COMPLEXITY AS A CAUSE OF ENVIRONMENTAL INACTION: CASE STUDIES OF LARGE-SCALE WIND ENERGY DEVELOPMENT IN SASKATCHEWAN

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ABSTRACT

The rate of development for large-scale wind energy in the Canadian province of Saskatchewan is a complex issue such that the various actors of the surrounding policy community (decision-makers, influential stakeholders, and the attentive public) cannot reach consensus. Inaction on resource and environmental issues like this one is often the result of complexity, either the inherent complexity of the problem being targeted or the complexity of the communicated information surrounding the problem. Inherent complexity is managed chiefly by central decision-makers and influential stakeholders of the policy community, while information complexity must be dealt with primarily by the attentive public of the policy community. This thesis uses a case study of large-scale wind energy development in Saskatchewan to explore complexity as a root cause of environmental inaction.

In manuscript style, this thesis investigates two types of environmental complexity and two segments of the wind energy policy community. Through an exploration of barriers to wind energy expansion in Saskatchewan, the first manuscript focuses on the complexity of environmental problems themselves as dealt with by decision-makers and other influential policy actors. Interviews were conducted with a range of experts and stakeholders where participants were asked to describe barriers to development in each of six categories: agreement, knowledge, technology, economic, social, and political barriers. A number of key issues are identified: disagreement regarding the balance between environment and economy, contradictory knowledge about the benefits of wind energy, conflicting faith in technology to accommodate high levels of wind energy, unquantified non-economic benefits of wind energy, lack of social interest in and support for wind energy, and lagging provincial political leadership on the issue of wind energy. Perhaps more importantly, the interviews reveal that experts disagreed on many

facets of the wind energy issue, which demonstrates that the complexity of the issue makes consensus and any resulting action difficult to accomplish. Intuitive solutions for managing complexity through the more effective reconciliation of disagreement are also suggested.

The second manuscript focuses on the complexity of environmental information by examining policy information regarding wind energy implementation in Saskatchewan for complications that might reduce understanding about and participation in the issue by the attentive public. Through a review of publicly available reports, articles, and documents, four complexity-related problems are uncovered: non-intuitive information, misreported information, obsolete information, and absent information. Such occurrences may well be problematic for environmental policy information in general, so intuitive solutions involving clarification and elaboration are suggested for managing each one.

Together, the two manuscripts illustrate that both inherent and information complexity can be problems for environmental issues, especially when one causes or feeds back into the other. Results from this thesis provide a way of thinking about environmental complexity and understanding environmental inaction as managed by policy communities.

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AKTESP: agreement, knowledge, technology, economic, social, political

CCEI: Canadian Centre for Energy Information

CIC: Crown Investments Corporation of Saskatchewan

CO_2: carbon dioxide

CWEA: Canadian Wind Energy Association

ENGO: Environmental Non-Government Organization

EPP: Environmentally Preferred Power

EU: European Union

GDP: Gross Domestic Product

GHG: Greenhouse Gas

GWEC: Global Wind Energy Council

GWh: gigawatt hours

IEA: International Energy Agency

IPCC: Intergovernmental Panel on Climate Change

km: kilometres

kW: kilowatts

kWh: kilowatt hours

MW: megawatts

NIMBY: Not In My Back Yard

OECD: Organisation for Economic Co-operation and Development

SaskPower: Saskatchewan Power Corporation

SRC: Saskatchewan Research Council

WPIDU: Wind Power Integration and Development Unit

WPPI: Wind Power Production Incentive

˚**C:** degrees Celsius

CHAPTER 1

INTRODUCTION

1.1 Introduction

Saskatchewan policymakers have often claimed that the province leads Canada in the large-scale wind energy* industry (see SaskPower 2010 and Prebble 2006). Such claims are at least partially correct: in 2009, wind energy comprised 5.30% (171.2 MW) of Saskatchewan's electricity generation capacity, the highest percentage in the country, well ahead of the national average of 2.25% (CCEI 2009). In addition, Saskatchewan's Green Options Plan aims to add an additional 200 MW of wind-generated capacity to its energy mix (Government of Saskatchewan 2009). By these accounts, the province appears to be performing fairly well with regards to the development and expansion of wind-generated electricity.

Conversely, environmental interest groups argue that Saskatchewan should have a much higher level of wind energy; some maintain that wind should meet at least 20% of the province's electricity demands (see SES 2007). When other factors surrounding the energy issue are considered, these claims also seem somewhat legitimate. The wind resource in Saskatchewan is vast enough that most of the province's large-scale turbines are among the top 10% in the world in terms of efficiency (Enterprise Saskatchewan 2010), but its wind energy penetration is much lower than leading global jurisdictions – Spain, Germany, China, and the U.S. have established from 12.1% to 22.1% of their total generation capacity from wind power (GWEC 2010).

* power plant-level generation on turbine farms as opposed to individual small-scale generation

Saskatchewan may also have an additional responsibility to reduce its dependence on fossil fuels due to its especially high greenhouse gas (GHG) emissions; in 2008, the province's GHG emissions per capita were 73.8 tonnes of CO_2 equivalent per person, while Canada's as a whole were only 22.0 tonnes of CO_2 equivalent per person (Environment Canada 2010). Note also that Canada's CO_2 emissions per capita are nearly twice as high as the average in other OECD countries (IEA 2009). Finally, since 2006, Canada has roughly doubled its wind energy penetration while Saskatchewan did not build any new wind farms during a period of such unprecedented growth (CWEA 2010). By these accounts, the province's initiatives on developing wind energy appear insufficient.

Why, then, has Saskatchewan not increased its wind energy investment in recent years? If either of the above viewpoints is considered independently, the issue of wind energy development in Saskatchewan seems simple: either the current rate of wind energy development in the province is relatively appropriate or expansion should take place much more rapidly. On the other hand, if both viewpoints are taken into account together, the question becomes much more complex. Such complexity may contribute to Saskatchewan's difficulty in making further progress on the issue of large-scale wind energy, exacerbating the existing disagreement regarding whether the province's current rate of expansion is appropriate.

1.2 Environmental Complexity

The environment is one of few policy sectors beset by uniquely high levels of complexity – due either to the complexity of the environmental system itself or because of complexity in the knowledge and communication surrounding the issue. A complex environmental system is one where multiple variables and paths of interaction make cause-and-effect patterns difficult to

predict – such systems are more spontaneous, more disorderly, and more subject to sudden and unpredictable change (Mitchell 1997). For example, Wilson and Anderson (2006) explain that during the recent round of debate over clean air legislation in the U.S., policymakers on both sides of the issue used scientific evidence to support their arguments, but due to the complexity of pollutants' behaviour in the atmosphere and how they affect living things through respiration, the evidence only served to complicate the issue. Studies in epidemiology showed the damaging effects of the current levels of air pollution and thus were cited by those who supported more stringent standards, while toxicologists found that natural systems were not being harmed significantly under existing emissions rates and thus backed those who opposed tighter regulation. The complexity of the issue led to seemingly contradictory scientific evidence and consequently policymakers could not make progress in resolving the debate. Because most resource and environmental systems are complex, it is challenging for decision-makers to agree on how to address the associated problems and to do so successfully. The above example illustrates complexity generated directly by an environmental problem itself.

