations, however, has dropped 10-fold in the past two decades, approaching par with fossil fuel-based electricity sources on a per kilowatt basis (see e.g. www.renewableenergyworld.com). The costs efficiencies increase as the size of the installation increases. Some analysts forecast a further drop of 40% in the next few years (Parkinson, 2015). Continued improvements in solar technology will only serve to drive these prices down further. Researchers at the University of Alberta, for example, are currently working on nano-solar technology, and have developed a plastic solar cell that is 30% more efficient than conventional cells, thus offering significant economic advantages (Western Sky, 2009). As well, the Alberta Research Council (ARC) has developed a thermal solar collector, which has the ability to store heat from solar panels.

The required physical infrastructure associated with large-scale solar power adoption can be extensive, however. And “soft costs”—those associated with the permitting process—of solar installations can be high in some regions. Dong & Wiser (2013) noted that these soft costs constituted over 50% of the cost of installation of residential photovoltaic arrays in California. Intermittency also poses not only an availability concern but also an economic concern. When power floods the market, as is likely to happen during peak solar periods in an electricity grid dominated by solar, the price paid per kW/h can drop significantly (Hirth, 2013), thus renewable energy suppliers may not reap sufficient economic reward.

Conversations with Alberta’s Renewable Energy Experts

Potential for Renewable Energy Expansion in Alberta

Four of our five interviewees were confident that we could achieve 100% renewable electricity in Alberta. Of these, three went on to suggest that doing so is possible today with existing technologies. The remaining interviewee was more cautious, expressing doubt that consumers would be willing to pay for renewable electricity prices, but suggested that if renewable sources were in fact competing on a level playing field with conventional sources, comparable prices would make the transition more achievable. The perceived absence of a level playing field was a common theme among our interviewees and is discussed in more detail later.

Interviewees also expressed confidence that the combination of wind and solar power development would partially address the intermittency challenges associated with each, due to the fact that solar power reaches its peak level of production during the day, while wind turbines tend to produce more power at night. Nonetheless, interviewees did acknowledge the challenge of meeting energy demand with wind and solar alone, as these sources may be capable of meeting total demand, but not necessarily at the time or place it is needed.

Scale of Adoption in Alberta

We also discussed current trends in renewable electricity adoption in Alberta, and the potential for rapid expansion. Our interviewees tended to agree that industrial scale wind development would be more likely than residential-scale development considering the scale, input costs, and locational constraints associated with turbines, but the potential for solar power adoption could be seen at both the industrial and residential levels. Large-scale wind power developments were described as the most economically competitive, with an advantage over large-scale solar because of the smaller land requirements. Additionally, interviewees noted that farmers who establish wind turbines on their property receive extra income without notable interferences with their crops or cattle, unlike either conventional oil and gas extraction or large-scale solar projects.

On the other hand, small-scale solar production can easily be adopted by households and small businesses. In contrast to large-scale wind developments, these projects would primarily serve the electricity needs of the household or business, with the excess generation sold to the grid. Adopters are most likely to be motivated by savings in electricity costs, as well as moral support for green lifestyles and businesses. Overall, however, interviewees agreed that efforts to encourage renewable energy adoption should not be limited to one specific area or scale, as differing energy types are more appropriate at different scales and in different places.

Excess Supply, Storage and Redistribution Concerns

A weakness of both solar and wind power is intermittency, and our interviewees discussed this challenge at length. Without the ability to store excess supply, renewable electricity suppliers cannot simply turn on and off their sources according to shifts in demand, translating into fluctuations in power supplied to the grid. Currently, Alberta lacks the ability to manage this excess energy efficiently. The technological capacity to store renewable energy supplies is currently limited to reliance upon relatively inefficient, or very expensive, battery technologies. One interviewee remarked that storage was the biggest barrier for solar.

One way to circumvent the storage issue is to redistribute the electricity to where the demand is needed. Our interviewees noted that the vast geographic landscape of Canada has implications for the cost of expanding transmission lines, in comparison to more densely-populated countries that have introduced renewable energies. Regional infrastructure would need to be established with other neighbouring regions such as B.C., Saskatchewan, or with states south of Alberta. According to some of our interviewees, there is already some connection with both B.C. and Saskatchewan, but the infrastructure is limited and not capable of handling a thoroughly integrated system. On the other hand, compared to wind, interviewees suggested that solar is potentially less exposed to these constraints, given its ability to be economically effective on a smaller scale, for which storage may be less of an issue, and battery limitations may be easier to overcome.

Economic, Political and Social Constraints

According to our interviews, the viability of standalone solar (technology without dependence upon connections to the grid) is well established. Primarily, industry is using mono-crystalline technology, which is inexpensive to manufacture. Multiple interviewees agreed that the current mono-crystalline silicon technology is enough to support the transition to 100% renewable energy in Alberta. Moreover, research and development has succeeded in increasing the energy efficiency of solar panels. However, one solar installer remarked that the majority of the research and development benefits that are usually discussed in popular media are not yet commercially viable for producers here in Alberta. Despite the lack of development, the mono-crystalline units that are popularly installed here in Alberta have been on a general downward trend in terms of cost. One interviewee emphasized the advantages of solar panels, which have a 25-year lifespan on average, and are inexpensive in the long run, considering the energy a household consumes over a lifetime. Two of our interviewees predicted even lower prices in the future.

Respondents nonetheless were in agreement that significant expansion of renewable energy capacity in Alberta would require supportive policies, which are currently lacking. This in turn requires sufficient public support to encourage politicians to enact policies in favour of renewable energies. Interviewees observed that it has been difficult to establish strong public support for renewables in Alberta, because many assume that adopting renewables will conflict with the existing economy. One interviewee remarked that energy is simply not a regular topic of discussion, and speculated that the role of the media is in part to blame, suggesting that when the media do discuss renewables, they do not present the multiple potential benefits, particularly job creation. Rather, the media all too often present the adoption of renewables in terms of 'costs' and 'sacrifices.' Thus, despite rapid advances in renewable energy technologies, interviewees perceived the political climate in Alberta to have been relatively unreceptive, at least up until the time of our interviews in early 2015. According to one interviewee, with a more progressive provincial government, Alberta could be a global leader because of the vast amount of renewable resources we have to offer. This sentiment was echoed by another interviewee, who suggested that politicians are unwilling to "rock the boat," despite the significant employment opportunities in the renewable sector. One interviewee's notable frustration was representative of our sample, noting that "political chatter around renewable energy is all rhetoric … every time there has been a new Premier, they have talked up [renewable energy] in their campaign. And then nothing." Another interviewee was of the opinion that the political climate is slowly changing, in comparison to a decade ago when politicians were not interested in renewables at all.

Market Barriers

Many of the interviewees strongly expressed the need for a "level playing field" for renewable energy, due to the belief that renewable energy was at an inherent disadvantage in Alberta due to current regulatory structures. Many interviewees suggested the need to remove subsidies, including tax breaks and low royalty regimes, for fossil fuels. The fact that the externalities associated with fossil fuels are paid for in the long term by tax payers through health care costs and environmental destruction was also mentioned, as were infrastructure subsidies that benefit large scale producers to the detriment of micro-generators.

Many other proposals that were discussed in interviews currently lacking in Alberta are also supported by a number of scholars, such as production-based subsidies, feed-in-tariffs or renewable portfolio standards (Benitez, Benitez, & Van Kooten, 2008; and Black, Holley, Solan, & Bergloff, 2014). These policy options have been used individually or in combination in other regions to stimulate the growth of the renewable energy sector, and provide certainty and incentives for investment. In addition to missing what are considered effective policies, all respondents noted the lack of financial incentives for renewable energy development in Alberta. Three interviewees mentioned the federal accelerated capital cost allowance (ACCA), which allows certain commercial customers to write off their investments against taxable income. However, the ability of the ACCA to compensate for up-front costs is limited, and it is not unique to renewable energy, but is common in various industrial projects that benefit from other programs and subsidies. Meanwhile, renewable energy investment is hindered by lack of certainty, as there are no price protections or tariffs that ensure a return on investment.

Alberta's deregulated market also challenges the ability of small micro-generators to enter into a fair long-term power purchasing agreement (PPA). A PPA is an agreement between an energy purchaser and an alternative energy generator (such as a micro-generator) to purchase the generated power for an agreed amount, rate, and length of time. Currently, micro-generators are given the right to sell to the grid, after entering a PPA with a purchaser company who purchases the energy from the micro-generator. With no set price or regulation in place, however, these micro-generators are offered the retail price determined by the purchasing utility company, so there is a perception among these producers that they do not receive fair market value for their production. According to one interviewee, this unfair market system does not guarantee enough economic certainty for renewable energies, which is a significant constraint for long-term investments. While some households have expressed willingness to invest in solar power anyway, potential investors in larger-scale facilities simply are unwilling to take such a financial risk. All five interviewees noted that the current market system works better for companies in the oil and gas industry, who are given some certainty through government and are aided in grappling with the initial startup costs.

The Influence of Regulations

Directly and indirectly, regulations can have a strong influence on the future trajectory of renewables in Alberta. Three interviewees noted that the relatively lax polluter-pays-principle practiced in Alberta allows industries to externalize their costs of damaging the environment. The market price thus does not capture the value of renewable energy, such as the benefits of clean electricity and positive environmental externalities that it provides relative to other forms of energy production. One of the business interviewees noted that the government ends up spending its revenues on cleaning up pollution, when the budget could have been used to create subsidies for renewable energies. Another interviewee described British Columbia’s carbon tax as a fair approach that captures revenue from polluters and reinvests this capital into research and development towards renewable energy and other GHG reduction initiatives.

One respondent also suggested that we need more regulations and government support in other ways as well, mentioning that solar energy facilities require relatively larger land areas depending on the location, available technology and topography of the site, and thus the land for solar facilities is less likely to be used for other purposes, compared to wind farms that can coexist with other land uses. Hence, we need more regulations to ensure that the best locations with minimal impact are chosen, and to promote best practices.

Summary

The potential to increase Alberta’s renewable energy capacity is quite high. Solar energy adoption, especially at the residential level, can be expanded rapidly with a minimum level of policy-based incentives, because the technology exists, installation costs have been dropping significantly, and there is no need for new infrastructure. Current technologies, regional production potential, and dropping prices, in combination with the notable environmental benefits also make expansion of large-scale solar and wind power generation attractive for Alberta, but will most likely require a greater level of governmental support. Many factors have been identified that constrain renewable energy expansion, most notably an historically unfavourable political climate that offers far more benefits to fossil fuel-based energy production, and technological limitations on storage combined with limited transmission capacity. As a result, Alberta has not captured the benefits of renewable energy to nearly the extent as are enjoyed elsewhere. The political and social dimensions of renewable energy are discussed in greater detail in the following chapters.

Political Opportunities and Barriers to Achieving a Renewable Energy Transition in Alberta

Introduction

This section describes how the political climate shapes the potential for renewable energy expansion, offers an analysis of policy options commonly employed to support renewable energy expansion, and identifies key factors in Alberta's political climate considered to be sources of opportunity and constraint. The chapter begins with an overview of literature synthesizing the state of knowledge regarding renewable energy policy options. Next we provide a picture of Alberta's political climate pertaining to electricity production and provision, based on analysis of secondary sources. Following this, we report on the findings of our interview-based research. We carried out seven interviews with Albertan academics and policy advocates in civil society. Key themes described include the double-edged sword represented by a de-regulated electricity market, the political power of vested interests, and dominant cultural narratives.

Literature Review: Advantages and Disadvantages of Policy Options

A variety of policy options have been implemented in different political contexts to encourage renewable energy adoption. Broadly speaking, these policy tools can be categorized into price-based incentives, quota-based incentives, and financial incentives.

Price-based Incentives: The Feed-in-Tariff

Many jurisdictions have adopted Feed-in-Tariffs (FITs) in an attempt to make renewable energy sources more economically competitive (Stokes, 2013). A Feed-in-Tariff consists of a contractual purchasing agreement between the government and renewable electricity suppliers (Menanteau et al., 2006). The contracts specify a set price for electricity generated by renewable sources, for a specific period of time, which can extend as far as 10-25 years (Klein, 2013; Lipp, 2007; Couture, 2010). It is premised on the idea that monetary remuneration will encourage adoption by providing a price incentive and stabilizing the market for investors and manufacturers (Peters & Weis, 2008). Among the first and most comprehensive FITs to date was adopted by Germany in 1991 (Peters & Weis, 2008; Ketterer, 2014).

FITs offer security and stability to investors (Mitchell et al., 2006; Lipp, 2007; Butler and Neuhoff, 2008; Couture et al, 2010; Stokes, 2013), and can create a larger market base by allowing both small- and large-scale producers to participate, thereby enhancing the rapid creation of fair market conditions (Jacobson et al., 2006; Stokes, 2013). FITs also allow households adopting micro-solar installations to recover their costs more quickly, as they can receive a price premium for excess power sold back to the grid. A study in Wisconsin found that FITs encouraged households to invest in residential photovoltaic infrastructure, by providing the opportunity for households to make money by selling energy which "broadened the potential audience for solar energy" beyond those who adopt renewable energy purely for environmental reasons (Schelly, 2014). Researchers have also observed that FITs have induced a notable increase in innovation in renewable energy technology development (Mendonça 2007; Klein 2008; Lipp 2007; Couture 2013), and reduced the instability associated with electricity prices (Mitchell et al., 2006; Lipp, 2007; Butler and Neuhoff, 2008; Couture and Gagnon, 2010; Stokes, 2013). On the other hand, FITs do not account for the large start-up costs of renewable electricity projects, leading some to express concern that only larger investors are able to take advantage of the policy (Barclay, 2009, Stokes, 2013). FITs also require a relatively high degree of administrative oversight (Lesser and Su, 2008; Couture, 2013), as well as sufficient revenues to support a competitive price contract (Menanteau et al., 2006; Couture, 2010).