The second type of environmental complexity is that generated by the societal information and communication surrounding an environmental issue. Bradshaw and Borchers (2000) touch on this type of complexity in a study examining the differences in perceptions of uncertainty between policymakers and scientists. They argue that most large-scale environmental problems are characterized by a diverse collection of special interests and conflicting opinions, so much so that even unprecedented incidents of global scientific consensus like the Intergovernmental Panel on Climate Change (IPCC) reports are insufficient to galvanize societal action. For example, Teel et al. (2006) conducted an experiment evaluating students' attitudes towards drilling for oil in an arctic wildlife refuge before and after being exposed to exaggerated

media information representing both sides of the debate. They concluded that people tend to process environmental information in a biased fashion, only internalizing that which is consistent with their initial understanding. This study shows how the complexity of information surrounding an environmental issue (i.e. politically-charged and biased pieces of evidence) can preclude coordinated societal action. In regards to Saskatchewan's wind energy situation, the different comparisons used to advocate opposing positions on the appropriate level of development (e.g. a comparison to other provinces versus a comparison to leading countries) would constitute complex information, making it difficult for the public (and some central decision-makers, depending on their level of expertise) to understand and engage with the issue.

Environmental issues, then, are wrought by a unique and systemic complexity which makes consensus and coordinated action difficult to achieve. Such complexity can manifest in the issue itself or in the information surrounding the issue. Mitchell (1997) maintains that effective resource and environmental management must bridge both technical and civic concerns; a broad perspective ensures that the context of resource issues is understood before solutions are developed. As such, this thesis focuses on both types of complexity.

1.3 Policy Communities

The exploration of a complex issue can be simplified through the use of a framework that forms the basis for comprehension and analysis. This thesis adopts the approach of 'policy communities' which provides a model for understanding the influences of and relationships between actors in a given field of policy. Pross (1984) describes a policy community as consisting of two segments: the sub-government and the attentive public (Figure 1.1). The sub-government (inner circle) is the primary policymaking body in the particular field under study.

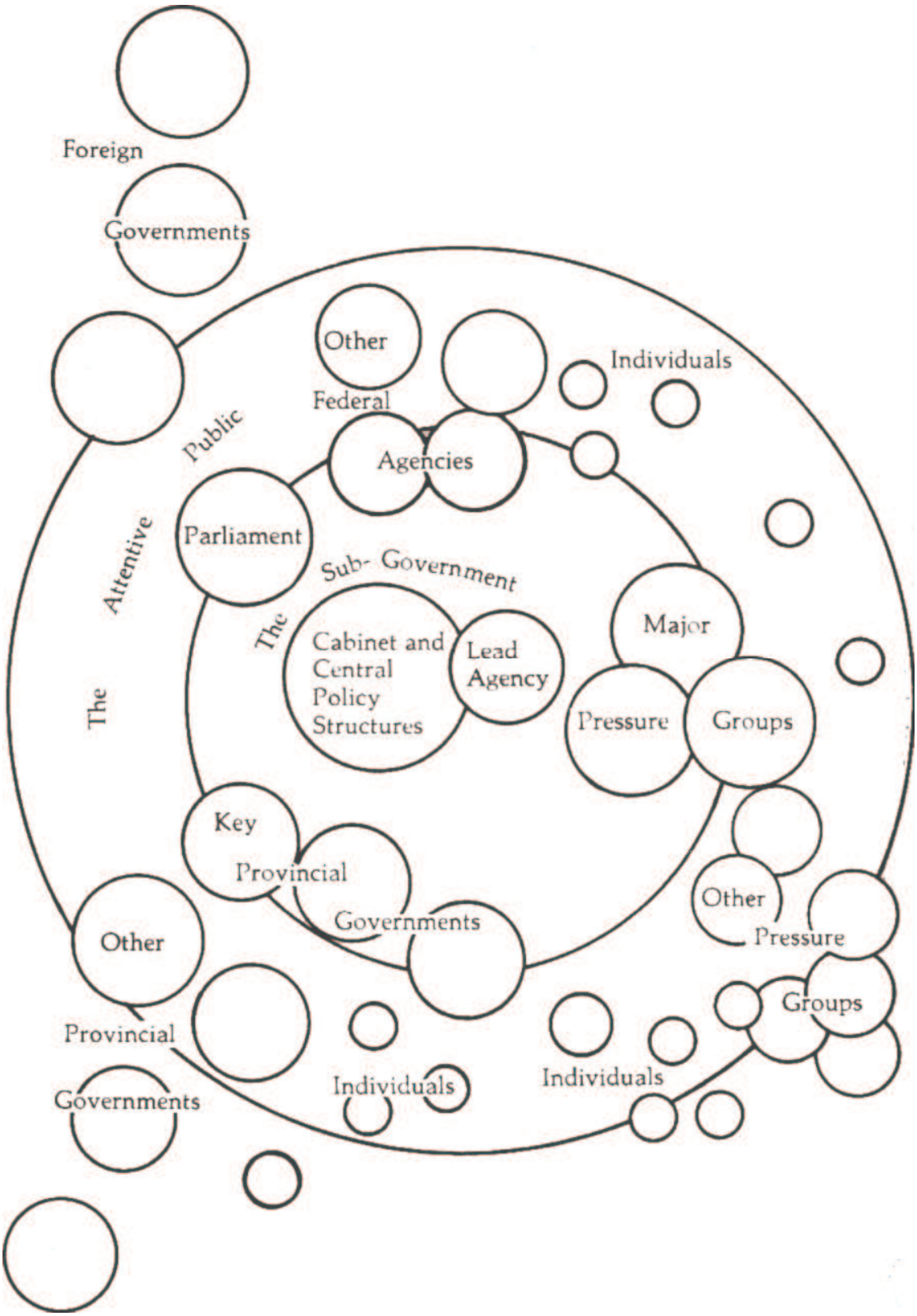

Figure 1.1 – Hypothetical Policy Community for a Canadian Federal Policy Field (Pross 1984)

For a Canadian federal policy issue, it would include central decision-makers such as the lead agency responsible for policies and programs in the field, as well as Cabinet along with its associated committees and support structures (e.g. the Treasury Board, the Ministries, the Privy Council Office). At the outskirts of the sub-government, with less decision-making power, are other influential actors that participate on the periphery of decision-making such as parliament, other federal agencies, stakeholder provincial governments, and major related interest groups. The attentive public (outer circle) includes those who are interested in policy issues but do not participate in policymaking on a regular basis. Its main function is to maintain a perpetual review of the policy process. Essentially, the sub-government consists of the relevant decision-makers and key actors who might exert strong influence on such decisions, while the attentive public consists of those interested in or affected by policy decisions but usually with little direct influence on the process. The policy community model allows for all actors involved with a policy issue to be examined in the context of their broader public policy role. Note that models exist of policy networks more modern than the policy community which do a better job of explaining the intricacies of the policymaking process (see Thatcher 1998) but tend to focus less on the organizational division between the sub-government and attentive public, concentrating more on the interactions among central decision-makers. The policy community model's roughly equivalent emphasis on the sub-government and attentive public is more useful for analyzing issues in a way that transcends both groups. As Mitchell (1997) suggests, when seeking to manage environmental complexity, a holistic approach is necessary to ensure that all sides and aspects of the issue are represented.