FITs are most effective when implemented over a long period of time (Couture, 2010; Stokes, 2013). One of the reasons that the FIT has been successful in Germany is the integration of their energy market with neighbouring countries, allowing for trading of power and consequent stabilization of price volatility (Ketterer, 2014). Germany has also been transitioning towards FITs that are determined by market-based methods rather than a fixed-price tariff (Ketterer, 2014). Although the fixed-price tariff was effective at promoting renewable electricity adoption, Ketterer (2014) argues that market-based methods provide a more economically efficient tariff price, as renewable technologies continue to mature and become more efficient, cheaper, and accessible.

Closer to home, Ontario was the first province in Canada to adopt FITs (Peters & Weis, 2008). Although the policy was initially successful in promoting better prices for generators and reducing barriers to deployment, some observers believe its effectiveness has weaned over time, due in part to the difficulty in determining appropriate tariff pricing (Stokes, 2013). Stokes (2013) suggests that more effective pricing can be achieved when policy-makers consult multiple sources of information when designing FITs, and ensure that FIT prices are regularly adjusted to adapt to changes in renewable electricity-adoption costs.

On the surface, FITs may appear to counter the principles of a competitive marketplace because it establishes a fixed price (Peters & Weis, 2008). Nonetheless, FITs can encourage competition by allowing electricity generators to make technology choices, they allow consumers to purchase electricity from the most competitively-priced manufacturer, and encourage new entrants into the market (Chaton & Guillerminet, 2013).

Quota-based Incentives: The Renewable Portfolio Standard

Another common policy option is the renewable portfolio standard (RPS). An RPS requires electricity providers to maintain a certain percentage of the total electricity provided to consumers from renewable energy sources. Compared to Feed-in-Tariffs, RPS allow the market to determine prices (Cory, 2009). If utility companies provide more renewable energy-generated electricity than the target amount, they can receive certificates (often called “green certificates”) that other electricity providers can then purchase if they fall short of their own targets (Schelly, 2014). One of the many attractive features of the renewable portfolio standard is its administrative simplicity. A market-based approach is also relatively more palatable in many jurisdictions, and is likely what enabled its adoption in 28 states in the US (Cory, 2009; Rader & Norgaard, 1996). As well, the choice of strategies employed to meet the standard is left up to companies and investors (Cory, 2009; Rader & Norgaard, 1996). Some studies have indicated that an RPS can actually lower electricity costs, as occurred in New York (Wiser & Bolinger, 2006).

Other states have had variable success (Wiser et al., 2007; Tang et al., 2012). In Texas, an RPS enabled significant increases in renewable electricity deployment, whereas Nevada, New York, and California have been relatively less successful, likely due to different RPS designs, such as differing severity of penalties, and the unique context within each state (Wiser et al., 2007). Some RPS targets may also be more unrealistic than others based on factors such as costs and available technology. Similar to some FITs, an RPS does not compensate for the high start-up costs of renewable electricity projects (Tang et al., 2012).

Auctions

Auctions constitute another quota-based incentive policy. Renewable energy providers propose projects that can provide a certain amount of renewable energy at a particular price. Governments or private investors then bid on these projects. In principle, this policy tool breeds competition among producers because investors will choose projects that can provide the most renewable energy at the cheapest price. As such, auctions have the ability to encourage innovation and make renewable energy production more efficient and cheaper (Rio & Linares, 2014). Countries such as Ireland, the U.K., and China have all used auctions, but have since switched to FITs or tradable green certificate systems (Rio & Linares, 2014). As a result, auctions have become a relatively obsolete policy tool. One factor in their decline includes concerns about their high transaction costs, complicated bureaucratic implementation, lack of ability to ensure project success, and financial uncertainty of the projects (Rio & Linares, 2014).

Rio and Linares (2014), however, suggest that by creating well-designed and context-specific auction systems that include enforcement measures such as financial penalties to hold project proponents accountable, these downfalls can be mitigated. "Descending-clock" auctions offer an additional strategy to boost effectiveness, whereby bidders respond openly to other bids to allow for price discovery, to achieve realistic bid prices, and prevent underbidding. This could be followed by a sealed-bid whereby bidders do not know what other stakeholders are bidding in order to prevent collusion. It is also important to use technology-specific auctions to encourage the development of immature technologies and to avoid the market domination of others.

Financial Incentives

Governments sometimes use financial incentives to promote renewable energy deployment by subsidizing the costs of production. This may include loan programs, government grants, or tax incentives. These policy tools can offset high start-up costs. Japan and Taiwan have experienced increased uptake of photovoltaic installations after implementing subsidy programs and providing financial support for producers (Chen et al., 2014). Based on a study in Denmark, however, Rosnes (2014) notes that investment subsides tend to dictate which technologies are adopted but have little influence over the actual amount of renewable energy produced. Financial incentives may also inhibit the development of younger technologies, so it is important that loans and subsidy programs distribute funding in a way that prevents domination of one technology. Financial incentive programs may also be quite costly to governments, which may create discontent among voters.

Political and Regulatory Structure Pertaining to Energy in Alberta.

Two key features of Alberta have dominated energy decision-making to date: 1) an economy heavily dependent upon the extraction of fossil fuels, and 2) endorsement of a neo-liberal political paradigm that dictates free markets and minimal government oversight. As a fossil fuel-based economy, much of our current infrastructure, human resources, and policy supports have evolved to support the extraction, production, export and consumption of oil, natural gas, and coal, imposing structural barriers on renewable energy sources. Many of our citizens and elected officials alike also perceive continued reliance on fossil fuel development as critical to the province's economic wellbeing, and thus, alternative forms of energy tend to be met with more reticence than might be true in other jurisdictions.

As well, the province's electricity market shifted towards deregulation in 1996 and became fully deregulated in 2001 (Alberta Electric System Operator (AESO), n.d.). Interestingly, while deregulation of the market was not implemented with renewable energy in mind, a de-regulated market does offer a window of opportunity for emerging renewable electricity suppliers. Any electricity provider can join the pool of provincial retailers by applying to AESO. AESO has also implemented inter-ties specifically for wind power, to allow for integration of wind-generated electricity into the grid (AESO, n.d.).

Several energy-related policies have been put into place, which altogether define a rather mixed policy climate for renewable energy expansion, with the key climate and energy-related policies described briefly below. The current Provincial government is exploring revisions to several of these policies.

Existing Legislation and Policies

1. Alberta's Provincial Energy Strategy. *Launching Alberta's Energy Future: Provincial Energy Strategy* (2008), outlines goals for energy development and utilization. As a provincial government document, it gives insight into current policy standpoints as well as future policy goals. The Strategy recognizes that renewable energy sources are cleaner than fossil fuels, but points to a variety of technical constraints. It states that while fossil fuels have large environmental impacts, Alberta's extensive infrastructure in place committed to the production and transport of fossil fuel energy justifies their continued use. Renewable energies are primarily conceived as a means to "enhance clean fossil fuel production." The Strategy goes on to state that methods of encouraging renewable energy development such as cap and trade systems and carbon taxes will not be implemented in Alberta, as "they are not proven to be effective and not relevant to an energy production industry." Wiser energy use through creating further awareness about energy consumption and emissions is recommended, as well as adopting investment in projects that offer consumers cleaner energy options, and creating greater efficiency as a means to reduce emissions.

2. Alberta's Climate Targets. Alberta's climate targets are relevant as coal-fired power plants currently represent one of the largest contributors to greenhouse gas emissions in Alberta (Pembina Institute, 2014), and thus they are an integral part of climate change concerns. Alberta's current climate target is to reduce emissions by 50 Mt by 2020, and by 200 Mt by 2050 (Energy Alberta, 2014). Alberta is currently not on track to meet these targets (Pembina Institute, 2014).

3. Climate Change and Emissions Management Act. This Act sets out emissions intensity limits on greenhouse gases. It requires large greenhouse gas emitters (over 100 000 tonnes of CO_2e annually), many of which are coal-fired electricity plants, to reduce emissions by 12%, either through direct reduction, purchasing carbon offsets, or paying $15 per tonne of carbon dioxide emitted over the allowable limit into the Climate Change and Emissions Management Fund (CCEMF) (Province of Alberta, 2007). This levy will be increased to $30 in 2017, and the required reductions increased to 20%.

4. Growing Forward. The Albertan government implemented this pilot project to facilitate research into renewable energy, which ended in 2013. Its goal was to collect data on equipment and installation costs and energy production from the installation of solar PVs on farms. It then synthesized this information so that farmers could make purchasing decisions in the future (Lund, 2012).

5. Early retirement of coal-fired power plants. The federal government currently requires the phase-out of coal-fired power plants after a 50-year lifespan, during which, however, the plants face no requirements to reduce in greenhouse gases (Pembina Institute, 2014).

6. Micro-Generation Regulation. Under the *Electric Utilities Act*, this sets out rules surrounding the generation of "environmentally friend electricity" by Albertan citizens, enabling them to receive credit as micro-generators if they send power into the main electricity grid (Province of Alberta, 2008).

Conversations with Alberta's Energy Policy Experts

With this context in mind, we approached several policy experts from the academic, public, and private sectors in Alberta, to discuss opportunities and barriers to renewable energy expansion, with a particular focus on wind and solar power. Three themes dominated these discussions: the deregulated energy market; the various ways that vested interests in fossil fuel production are expressed; and the political and cultural narrative that has dominated Alberta politics for the past four decades.

The De-regulated Electricity Market: A Double-Edged Sword

The electricity market in Alberta was ostensibly deregulated to give consumers the ability to choose among competing generators, resulting in a more economically efficient grid system. One of our interviewees, however, believes that the change was politically motivated, and a reflection of the dominant Albertan culture. The more a decentralized market enjoys ideological support, moreover, the lower the likelihood for the very forms of policy flexibility that are necessary in dynamic circumstances. Our interviewees all identified both opportunities and barriers associated with a deregulated market, although even those interviewees who expressed support for a deregulated market recognized the barriers inherent to the system.

One informant stated that a decentralized approach allows for profit from energy production to accrue in local communities. Another opportunity suggested was that this system gives some freedom to municipalities to invest in programs such as the new feed-in tariff in Banff. The City of Edmonton also recently launched an aggressive carbon reduction plan, noted one interviewee. Two interviewees mentioned that reduced barriers to entry into a deregulated market allow for entry of both small and large players, incorporating a diversity of generating technologies. The resulting source diversity provides an economically efficient patchwork grid that accommodates a potentially high level of renewable energy technologies. Another interviewee, however, expressed concern that there are actually huge transaction costs imposed on smaller new-entry players. Large capacity generators, with significant market power, are able to manipulate the market and exclude smaller players.

Another avenue offered by a decentralized market for renewable electricity pertains to micro-generators. One interviewee expressed the view that, in order to achieve a transition to a renewable energy future, we will need both a top-down transition among high capacity generators, and a bottom-up investment among homeowners in solar panel arrays, increasing efficiency in construction design, and other household-level initiatives. Such micro-level actions support the renewable electricity sector through further investment, while also increasing the penetration of renewable energy sources onto the grid. As noted by one interviewee, a deregulated system allows such bottom-up changes to accumulate, particularly with the aid of emerging green electricity retail cooperatives like the Alberta Renewable Electricity Cooperative (Spark). Homeowners are, however, required to enter into a contract with an existing utilities provider, and because there is no government agency to establish these contracts, the homeowner must cater to the utility. One interviewee viewed this as a significant caveat, since utilities can ultimately limit the capacity that homeowners are allowed to install in order to manage the variability of that utilities' output, and currently Edmonton's utility provides only the market price for the excess power generation that homeowners sell back to the grid; thus micro-producers to not receive the price advantage that the sale of green electricity should provide.

The tipping point enabling a transition toward renewable electricity will be defined by the ability of renewable sources to achieve "grid parity" with fossil fuel sources—the point at which a new technology can produce electricity at the same cost to ratepayers as traditional technologies (REA, 2015). Grid parity may be difficult to achieve without the help of at least temporary price support policies, which are considered anathema among free market advocates. One interviewee pointed out that renewable energy technologies are becoming rapidly more efficient, affordable and competitive, but as long as we have access to cheap fossil fuels then renewable energies will likely not be able to overcome the vested interests in coal-fired electricity. Several interviewees still considered the limited economic competitiveness of renewables to be the biggest barrier, despite the fact that, once the full costs associated with coal-fired electricity as well as the full benefits of renewable energy technologies are considered, renewables measure up quite favourably.

In other words, due to existing infrastructure, and lack of full cost accounting, coal-fired electricity is artificially inexpensive, implying the need for changes in policy. Interviewees generally expressed preference for renewable portfolio standards or a carbon tax, rather than a feed-in tariff. As noted by one interviewee: a tariff would create an inefficient system, while the carbon tax represents a tool to incorporate the true cost of carbon emissions. Renewable portfolio standards were seen as a tried and true way to quickly develop renewable energy generation. Two interviewees identified a carbon tax as potentially a very effective tool to manage the externalities associated with carbon-intensive fuels and level the playing field for renewable energy. By some estimates it would require a tax of $70/tonne CO_2 to achieve grid parity between renewable and non-renewable energy (Prescott & van Kooten, 2009, pg. 164). One interviewee suggested it should be more like $200/tonne.

Vested Interests

A formidable barrier to a transition towards a renewable energy future in Alberta, discussed by most interviewees, is the gamut of vested interests in fossil fuel industries. According to one interviewee, the government is "intertwined" with oil, gas and coal industries, whose lobby groups assert tremendous pressure to maintain the status quo. Another interviewee added that the barrier is not so much policymakers, but utilities and utility investors. For example, planning by the Independent System Operator (ISO) and large utilities is based on an expected indefinite 3% electricity growth. The utilities and wire carriers also want to "keep government off their backs, and keep growth steady," according to one interviewee.