In the case of Saskatchewan's wind energy policy community, the central sub-government includes SaskPower (a crown corporation functioning as the lead agency), the

provincial Cabinet (in particular the Minister Responsible for SaskPower, the Ministry of Energy and Resources, and the Ministry of the Environment) and the legislative assembly (in particular the Standing Committee on Crown and Central Agencies) – these actors are the primary decision-makers for wind energy issues. The periphery of the sub-government consists of influential environmental non-government organizations (such as the Saskatchewan Environmental Society), academics engaged in wind energy research, and private corporations with wind energy interests – these actors regularly engage with issues pertaining to wind energy, attempting to influence or inform the key decision-makers. The attentive public is comprised of members of the public who are interested in and potentially affected by the issue, those who must process the information provided by the sub-government.

While both segments of the wind energy policy community must grapple with both types of complexity, each deals primarily with one type. The sub-government, in making policy, must deal with complexity manifested in the wind energy issue itself while the attentive public, in attempting to understand and form an opinion on the issue as it is presented by the various actors of the sub-government, must deal with complexity manifested in the information surrounding the issue. In either case, complexity can pose a barrier to effective, coordinated action regarding wind energy development. Thus, in seeking to explain the current state of wind energy development in Saskatchewan, both types of complexity and both segments of the policy community are worthy of exploration.

1.4 Thesis Purpose

The debate over wind energy expansion in Saskatchewan, like many resource and environmental issues, is a complex problem. The complexity of the problem itself makes it

difficult for key decision-makers and influential actors to reach consensus about further investment in wind energy, while the complexity of the related information communicated to the public precludes social support and engagement regarding the issue. There exists a lack of understanding on how to address the environmental complexity of the problem across the breadth of involved sectors, disciplines, and groups of decision-making actors. As such, the overall purpose of this thesis is to explore complexity as a root cause of environmental inaction. This purpose is accomplished using a case study of large-scale wind energy development in Saskatchewan. The specific objectives of this thesis are:

i. to illustrate the problems associated with complexity inherent to environmental issues as dealt with by policymakers and influential actors; and
ii. to illustrate the problems associated with the complexity of information surrounding environmental issues as dealt with by the attentive public

1.5 Thesis Structure

This thesis adopts a manuscript-style format. Two stand-alone manuscripts are presented following this introduction, each exploring one source of environmental complexity and one segment of the policy community. The first manuscript examines the complexity of large-scale wind energy development in Saskatchewan as a case study through interviews with experts and stakeholders from the sub-government (decision-makers, academics, interest groups, etc.). It addresses the broader theme of complexity generated by environmental problems themselves. The second examines the complexity of Saskatchewan wind energy policy information distributed to the attentive public as a case study through a document review. It addresses the broader theme of complexity in information surrounding environmental issues. This thesis

concludes by bringing the results of each manuscript together to construct new theories illuminating complexity as a root cause of the broader problem of environmental inaction from the case study of Saskatchewan's large-scale wind energy development. References are self-contained in each chapter of this thesis.

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CHAPTER 2

THE INHERENT COMPLEXITY OF RESOURCE AND ENVIRONMENTAL ISSUES: A CASE STUDY OF LARGE-SCALE WIND ENERGY IN SASKATCHEWAN

2.1 Introduction

Complex systems; those where multiple variables and paths of interaction make cause-and-effect patterns difficult to predict and are thus more spontaneous, more disorderly, and more subject to sudden and unpredictable change; are often central problems in resource and environmental management (Mitchell 1997). Consider the fourth assessment report by the Intergovernmental Panel on Climate Change (2007) recommending substantial reductions in anthropogenic greenhouse gas emissions. It proposes that 60-80% of such reductions would come from energy and industrial processes, suggesting increased use of renewable energy sources as a key mitigation policy. Not only does the report go on to mention numerous policies for increasing renewable energy penetration, including financial incentives like feed-in tariffs and the legislation of targets and obligations for implementation, but it also lists a number of different renewable sources that should be considered: hydropower, solar, wind, geothermal, bioenergy, wave, and tidal technologies. This example demonstrates well the complexity inherent in resource and environmental problems, given the considerable diversity of disciplines and stakeholders that must be consulted by policymakers in attempting to implement the IPCC's recommendations. It is understandable, then, that complexity might make progress on such

issues difficult. Managing complexity effectively is thus a key step in addressing resource and environmental matters.

Literature related to the field of environmental management has explored complexity-related barriers to environmental action. Specifically, a lack of consensus on environmental issues can lead to exaggerated or false claims which are difficult to act upon (see Gordon 1981, Teel et al. 2006, Wilson and Anderson 2006); poor communication and use of the scientific method may disenchant the public with sustainability (see Bradshaw and Borchers 2000, Lahsen 2008, Song and M'Gonigle 2001); inexperience with new environmental technology limits options for action (see Dell and Rand 2004, Jagadeesh 2000); high capital and upkeep costs curb support for environmental projects (see Ackermann and Söder 2002, Jacobsson and Johnson 2000, Jagadeesh 2000); members of the public may act solely in their self-interest, arbitrarily support the status quo, and exhibit contradictory values, making it difficult to engineer the necessary environmental change (see Eltham 2008, Hardin 1968, Owens and Driffill 2008); and finally, political decision-makers may continue to under-value long-term benefits and uncertain scientific findings (see Bradshaw and Borchers 2000, Mitchell and Connor 2004, Pollack 2007). Trudgill (1990) categorizes such 'barriers to a better environment' under six major themes: agreement, knowledge, technology, economic, social, and political (i.e. the 'AKTESP' framework). While the collective body of literature generates some important ideas, it completes only a generic assessment of the barriers to environmental action, which is unlikely to be applicable when it comes to any specific policy decision (Demirbas et al. 2004, Reiche and Bechberger 2004). Further study targeting a specific regional environmental issue is required so that more practical lessons can be extrapolated for other jurisdictions and the broader problem of complexity-related inaction.

The purpose of this paper is to illustrate the problems associated with complexity inherent to environmental issues as dealt with by policymakers and influential actors. This purpose is accomplished through a case study of barriers to large-scale wind energy expansion in Saskatchewan, Canada. In the following section, barriers to environmental action, as described by the environmental management literature, are explored to illustrate the inherent complexity of environmental issues (with a minor focus on wind energy). Then an overview of wind energy in Saskatchewan is provided, followed by an analysis of purported local barriers to further expansion informed by interviews with influential actors of the surrounding policy community. The paper concludes with a discussion of the broader implications for complexity and environmental action in other jurisdictions within Canada and globally.