The provincial government will not develop favourable policies unless a significant percentage of Albertans demand it, one interviewee pointed out, and a significant percentage of Albertans have a vested cultural or economic interest in fossil fuels. Moreover, one interviewee suggested that in Alberta much of the debate regarding energy policy takes place behind closed doors, making it challenging for stakeholders to take part in the process. Another interviewee highlighted the fact that many of our post-secondary institutions emphasize programs focused on resource extraction rather than conservation, which perpetuates this vested interest. An historical prioritization of fossil fuel development has also shaped the development of our physical infrastructure, designed to support oil, gas and coal, with limited utility for renewables in many cases.

Political and Cultural Narratives

One of the largest barriers to achieving a renewable energy transition in the province noted by many interviewees is a lack of political will. This lack of political will, however, cannot be explained solely by the presence of vested interests in the fossil fuels industries, but runs deeper, embedded in long-standing political and cultural norms and practices that support neo-liberal market policies and traditional extractive industries. Moreover, elected policy makers prioritize short-term results, limiting support for long-term policy considerations. Given that renewable energy adoption is motivated by long-term goals like climate change mitigation and energy security, this barrier can negatively affect renewable energy adoption. One interviewee suggested that the history of renewable energy generation in Alberta has more often been marked by provincial political opposition than support, citing previous efforts to install renewable production facilities in Pincher Creek as an example. Another noted a popular program in place for farmers to produce renewable electricity, which was cancelled. Another interviewee was of the opinion that the high potential for geothermal technology in the province has been constrained by the limited and confusing policy landscape.

One interviewee described our provincial culture as one steeped in a history of fossil fuel extraction. Furthermore, due to the neoliberal, hands-off sentiments toward government intervention—as one interviewee asserted—the debate is about whether the government has a role to play at all, not what the role should be. Ultimately, several interviewees suggested that the political support required for a renewable energy transition would have to be instigated through civil action: public pressure-letters, meetings, and demonstrations. While grassroots support for renewables in the province is growing, to this date it has not been sufficient to achieve more than incremental growth.

One of our interviewees sensed that the political climate is indeed changing, and that general political debate is moving in favour of climate change mitigation, and a recognition that globally we are relatively behind in the adoption of renewable technologies. Even in economic terms, the case for renewables is gaining ground. For example, the City of Edmonton's plan to reduce CO_2 by 2035 is expected to realize significant benefits over costs. Many of our interviewees emphasized that due to the inevitability of a global shift toward renewable energy, we have a great opportunity to be leaders. According to one interviewee, the current political climate of fiscal crisis and oil criticism internationally may well serve as an opportunity for expansion. Other issues broadening the debate noted by interviewees include the growing prominence of quality of life concerns, and health. One interviewee mentioned a recent Pembina Institute study of the effects of coal, for example, which estimated that coal is costing Alberta at least $300 million per year in health care costs.

Summary

A transition to renewable energy ultimately requires grid parity for ratepayers between renewable energy options and dominant fossil fuel generators. While we do have ample renewable energy potential in Alberta, we also have ample supplies of fossil fuels, as well as an existing infrastructure designed to support the use of fossil fuels. Consequently, while renewable energy technologies are maturing rapidly, and their economic competitiveness has improved tremendously over the past decade, a renewable energy transition in Alberta will require policy support. Ultimately, leveling the playing field could take two general approaches. The first method would be to 'bring down', or remove specific advantages that traditional thermal power energy is enabled by – such as a regulatory or market mechanism to capture the cost of externalities. The second general approach would be to 'lift up' the renewable energy sector while it is still vulnerable and young, by creating production-based subsidies, quota systems, or feed-in-tariffs. Whatever the approach, the literature suggests that enacting policies that are perceived to be strong and effective, yet not over-bearing, can have a positive effect on investments in renewable energy technologies. More to the point, according to Rio and Linares (2014), the policy *tool* is less significant than the policy *design*. Focusing on a few well-orchestrated and well-integrated policy tools to achieve renewable energy deployment is preferable to adopting multiple tools simultaneously (Schelly, 2014; Rio, 2013). Often, renewable energy policies that are implemented with disregard for existing policy tools result in unexpected conflicts between policies. The co-existence of emission trading schemes and renewable energy support programs, on the other hand, offers a number of potential synergies (Rio, 2013). Setting emission targets may encourage companies to use renewable energy sources to satisfy emission reductions, which in turn would achieve the goals of renewable energy adoption. Factors such as target levels, cost of emission credits, and cost of renewable energy technologies must be considered when designing policies. Finally, a successful renewable energy policy strategy in Alberta must accommodate the province's social, economic, and political context, including the maturity of renewable energy technologies available, costs to consumers and energy providers, and the administrative burden associated with policy implementation.

The Role of Citizens and Consumers

Policies that would enable successful transition to renewable energy hinge upon the support of the citizenry, who represent both significant consumers of energy, as well as the source of electoral support for policymakers. In this chapter, we review recent academic literature concerning individual-level attitudes and behaviours toward renewable energy, and the role of citizen support in politics. This is followed by a brief summary of recent research regarding environmental attitudes among Albertans, and finally presentation of the findings of our focus group study among a sample of Edmonton residents. We conducted three focus groups, each with 6-9 participants, and lasting between 1.5 to 2 hours. Participants were asked to discuss their understanding and feelings regarding renewable energy, and provide their reactions to a sample of visual message frames.

Literature Review

Research has indicated that significant reductions in energy consumption can be achieved with the adoption of a handful of basic behavioural changes at the household level (Dietz et al., 2009). The realization of this so-called Behavioural Wedge, however, is another matter. Cost, reliability, and ease of use are all found to be more important factors to citizens than environmental benefits in many studies (e.g. Blenkinsopp & Kirwan, 2013). Individual-level decision-making also takes place within a social context, in which values and worldview come into play, as does social acceptance. Because energy consumption in Western nations like Canada includes behaviours that are largely hidden from view, and include many daily habits that are largely taken for granted, many studies have concluded that changing personal energy consumption behaviours can be an uphill battle. Ohler and Billger (2014), in a study of energy-saving behaviours among consumers in Missouri, showed that respondents failed to reduce energy use even when they agreed that doing so is socially responsible. Not surprisingly, individuals with a greater concern for comfort had higher energy usage, whereas individuals more concerned with energy costs utilized less electricity (Ohler & Billger, 2014).

In short, while many people may be concerned about climate change and the environment, this concern does not necessarily translate into behavioural change, a phenomenon researchers call the Value-Action Gap (Frederiks, Stenner, & Hobman, 2015). Factors used to explain this gap include a desire to maintain the cultural status quo. Another is *satisficing*, whereby consumers settle for a “good enough” result rather than an “optimal” one. Temporal discounting—perceiving benefits as less valuable if accrued further in the future—has also been expressed in survey research. The final factor of note is trust for communication sources, particularly the media (Frederiks et al., 2015).

The Role of Citizen Support

Policy makers consider public opinion integral to the success or failure of many initiatives, and support from the public can also translate into political triumph or defeat (Irvin & Stansbury, 2004). Similarly, citizens are more likely to support the policy implementation process if they supported the directive in the first place (Irvin & Stansbury, 2004). It is increasingly recognized that policy effectiveness can be substantially enhanced through citizen engagement (Sheedy et al., 2008; Irvin & Stansbury, 2004). Irvin & Stansbury (2004, p. 55) suggest that: “with citizen participation, formulated policies might be more realistically grounded in citizen preferences, the public might become more sympathetic evaluators of the tough decisions that government administrators have to make, and the improved support from the public might create a less divisive, combative populace to govern and regulate."

British Columbia's successful effort to implement a carbon tax illustrates the important role of public opinion in the policy-making context. Not only has the province's per capita fuel consumption decreased, but the carbon tax has also survived two provincial elections and a change in Premier (Horne & Suave, 2014). In the 2009 election, a year after implementation, there was a clear correlation between support for the carbon tax and party support (Harrison, 2012). The carbon tax did not initially resonate with voters following its introduction, but the policy has since continued to gain public support, enhancing its long-term success. Between the 2008 and 2012 elections, public support for the carbon tax rose from 40% to 64%, and again rose to 75% in 2013 (Horne & Suave, 2014; Harrison, 2012). In the 2013 election, all of the candidates who won seats were supporters of the carbon tax (Horne & Suave, 2014). With the implementation of the carbon tax, citizens saw a $10/tonne tax starting in 2008, followed by $5/tonne annual increase until $30/tonne was achieved in 2012 (Horne & Suave, 2014; Harrison, 2012). The carbon tax contributed to BC's provincial revenue and was leveraged to lower personal and business taxes and provide low-income tax credits (Horne & Suave, 2014).

Environmental Attitudes in Alberta

Publicly available polls related to environmental attitudes in Alberta are limited in number, but do offer a snapshot of the potential for public support for policies intended to foster renewable energy expansion. A 2006 poll conducted amongst 500 Albertan adults by telephone found a very high level of concern about environmental issues in Alberta: 85% were either very or somewhat concerned about environmental issues in the province. An overwhelming majority of Albertans (91%), furthermore, expected protection of the environment, even if this slows down opportunities for oil sands development (Pembina Institute, 2006). A more recent comparative survey revealed that while most Canadians and Americans agreed that global temperatures have increased in recent decades, the level of belief in the existence of climate change among Albertans was significantly lower than among other Canadians. Support for renewable portfolio standards (RPS) is relatively high in both countries, and Canadians were more likely than Americans to indicate that they are willing to pay more for the production of renewable energy (Canada 2020, 2013).

Lastly, a meta-analysis of surveys of 1,000 respondents or more that had been conducted as far back as 1990, found that among Canadians, including Albertans, nobody would disagree that they want to safeguard our planet and our citizens' wellbeing. When it comes to adopting personal behaviours, however, researchers found that other issues take priority; many respondents don't feel they can make a difference; and most are not willing to make any financial sacrifice (ACEE, 2008). A subsequent report focused on Alberta youth found high levels of environmental concern, yet a relatively low degree of perceived personal responsibility for protecting the environment (ACEE 2010). Alberta youth also do not have a high degree of environmental knowledge or literacy. Time and cost emerge as perceived barriers to environmental action; however, a desire to protect health appeared to be a strong motivating factor.

Focus Group Research Findings

We conducted three focus groups with a sample of Edmonton residents in March, 2015. Each focus group had 7-9 participants, representing a wide range in age, gender, ethnicity, and occupation. A number of noteworthy themes emerged. First, participants have mixed feelings about renewable energy, including reservations regarding cost in particular. Second, participants identify closely with the province's history and status as a major fossil fuel producer, and are sensitive to perceived threats to this sector. Third, public support for renewable energy can be strongly influenced not only by the nature of information provided, but also by the means by which such information is framed.

General Attitudes and Beliefs about Renewable Energy

Most members of all three focus groups associated renewable energy with a moral way of living. Those who invest in renewable energy or politically support the introduction of renewable energy in Alberta were seen as moral people. However, a belief commonly held across all three focus groups was that renewable energy is expensive and inefficient, and indicated that without economic incentives, they would not switch to renewable electricity. This duality created a clear tension within all three focus groups: the morality that participants identified with renewable energy and environmental protectionism, and the higher perceived economic benefits and efficiency associated with fossil fuels.

Many participants associated electricity generated from renewables positively with a reduction in waste. Several participants indicated that they believed that coal-generated electricity has harmful byproducts and waste that renewable electricity generation does not. Several participants indicated this to be a very positive association, and suggest that if the price of renewable electricity were competitive, this attribute would make switching to a renewable electricity provider attractive. Nonetheless, a majority of both the middle aged professionals and the younger students in our sample indicated that environmental concerns were not of great importance to their lives. Several participants were also un-motivated to change behaviours, based on the attitude that Alberta's energy consumption is negligible with respect to total global consumption.

The primacy of economic considerations emerged in several ways. One participant, for example, indicated that although she felt she was relatively unaware of renewable energy technologies, she was not motivated to learn more because she so strongly associates renewable energy with costliness. Several others acknowledged that the only time they ever consider their electricity usage was when the bill arrived. Most participants did not understand measures such as the kWh, and only "measured" electricity usage in terms of much it cost them every month. Many participants noted the complex language often associated with the energy sector. Other indications of a relative lack of knowledge regarding electricity systems were common. A reduction in electricity use was important to some participants, not for environmental reasons, but because it would reduce their electricity bill. Several homeowners indicated that price is the most important factor when choosing their electricity provider, and stated that if renewable electricity were of comparable price to coal-fired electricity they would likely switch providers. Several participants in all three focus groups brought up LED lights as an example of a green measure they were motivated to adopt, not for environmental concerns, but as a way to reduce their electricity bill.

Other attitudes toward renewable energy that at the outset appeared to be economic in nature, revealed a deeper level of class-consciousness that reduced support for renewables. These participants described renewable energy, as well as items such as LED lights and hybrid cars, as "luxury" goods for the wealthy. Many focus group participants similarly associated renewable energy with radical, left wing political advocates, to which many Albertans are ideologically opposed.

Efficiency was another key concern, particularly among middle-aged professionals. Several participants shared the belief that renewable electricity production is not as efficient as fossil fuel production. Several middle-aged professionals also believed that renewable energy is unreliable, due to intermittent periods of wind and solar activity. One immigrant participant suggested that the most important concern she had about her electricity is reliability, as in her home country she did not have reliable electricity, and as a resident in a wealthy nation like Canada, she wants to trust that her lights will turn on, no matter the weather.

When asked what barriers exist that would prevent a switch from coal-produced electricity to renewable electricity generation, several participants cited a lack of information and perceived urgency. Several of the younger participants, aged 18-30, suggested that a targeted information campaign would increase interest in renewable energy. These participants further suggested that the reason that renewable energy has not been adopted is because climate change is perceived as a future problem. They indicated that a targeted political campaign that appealed to short-term concerns, such as the inevitable unreliability of fossil fuel-generated electricity as a result of scarcity, would likely make renewable electricity more attractive to consumers.