2.2 Barriers to Environmental Action

There are a substantial number of potential obstacles that could apply to any given environmental action. Trudgill (1990) categorizes such obstacles in the 'AKTESP framework' of barriers, but does not provide a rigid definition for each barrier, cautioning that the proposed categories should only be used as a framework for analysis. Rather, he focuses on the identification and significance of each barrier and applies them to case studies of environmental problems to illustrate the utility and flexibility of the framework. The AKTESP barriers have been used in a number of subsequent studies of environmental problems such as the implementation of cumulative effects assessment (Piper 2001), the conservation of cultural landscapes (Selman 2004), and public resistance to solar energy (Haw et al. 2009). This widespread use of the AKTESP classification illustrates its applicability to diverse environmental problems including the implementation of renewable energy. Each of these

barriers is discussed below within the broad context of complexity-related inaction and then used to analyze obstacles to wind energy expansion in Saskatchewan.

2.2.1 Agreement Barriers

Barriers to reaching agreement evidently exist among politicians and the general public on a range of policy issues, but such controversy and the resulting inaction is exacerbated when there is disparity among experts as well. Wilson and Anderson (2006) establish that for the recent clean air legislation debate in the United States, the difference between the expert information used to inform the argument on both sides of the issue was substantial: policymakers who supported more stringent standards drew upon epidemiological evidence (which showed the existing harms of contaminated air on the ecosystem) while those who resisted stricter regulation cited studies in toxicology (which demonstrated that local ecosystems were resilient to such pollution). Even in the realm of science, then, there is often a lack of coordination between related studies such that experts can legitimately come to contradictory conclusions.

When decision-makers see conflicting information coming from experts, they may be able to pick and defend any position arbitrarily, as evidenced through a study by Teel et al. (2006). In the study, students were asked for their opinion regarding drilling for oil in a wildlife refuge, exposed to exaggerated information from each side of the debate, and asked if their opinion had changed. They found that participants tended to defend their initial position, evaluating the opposing position's material much more harshly. Disagreement among experts, then, can be a major barrier to galvanizing concerted public support for beneficial political action. Similarly, Gordon (1981) argues that extremist views on either side of an environmental debate can be damaging; environmentalists often presume that policymakers underestimate problems

because of inadequate knowledge while skeptics may believe that regulation is driven by alarmist and politically potent groups who are overreacting. Each of these claims is easily justified when expert groups fail to come to a consensus, but are damaging if used as overarching generalizations. Agreement barriers, then, may result in misinformed decision-making or inaction on environmental issues.

2.2.2 Knowledge Barriers

Informed authorities, members of the public, and decision-makers can all be sources of knowledge-related barriers to environmental action. Those that are generally less familiar with the scientific process (e.g. members of the public and policymakers) will often seek certainty and deterministic solutions for environmental issues; those that are generally more familiar with the scientific process (e.g. academics) recognize that uncertainty and estimation are normal elements of the scientific method (Bradshaw and Borchers 2000). As such, when scientific experts recommend precautionary environmental action based on the best available predictions, decision-makers and members of the public may require an inordinate amount of assurance before accepting the necessary action, potentially allowing detrimental business-as-usual scenarios to persist.

Lahsen (2008) illustrates that expert groups themselves may also fail to consider important scientific information, although it may be deliberate instead of incidental. She explores the motivations of a key subset of scientists who have contributed to the backlash against the anthropogenic climate change movement because of their personal motivations – to defend their traditional understandings of science, modernity, and themselves as the scientific elite. Note that similar bias can exist on the environmentalist side of the debate as well. If experts allow their

subjective personal interests to compromise the quality of the information they distribute, they will be less likely to educate policymakers and the public effectively. However, even when scientists are committed to transparency, their disciplinary focus and poor understanding of political and economic systems may cause them to communicate and coordinate poorly. Song and M'Gonigle (2001) show, through the example of conservation biology, that interdisciplinary knowledge is essential to avoiding academic stagnation. When the research efforts of expert groups are not tied together, unnecessary overlap, incidental omissions of important information, and poorer global understanding of complex issues may be the result. Overall, knowledge barriers can be present on the science or social side of an environmental issue and can be inadvertent or intentional.

2.2.3 Technology Barriers

Because environmental technologies tend to be new and experimental, many environmental problems are subject to technological barriers. These barriers in particular are especially relevant to energy issues, as controversy over generation supply questions has often concentrated on the technological differences between traditional and alternative energies. Wind energy technology, for example, has advanced at a rapid rate – in 1989, 300 kW turbines were state-of-the-art, but by 2002, 4 to 5 MW turbines were being developed (Ackermann and Söder 2002). Some studies show that the current level of technology could theoretically support highly efficient wind energy systems, mitigating the traditional issue of accommodating the intermittency of wind resources – Denholm et al. (2005) estimate that if wind energy is paired with the appropriate storage technology, it would be five times as efficient as the newest fossil fuel technologies.

Although the evolution of wind energy technology has been rapid, perhaps the largest technological obstacle to wind energy expansion is that it remains in a developmental (or theoretical) stage in comparison to well-established fossil fuel technologies (Jagadeesh 2000). As such, the following specific technical barriers persist for wind energy: a) it is limited to sites with sufficient wind regimes, b) it must be used as it is created or stored in batteries, c) it is unreliable and may require coupling with other energy types as a back-up, and d) its generating capacity continues to be lower than that of conventional or nuclear energy (Dell and Rand 2004). Due to these factors, the management of wind energy is a complex problem for power suppliers, who are thus more likely to choose simpler traditional technologies instead. There are a number of technological barriers, then, to accelerated renewable (e.g. wind) energy development, but they may be poorly understood by laypeople.

2.2.4 Economic Barriers

There is substantial overlap between economic and technological barriers, and hence an overlap in the relevant literature, because the end result of many technical obstacles is simply an increased price for the technology. However, even as technological barriers remain to the implementation of new environmental technologies, wind energy, for example, is becoming increasingly economically attractive in comparison to traditional sources of electricity generation (Jacobsson and Johnson 2000). Ackermann and Söder (2002) report that wind technology costs have tended to decrease about 20% every three years, similar to the cost reduction achieved during the first years of oil exploration a century ago – some estimates indicate that a further 50% reduction can be achieved by 2020.

While wind energy has seen rapid increases in economic efficiency, it still fails to provide electricity as cheaply as traditional fossil fuels on a kWh basis. However, Jagadeesh (2000) argues that if life-cycle costs are considered in addition to upfront costs or if environmental, social, and resource benefits are quantified, wind energy would be of superior or comparable value to that of traditional technologies. Thus, while economic barriers to contemporary environmental technologies like wind energy do exist, they are being addressed through technological innovation and a growing movement to quantify non-monetary benefits by means of more complete accounting procedures (e.g. carbon tax policies assign a value to the negative effects of activities that emit greenhouse gases).

2.2.5 Social Barriers

Significant policy change is unlikely to take place without public sponsorship, so community opinion can either be a social barrier to environmental initiatives or drive their implementation. Hardin's (1968) concept of 'tragedy of the commons' speaks to social inaction on environmental issues. Because humans possess a self-interested rationality, they may not consider the external effects of their decisions on society, failing to recognize, in the case of wind energy for example, the environmental benefit to future generations and society as a whole from wind energy development. For instance, as reported by Eltham et al. (2008), 59% of the population of St. Newlyn East (a village in the United Kingdom) in 1991 anticipated that the proposed nearby Carland Cross Wind Farm project would bring no positive environmental, social, or economic impact to the community. The project nonetheless went ahead and the wind facility was built in 1992. When asked about the issue again in 2006, only about 22% of residents shared that same pessimistic sentiment. Public stakeholders, then, may fail to recognize

even their own long-term self interest. Their behaviour is complex enough that they may project contradictory values regarding environmental issues, reporting pro-environmental attitudes in surveys and focus groups but being unwilling to change their own behaviours in practice (Owens and Driffill 2008). Consequently, the public may require unbiased information about complex issues in order to understand the true costs and benefits of any related government action. Because a mis-informed or under-informed public can result in social apathy or inappropriate pressures being put on political actors, it embodies a social barrier to environmental action.

2.2.6 Political Barriers

Possible problems with the decision-making processes or motivations of government actors would constitute political barriers. They are often identified by environmental interest groups as the primary obstacle to sustainability. For example, Bradshaw and Borchers (2000) argue that in comparison to the scientific realm, which is anticipatory and relies on replication for the legitimization of beliefs, government actors tend to operate on a more immediate time-scale and possess situational beliefs that change with the political climate under which they operate. The complexity of environmental issues tends to require long-term and consistent planning, which is something the political realm often struggles with. In the case of the United Kingdom, described by Mitchell and Connor (2004), renewable energy strategies have been in place since 1990 but suffer from a number of systemic policy issues: failure to solicit new contracts, failure to accommodate diversity, failure to create mentors, and failure to benefit small companies. Even though such policies were replaced by new support mechanisms in 2002, many of the problems persist. Because the time frame of government decision-making is closely tied to

election cycles, political actors tend to be focused on relatively short-term objectives and it is often difficult for governments to learn from such past mistakes.

Finally, because political actors may misunderstand the nature of scientific information, scientific uncertainty is often used as a reason to avoid making important environmental policy decisions; such rationale is an implicit endorsement of the status quo and arbitrarily protects business-as-usual strategies (Pollack 2007). Political barriers to environmental action, then, can entail tension with the scientific realm, inappropriate action on resource and environmental problems, and failure to address long-term issues due to stagnant decision-making processes.

2.2.7 Literature Gap

Any combination of the illustrated types of barriers could explain the difficulties in managing complexity for any given environmental issue. A range of causative factors is especially likely given the overlap between categories. For example, many concepts in the 'agreement' and 'knowledge' classifications appear under the 'social' and 'political' themes as well (e.g. the tension between scientific and political rationality), as public and government actors are likely to exemplify the harms of ignorance and controversy when they form their positions on environmental issues. Such intersections demonstrate that the collective literature on barriers to environmental action is generic, just as the AKTESP framework is flexible in its applicability. However, the broad nature of the lessons extracted from the existing literature means they cannot solve the challenges of managing complexity for any given environmental issue, but rather, provide a starting point for identifying and addressing barriers to action. Since there is no one-size-fits-all solution to resource and environmental challenges across the world, a local focus on a single issue is useful in generating practical solutions for bringing down such

obstacles, as demonstrated by the example of international dependence on fossil fuel. Demirbas et al. (2004) confirm, in their review of the global energy situation, that the choice between the various available energy technologies is strongly dependent on the local conditions of each country, while Reiche and Bechberger (2004) agree that each individual state must use its own appropriate promotion strategy to increase the use of renewable sources, a conclusion from their study on policy differences between EU members in meeting the EU renewable energy directive. Thus there is evidence that the international reliance on non-renewable energy sources is a problem but, due to its complexity, the solution cannot be global in scope – targeted, local analysis of renewable energy problems (and other resource and environmental problems) is an area requiring further academic work. As such, this paper will seek to use the local case study of large-scale wind energy in Saskatchewan to identify specific barriers to implementation in hopes that the local lessons uncovered will be applicable to other jurisdictions where the difficulties in managing complexity has led to similar inaction on resource and environmental issues.

2.3 Case Study: Barriers to Large-Scale Wind Energy Expansion in Saskatchewan

Saskatchewan is a western prairie province (Figure 2.1), covering 6.5% of Canada with an area of about 650 000 square km, which is comprised of prairie, boreal plains, boreal shield, and taiga shield ecozones. The climate is continental, characterized by wide-ranging seasonal temperatures and low precipitation. Its population was estimated at just over 1 million people in 2009 and is located largely in the southern (prairie) half of the province. Saskatchewan's economy, in recent years, has been characterized by rapid growth; the province led the nation in growth of real GDP per capita, growth of productivity (real GDP per employed person), growth of personal income, and growth of disposable income in 2008. This expanding economy is based