Fossil Fuel Identity

Both younger and older participants also strongly associated fossil fuels with job security in Alberta, and held the belief that renewable energy generation would threaten that job security. These sentiments persevered despite acknowledgement of the recent economic downturn and associated layoffs that resulted from low oil prices. Many retained confidence that the oil industry will bounce back. Such belief systems extend beyond instrumental economic calculuses, and reflect the historical roots of Albertan culture. Several participants related an Albertan identity to images of oil jacks and pumps; a positive association with Albertan pride as a leader in resource extraction. Fossil fuel production was identified as a key to Alberta's strong economic history and job security, while renewable energy was seen as a threat to this identity.

The Role of Framing: Main Findings

Participants were asked to analyze a variety of media images intended to present particular frames, or ways of viewing, various energy sources, and share their reactions. Participants were instructed to compare and contrast images as well as assess them individually. The initial image was of an oil well, while the second image showed a line of wind turbines adjacent to a highway. Both images had a sunset as the backdrop. Some believed that the oil well represented domination, aggression, and greed while the wind turbines portrayed a futuristic beauty of the energy field in Alberta. Most participants, however, had positive reactions to the oil well image and negative reactions to the renewable energy image. The oil well represented efficiency, money, prosperity, and the Albertan identity of industrialization. Alternatively, the wind turbines were linked to inefficiency, and were considered ugly, expensive and a self-sustaining structure that does not support jobs. Many indicated that the wind turbines had little to do with growing family incomes. This reaction fell in line with the groups' general perception of renewable energy as an energy source that replenishes itself and is sustainable over a long period of time, as it would involve limited human interaction. The image representing fossil fuels was more appealing to participants in general, and represented productivity. The reactions suggest that the promotion of renewable energy as an *alternative* to nonrenewable sources in Alberta is likely to be greeted with strong opposition, implying the shut down of our fossil fuel sectors.

The last image shown was an advertisement for a fictional provincial electricity retailer that offers renewable sources of electricity, created by a student at the University of Alberta for the purpose of the focus groups, utilizing a slogan, "You know you're dirty," with an image of a woman and child doing laundry, and a short blurb, indicating the price per kWh the company offers, as well as information on how to change providers. Participants' reactions were quite varied. Some felt that the message was shame advertising, and a few felt turned off by the image altogether. Alternatively, many felt that both the image and message gave a positive reinforcement to change their behaviour and participants felt more connected to the image because it shows a common household duty with playful marketing. The middle-aged participants (aged 30-60) had a stronger negative reaction to the image than their younger counterparts, indicating that they felt the slogan "blamed" consumers. They also thought the information provided was useless, as kWh units are not meaningful in their everyday life. Several participants suggested that the advertisement should include how much each load of laundry would cost, or show a cost comparison with another provider, in order to make the information regarding cost more meaningful. In contrast, participants aged 18-30 showed a strong positive reaction to the image. These participants thought the slogan, in relation to the positive image and the blurb stating how easy it is to switch to a renewable energy provider made the advertisement both memorable and positive. Unlike the older participants, the students believed the advertisement offered a positive message, and that the tongue-in-cheek humor made the advertisement and its message attractive. Overall, while some focus group participants perceived renewable technologies as "expensive, inefficient and self-sustaining," many were positive and believed that renewable energies represent "beauty", are "realistic," "clean" and "technologically elegant."

Summary

While the majority of Albertans express concern for the environment, numerous other social factors influence their daily practices in ways that do not necessarily support this concern. Gaining the political support of Alberta's voters, and the willingness to change energy consumption practices, will nonetheless be critical pre-requisites to a renewable energy transition. Lessons learned from the focus groups offered additional insights into the sentiments of Albertans, and the prospects for behavioural change. The study suggests that gaining public support for renewable energy will require integrating positive images of renewables into existing cultural fields that include strong associations of Albertan identity with the prosperity and pride of our fossil fuel-based energy history. Making negative associations with fossil fuels in an attempt to cast a shadow over the sector is likely to backfire. Using positive instead of negative imaging and messages is beneficial, since, as research has corroborated elsewhere, members of the public tend to react more strongly to positive re-enforcement. Framing the message in a way that is clear and understandable is also more likely to generate a positive response. Finally, the wide variation in responses among participants suggests that multiple communication strategies employed to promote renewable energy would be more likely to elicit a positive response from a wider spectrum of the public.

Conclusions

There is significant potential for Alberta to transition towards a pathway of renewable energy development, particularly in the electricity sector. As of September 2014, coal remained at a total production capacity of 6258 MW in Alberta, with natural gas at 5813 MW, and wind 1113 MW (AER 2014). At the time of this paper's writing, Alberta is facing an economic downturn associated with our high economic dependence on oil exports, which are currently facing falling prices, accompanied by a drop in natural gas prices from an average of $4.47 per thousand cubic feet (PCF) in 2014 to a low of $2.82 PCF in early 2015 (Calgary Herald, 2015). The incorporation of renewable electricity production will diversify Alberta's economy, increase economic stability and provide employment opportunities.

The Current Context

What Do We Have Going for us in Alberta?

Our existing attributes form a supportive foundation for a renewable fuel transition in electricity, including Alberta's vast geophysical potential for many forms of renewable power generation, and the diverse composition of the Albertan population. The climate and geophysical characteristics of the province support resource expansion towards wind and solar energy production, and geothermal capacity and small-scale hydro as well, although these latter two were not the focus of this report. The Albertan population cumulatively provides a set of skills, knowledge and motivation that can be brought to bear in a renewable electricity sector. Albertans' relatively high levels of wealth also represent sources of potential investment. Alberta is also home to a large number of academic institutions that can (and already do) support research and development as well as education and training of a skilled labour force. Expanding on this potential would require increases in funding to support research and training in renewable technologies. Finally, Alberta's cultural identity as an energy-producing province, ironically, may offer a discursive pathway toward increased political support for production of alternative sources of energy.

Barriers to Renewable Energy Adoption in Alberta

A serious barrier in the adoption of renewable energy in Alberta is the lack of political will. For the most part, our key informants believed that renewable energy simply has not been a "ballot box issue," and therefore, there has been little of the political debate needed to generate support for transition strategies. This, however, has been changing notably since the later months of 2015. As a number of other informants asserted, an additional barrier that may prove more difficult to change is the fact that fossil fuels are currently artificially inexpensive, not only due to direct subsidies for this sector, but also because many of the costs of fossil fuels are not included in their price. Strong support for neoliberal policies provide justification for current advantages offered to fossil fuels, as does the presence of powerful fossil fuel lobbies. Those who have invested in this sector are motivated to protect their assets.

Storage capacity is also a challenge. Meeting demand for electricity during peak hours with renewables could be a challenge without extensive storage capacity. The ability to move electricity between Alberta and neighbouring jurisdictions would alleviate the storage requirements, but the transmission infrastructure required is currently lacking. This uncertainty of availability also makes it less appealing for large investors, and consumers are wary regarding the availability of electricity when it is needed.