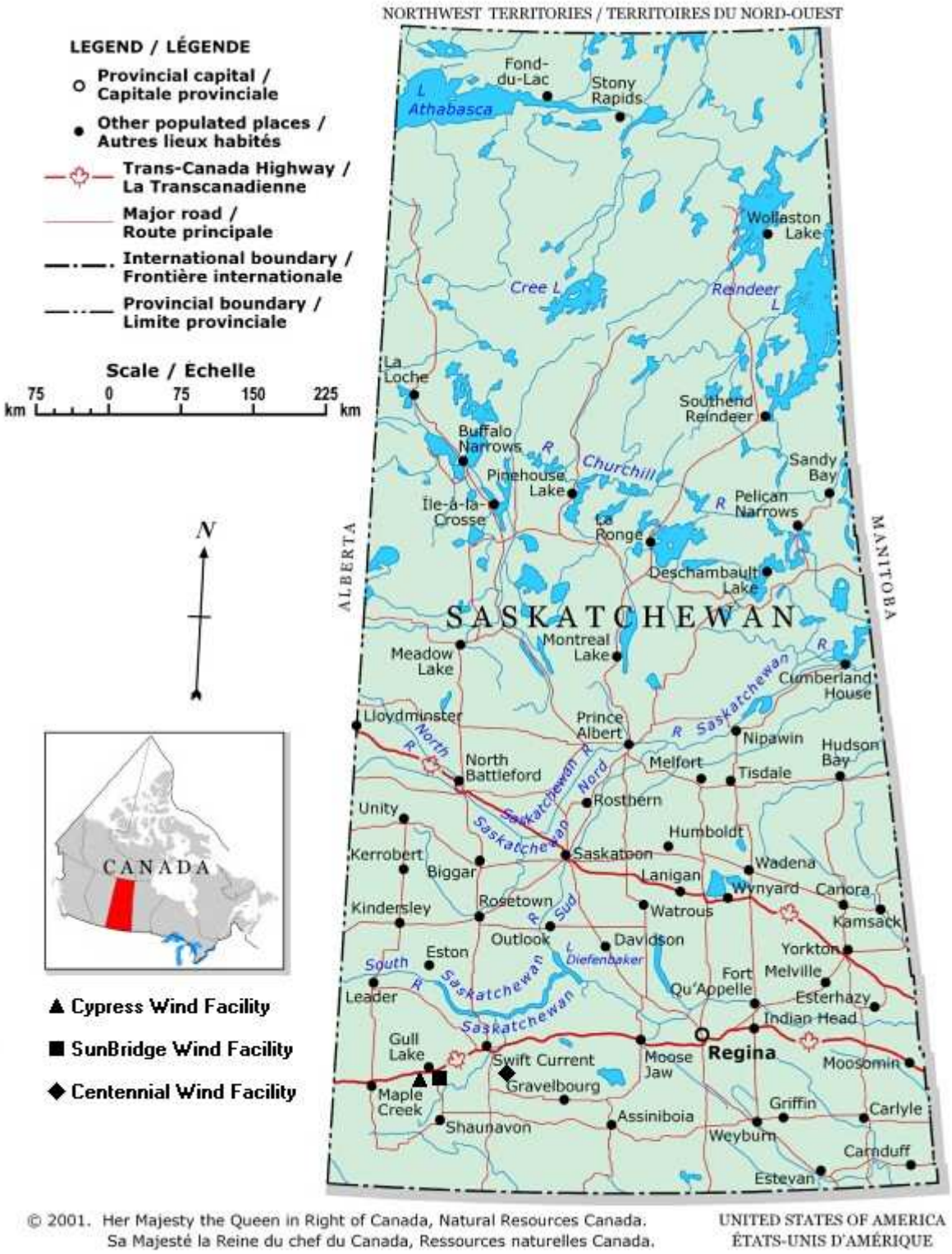

Figure 2.1 – Map of Saskatchewan Including Locations of Existing Wind Farms (http://atlas.nrcan.gc.ca/site/english/maps/reference/provincesterritories/saskatchewan, edited by the author)

primarily on the agriculture, mining, and petroleum industries (Government of Saskatchewan 2010). Because of the provincial economy's dependence on and success with non-renewable resources, the idea of shifting to a greater dependence on renewable energy may be especially controversial for Saskatchewan.

Saskatchewan's energy requirements are met by a range of non-renewable and renewable energy sources, including wind. The energy sources that comprise the province's electricity generation capacity of 3641 MW are 46% coal, 25% natural gas, 23% hydroelectric, 5% wind, and 1% other sources (SaskPower Environmental Programs 2009). The portion of Saskatchewan's electricity supply met by wind is provided by three wind farms located in the southwest region of the province (Figure 2.1): Saskpower's 11 MW Cypress facility constructed in 2002 and 2003, Suncor's and Enbridge's 11 MW Sunbridge facility constructed in 2002, and Saskpower's 150 MW Centennial facility constructed in 2006 (SaskPower 2010). The natural wind resource in Saskatchewan is rich enough that provincial wind farms can operate at an annual generating capacity of about 40%, a performance superior to that of turbines in most other areas of the world where the rate is 20 to 30% (Ibid). Thus, the province has a significant amount of large-scale wind energy potential. In fact, Saskatchewan's wind-generated electricity capacity of 5.30% is well ahead of the national average of 2.25% (CCEI 2010).

Provincial policymakers have often claimed that Saskatchewan leads Canada in the wind industry (see SaskPower 2010 and Prebble 2006). It is remarkable, then, that since the province's last wind farm was built in 2006, the country as a whole roughly doubled its wind energy generation capacity (CWEA 2010); Saskatchewan did not build any new wind farms during this period of unprecedented growth for the rest of the country. Like most other provinces, however, Saskatchewan does plan to expand its reliance on wind energy in the near future (Ibid) – the

province's Green Options Plan aims to add 200 MW more wind-generated capacity to its energy mix (Government of Saskatchewan 2009). Conversely, but perhaps more importantly, Saskatchewan's and Canada's use of wind energy pales in comparison to that of other countries – Spain, Germany, China, and the U.S. have established from 12.1% to 22.1% of their total generation capacity from wind power (GWEC 2010).

Lack of progress in the development of wind energy, then, is more of a Canada-wide problem than one that affects Saskatchewan in particular – the selection of this jurisdiction for a case study is mostly a matter of convenience. However, there are distinct gaps in the research regarding wind energy in Saskatchewan. Many related studies are poorly applicable, either being focused solely on the national level (e.g. Noble 2004) or curiously overlooking Saskatchewan when conducting provincial studies across Canada (e.g. Doern 2005). The local research that does exist has been government-initiated (e.g. Prebble 2006) and thus lacks academic scrutiny. Saskatchewan, then, is a suitable choice for a case study on barriers to large-scale wind energy development due to its unique research gap.

2.3.1 Methods

The research plan was designed to gather expert opinion regarding the identification and evaluation of barriers to large-scale wind energy development in Saskatchewan, facilitating an examination of the issue's inherent complexity. This study adopted an exploratory case study approach (Yin 1994) to wind energy barriers, where inductive, rather than deductive (hypothesis-driven), research was conducted. Broadly, a 'grounded theory' method was used, which involves three major phases: first, qualitative data regarding a phenomenon of interest are collected; second, the data are broken down, conceptualized, and put back together in new ways in a

process known as ‘coding’; finally, the resulting grounded theory should be faithful to the everyday reality of the phenomenon under study, be comprehensible, be abstract enough for application to a variety of issues related to the phenomenon, and be useful in guiding action addressing the phenomenon (Strauss and Corbin 1990). This method was used primarily because it is appropriate for case study research; it allows sufficient focus by examining a single case (or phenomenon) independently but generates findings that are broadly applicable to related issues, proposing future theories or policy implications. In addition, it permits the researcher to be creative and flexible during the process, adjusting data collection procedures to be more relevant as theory emerges (Ibid).

A document review and a set of semi-structured interviews comprised the first phase, the collection of data. A review of relevant documents regarding Saskatchewan’s large-scale wind energy situation was completed during the period of August 2009 to October 2009 to give the researcher sufficient background knowledge for completing the study. Publicly available (online) Government of Saskatchewan and SaskPower archives were searched for the term ‘wind energy’. New key terms that arose through this search (e.g. the government’s ‘Green Options Plan’ mentioned above) became the targets for additional searches, employing general internet search engines when necessary, until the researcher was knowledgeable about all terms of interest relevant to wind energy in Saskatchewan. The data provided pertinent excerpts, quotations, and information on Saskatchewan’s large-scale wind energy situation, assisting the planning and focus of the interview phase that followed (e.g. the interview questions were based on the researcher’s new understanding of the issue and the names of many potential interviewees were generated through the document review).

The bulk of the data collection process involved semi-structured interviews with wind energy experts and stakeholders recorded between October 2009 and February 2010. Interviews were an acceptable method for identifying barriers to further investment in Saskatchewan's wind energy industry. There is a lack of consensus regarding the most significant obstacles to resource and environmental issues like this one; interviews permit the discovery of multiple viewpoints and realities and allow the researcher to collect observations they could not make or have not made themselves (Stake 1995). Potential interviewees were identified from the core of the policy community surrounding the issue of large-scale wind energy in Saskatchewan, including decision-makers (members of crown corporations and the provincial government) and influential stakeholders (representatives of interest groups and private corporations, as well as academics) – Pross (1984) defines this inner segment of a policy community as the 'sub-government', the primary policymaking body in the particular field under study.

As such, during fieldwork, the researcher categorized wind energy experts and stakeholders into key groups of sub-government actors (i.e. academic, government, ENGO, and corporate) and efforts were made to contact a sufficient number of potential participants from each group to ensure diversity in the opinions collected. The use of semi-structured interviews allowed the researcher flexibility to deviate from the given structure in formulating new questions and determining the order of discussion topics (Sarantakos 1994). The interview process, then, was dynamic – although each interview was based largely on a pre-determined set of discussion topics (see appendix), some of the questions asked were based on findings in previous discussions in order to delve deeper into more complicated and controversial issues. Such evolution of qualitative research methods is consistent with the grounded theory approach (Glaser and Strauss 1967). The biggest obstacles encountered during the interview process were

varying response rates from the target groups and limited time for completing some of the interviews. These problems were dealt with through additional recruitment efforts targeted specifically at deficient groups and shifting interview focus to major points of discussion (i.e. whether Saskatchewan's investment in wind energy is appropriate and which barriers pose a problem for further development) respectively. The researcher contacted 37 potential interviewees and, in the end, was able to complete interviews with 18 participants: 5 academic, 3 government, 5 ENGO, and 5 corporate (Table 2.1).

Table 2.1 – Details on Interview Participants by Target Group

TARGET GROUP	RESPONDENT DETAILS
Academic	-an energy research initiatives advisor at a Saskatchewan university -a member of a government-owned research institute -an environmental economist at a Saskatchewan university -a director of energy-related institutes at a Saskatchewan university -an engineer from a Saskatchewan university studying wind power
Government	-a provincial Member of the Legislative Assembly serving on a committee investigating Saskatchewan's energy needs -two economists representing a provincial government ministry
ENGO	-a director of energy policy at a provincial ENGO -a member of a provincial ENGO who owns a small wind turbine -an energy conservation coordinator at a provincial ENGO -a director of energy awareness at a provincial ENGO -a research advisor at a provincial ENGO
Corporate	-a vice president of a private energy corporation with wind energy interests in Saskatchewan -an executive representing a private energy corporation with a wind energy project in Saskatchewan -two representatives of Saskatchewan's crown energy corporation -a representative of a subsidiary of the crown energy corporation

Interview responses were gathered and summarized under the themes discussed earlier (the AKTESP barriers) to complete the second phase of the grounded theory method: the coding process. By verifying collected qualitative information among different expert sources and making comparisons between the opinions under each theme, the researcher grouped the raw interview data into more accessible and understandable themes (Corbin and Strauss 2008); especially direct, interesting, or informative quotes were extracted from the interview recordings and organized under the themes for discussion. These conceptual themes, based on Trudgill (1990), were agreement, knowledge, technology, economic, social, and political barriers. Because the themes were derived from the literature before data was collected, this method would be considered a process of 'coding down' (Lockyer 2004). The coding down process allowed the researcher to be organized in his approach to the interviews, ensuring that each respondent spoke to a variety of potential barriers to wind energy expansion in Saskatchewan. The biggest challenge during this step was managing the sheer magnitude of interview data, which was accomplished by only extracting particularly relevant quotations instead of transcribing every word of discussion. This approach left the gamut of responses for any given topic grouped together so that they could be compared easily and analyzed collectively in generating grounded theory about complex obstacles to the accelerated implementation of Saskatchewan's large-scale wind energy, the third phase of the grounded theory method, which is presented in the following sections.

2.4 Results and Discussion: Lessons for Wind Energy Development in Saskatchewan

During the interview process, participants were first asked to describe the current state of affairs surrounding wind energy development in Saskatchewan and asked whether they thought

the current rate of development was appropriate. Questions then focused on potential 'AKTESP' barriers to wind energy expansion in the province; at the conclusion of the discussion of each type of barrier, interviewees were asked whether they thought that type of barrier had a significant negative effect on the rate of development.

There was no consensus amongst participants regarding whether the current rate of expansion of large-scale wind energy in the province was appropriate; the pool of respondents was fairly evenly divided on the question. Nonetheless, barriers to development were recognized by many participants, technological and political obstacles being cited the most often (Figure 2.2). Interestingly, respondents who thought the current rate of wind energy development was appropriate also tended to identify technology as a barrier, while interviewees holding the

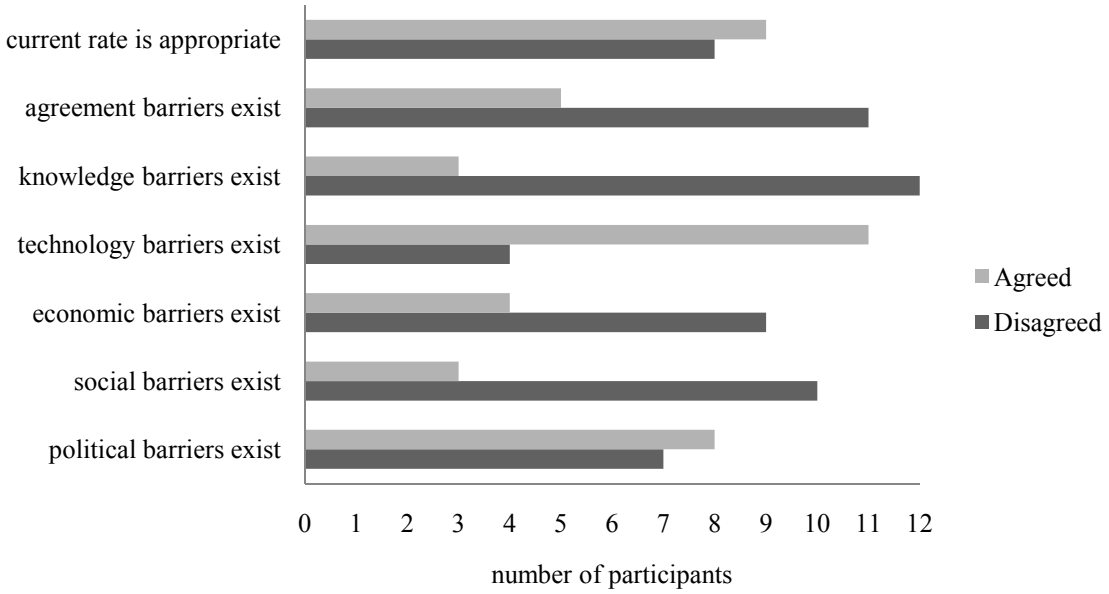

Figure 2.2 – Areas of Agreement and Disagreement among Interview Participants Regarding the Rate of Large-Scale Wind Energy Expansion in Saskatchewan and Potential Barriers to Further Development.*

* The histogram shows how many participants agreed and disagreed with each statement during the interview process – note that while 18 people were interviewed the responses do not always add up to 18 for each statement since each respondent was not asked and did not answer every question and some had neutral opinions on certain statements.

opinion that current expansion was insufficient usually agreed that definite political barriers existed. Thus the participants could largely be divided into two major groups that essentially held opposing viewpoints. Each of the barriers addressed (agreement, knowledge, technology, economic, social, and political) is discussed further in the sections that follow.