Enhancing Renewable Energy Generation in Alberta: Policies that Make Sense

One way to incentivize renewable energy production within the existing Albertan policy framework is to restructure the *Specified Gas Emitters Regulation* (SGER), by incorporating both micro-scale and large-scale renewable power generators as carbon offset permit sellers. Protocols exist for the quantification of emissions reductions for both centralized and decentralized renewable energy generators (ESRD, 2015a), however, prospective permit generators must "reduce their emissions and register these reductions" (ESRD, 2015b) before they can receive a credit for their reductions. A more favorable policy would allow large emitters to approach renewable energy generators and purchase emissions reductions credits prior to the renewable energy generator completing their project, providing small generators with the capital necessary to complete emissions-reducing projects, which would then fulfill the purchased emissions reductions quota. Additionally, permit price is determined through an offset market, which translates into income uncertainties for renewable energy generators. A guaranteed return on a permit could stabilize returns for generators. Regulation could also mandate the removal of restrictions placed by utility companies on the generating capacity of individual micro-generating rigs. These steps would provide an overall higher price to homeowners and larger contribution of renewable power to the grid.

An additional option is to pay into invest the Climate Change and Emissions Management Fund in Albertan renewable energy projects, providing much-needed investment in large-scale renewable energy projects with high start-up costs, or in renewable technologies that require further research and innovation. Much of the fund currently goes towards investment in carbon capture and storage technologies and other “carbon use” projects (CCEMC, 2015).

Provincial land use policy that designates and regulates land use for large-scale renewable energy projects would ensure the availability of areas with high potential for renewable energy projects, and restrict development of those locations where the risks of ecological impact are highest. This in turn would provide renewable energy projects with further social license. Additional municipal policy could benefit micro-generators, including zoning support for novel micro-wind set-ups in metropolitan areas and urban photovoltaic support.

Other policies that would be favorable to renewable energy development but are generally agreed to be less likely in the Albertan context include a feed-in tariff for small-scale renewable energy generators, renewable portfolio standards, or direct subsidies for construction of small and large renewable energy generation projects. The competition that FITs promote would work well in Alberta’s deregulated electricity system because it would encourage generators to develop the most cost-effective and efficient means to produce renewable electricity. Renewable portfolio standards, on the other hand would involve a much lighter administrative burden.

Early retirement of coal plants represents another important inducement for renewable electricity transition. The government of Canada finalized its Reduction of Carbon Dioxide Emissions from Coal- Fired Generation of Electricity Regulations in 2012, which sets the useful life of coal power plants at 45-50 years of age unless they can upgrade to current standards, with no requirement for them to upgrade before reaching the age threshold (Dion et al., 2014). This leaves a significant gap, in which operating coal-fired plants have little to no incentive to upgrade. Combining incentives to invest in renewable production capacity combined with the establishment of strict timelines for the rapid phase-out of coal-fired power plants offers a two-pronged approach that will enhance the rate of renewable energy transition while ensuring secure electricity supply. Such a phase-out offers economic advantages as well. Coal powered generation has traditionally been favoured in Alberta due to its competitive cost advantage, however this is currently questionable, particularly when the eventual need to incorporate carbon capture and storage is considered.

Stronger, economy-wide policy approaches to greenhouse gas reductions would also offer a substantial incentive to renewable energy industries. The expansion of the current SGER framework to include smaller emitters, higher prices and steeper reduction targets would not require significant changes in policy or administration. Ultimately, however, a carbon price may represent a simpler and more efficient means of reducing emissions; it would be more difficult to secure political support for this mechanism, but not impossible, as discussed further below.

From the Ground Up: Supporting Change at the Grassroots

To ensure the uptake and long-term political support for any new policies intended to foster a renewable energy transition, a targeted and specific public dialogue aimed at motivating consumer engagement would be necessary. The results of the focus groups that we conducted suggest that Albertan citizens do not have a large amount of knowledge about renewable energy, and they are also not particularly motivated to learn more about these technologies. Several participants indicated that the oil and gas industry is strongly associated with a sense of Albertan pride, as well as a robust economy. Participants expressed concern that moving from a fossil-fuel energy-based economy to a renewable energy economy would result in a loss of jobs, and economic decline. To combat this public resistance to renewable energy, advocates should work towards reframing the Albertan identity, not as producers of oil and gas, but as global leaders of energy production. Campaigns could highlight the value of renewable energy as a means of diversifying our current fossil-fuel-based system, and creating new jobs. Likewise, campaigns should reinforce the long history Alberta has enjoyed as a world leader in energy production, and highlight that renewable energy represents an economic and leadership opportunity for Alberta as an energy producer. There should be a visual synergy between images of fossil fuel and renewable energy production that link renewable energy to a robust economy, and to the historical pride Alberta has enjoyed as a leader in energy production.

Similarly, campaigns should reframe information about energy consumption in everyday terms, rather than technical terms. For example, rather than listing electricity rates in kWh, household usage information such as number of loads of laundry, or number of hours of light bulb use, may make more sense. Moreover, results from the focus groups demonstrated that regardless of expressed values, most citizens pay more attention to their electricity bills than abstract notions of moral duty. Reframing the reasons for transition from the abstract to the concrete will likely capture a greater level of citizen attention. These campaigns could utilize non-traditional advocates as spokespersons for renewable energy as well. Using professionals from both fossil fuel and renewable energy sectors together could be useful to establish the potential synergies between the sectors, as well as reframing the self-image of Albertans as energy producers rather than oil and gas producers. It may also be useful to showcase every-day Albertans who are employed by the renewable energy sector as spokespersons, demonstrating the economic potential of renewable energy, and building an association between renewable energy and a robust economy. Additionally, having everyday Albertans as spokespersons would make renewable energy a more relatable concept to the general populace.

The focus group results further suggested that renewable energy generation is viewed by Albertans as an abstract, futuristic concept that is not yet grounded in the context of daily Albertan life. Thus, participants were wary of the reliability and efficiency of renewable energy. As one participant stated, "I need to know my lights will always come on after I flick the switch." It may be useful to portray renewable energy as the future of energy production, and that items such as PV solar panels are status symbols. This would not only reinforce the notion that Albertans are leaders in global energy production, but also link renewables with economic growth, progress and wealth (e.g. Margolle, 2014).

To motivate consumer engagement in the renewable energy sector, campaigns must reflect positive rather than negative messages. Many focus group participants did not respond positively to negative images. Participants felt that negative images such as smoke stacks and messages such as "Coal Kills" and "You have a Choice" invoked shame and guilt. Participants also immediately ignored any message that was seen as manipulative. Meanwhile, images that had clear, direct and positive messages were highly favoured. One participant stated that, "positive messaging is better because it encourages us to join the group." Focus group results also suggested that even among supporters, renewable energy adoption in Alberta is viewed as an abstract and futuristic concept. To make renewable energy something that people want to support now and incorporate into their daily lives, it needs to be made into a more immediate issue. Describing tangible consequences for the future of Albertans, both positive outcomes and what could be lost if renewables are not adopted, could convey a greater sense of urgency.

Alberta is generally perceived in terms of the energy sector, specifically the oil sands, and the Albertan identity is connected to prosperity, efficiency, and wealth. Campaigns for renewable energy adoption should be developed and promoted in a manner that connects with this identity, while at the same time working to expand this identity to encompass a more diversified and cleaner energy sector. Campaigns should strive to reframe renewable energy as productive, economically secure, and as a means to provide for improved ecological wellbeing and quality of life for our families.

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