2.4.1 Disagreement Regarding the Balance between Environment and Economy

While few interviewees (i.e. 5) identified agreement as a definite barrier to further development, those that did shared some convincing observations. As one provincial government representative put it: "there's not yet agreement on an analytical framework necessarily between those who are advocates of wind power versus those who may have responsibilities associated with the production of energy in Saskatchewan". Essentially, the experts and stakeholders involved with wind energy decision-making in Saskatchewan have not come to a consensus on how exactly those decisions should be made. Many aspects of this issue come down to subjective questions of value (e.g. "Are short-term benefits more important than long-term benefits?" or "Is the environment more important than the economy?") to which proponents on both sides of the debate may have completely reasonable yet entirely different answers. For example, one interviewee from a provincial ENGO argued that "you hear politicians talking about the need to balance environment against economy – and what I always feel is – no, these are not two things that you weigh against each other; you design your economy in such a way that it is environmentally sustainable" while another from a provincial crown corporation stated that "it's a balancing act between what's right for the environment and how much are we willing to pay as customers for everything that we do". There exists conflict between the philosophies of these

experts on the issue of wind energy, which may impede the consensus and decision-making processes required to move forward.

2.4.2 Contradictory Knowledge about the Benefits of Wind Energy

While knowledge was another area under which few respondents (i.e. 3) thought definite barriers existed, some of the comments demonstrate that misinformation can be a problem for experts who have made assumptions or non-experts who have poorer access to information sources. The example of wind turbine performance was put forward by one provincial government interviewee as an area of confusion: "It was brought up in our committee, through our presentations – one claim that once it got to be minus 30, that the wind generation had to be shut down – whereas another presenter said 'no, that was not true, no, they could operate in colder temperatures'". In this example, experts are disagreeing about questions that have objective answers; either the turbines shut down at -30°C or they do not. Such discrepancies are thus the result of misinformation, miscommunication, or misunderstanding instead of a difference in values. One participant from a provincial ENGO confirmed that the problem exists among the general public: "If they don't feel they have enough facts and figures to engage in a conversation then they're just going to form an opinion based on the small pieces of information that they already have stuck in the back of their mind – and so there needs to be some broad education first and then a consultation process would be excellent". Misinformation can, then, be exaggerated and gain arbitrary validity as it is repeated from person to person. However, ignorance is not only a problem among laypeople; experts can repeat and validate flawed assumptions as well. For example, while it is generally accepted that the implementation of renewable energy will substantially reduce global greenhouse gas emissions (as described in the

introduction to this paper), one academic researcher noted that "when we look at some of the European countries, the wind energy is not reducing greenhouse gases by a very large amount – that's true of Germany – in fact there are even papers coming out that say the effect is actually negative". As such, tension exists within information being distributed as fact by experts as well as the public, even though objective questions like these can only have one correct answer in a given jurisdiction.

2.4.3 Conflicting Faith in Technology to Accommodate High Levels of Wind Energy

Most participants (i.e. 11) agreed that technology-related challenges were a barrier to further wind energy development in Saskatchewan, but there was significant controversy over how easy it would be to accommodate such challenges. Everyone concurred that the intermittent nature of wind was the major disadvantage to wind energy; electricity must be used as soon as it is generated and the amount of electricity generated by a wind farm is not consistent over time – to be useful, wind energy must either be paired with more flexible energy sources that can rapidly ramp their production up and down or tied to other jurisdictions that can buy and sell energy to accommodate the fluctuations. Likewise, the respondents largely agreed that if effective and affordable storage technology could be developed, it would be a big step in making wind energy more manageable. One provincial crown corporation representative demonstrated the intermittency issues that come from having increasing amounts of wind energy on the power grid with no way to store the produced electricity: "We have had times now in the past years where because of the load being low enough and our tie-lines not being available that we've had to curtail our own wind – so there's been no place for us to put the electricity". So the disagreement was not over whether these technical obstacles to wind energy expansion exist, but

whether they can easily be dealt with and whether they provide good reason not to accelerate the province's rate of wind energy development. Demonstrating this conflict, one respondent from a provincial ENGO established that "the power corporation has failed to really examine what has been done in countries like Spain and Denmark in terms of achieving integration at high levels ... obviously they are in a different situation in the sense that they are on a European grid where they can move electricity back and forwards more easily – but if the Spanish can get up to 20% [energy capacity met by wind energy] and in areas of their country up to 30% and if the Danes can get 18%, surely we can figure out how to get 10%". Another participant from a provincial ministry pointed out, in response to this concern, that "Denmark benefits from having a large integration with the rest of Scandinavia so that if you treat the whole of Scandinavia as a single grid – including, of course, opportunities to trade with Germany as well as Poland – that Denmark actually, in that larger region, doesn't really have that high a percentage of wind power". The issue of technology, then, suffers from the same expert controversy over facts as described in the above section on knowledge barriers, though areas of consensus do exist.

2.4.4 Unquantified Non-Economic Benefits of Wind Energy

Many interviewees (i.e. 9) agreed that economic barriers to the further development of wind energy did not exist in Saskatchewan; the kWh cost of wind-generated electricity was seen as largely competitive with the province's traditional sources of energy. Respondents saw wind energy technology as relatively economically competitive under the status quo, but argued that if the costs of mitigating emissions were considered more important (e.g. more expensive CO_2 capture technology or 'clean coal' had to be used instead of traditional coal combustion), wind farms would actually be one of the cheapest energy investments. This situation would arise under

a carbon pricing system such as a federal tax or cap-and-trade policy that makes it more expensive to emit greenhouse gases. For example, one interviewee from academia compared wind to coal, noting: "Wind is probably at the moment a little more expensive still than coal-fired electrical generation with no capture – I don't have SaskPower's cost numbers but my guess is if we were to compare wind to coal-fired electrical generation with CO_2 capture, that wind would probably look pretty good". Another participant's comment illustrates the potential importance of such regulations from an ENGO perspective: "Our motivation to do this [rapidly expand our wind energy] should be really high, because we are going to be penalized for our coal resource – sooner or later we're going to end up paying some kind of a tax through the power corporation on the greenhouse gas emissions associated with our coal-fired generating stations". So perhaps the largest economic barrier is that the future of carbon pricing is unclear, as one government interviewee explained: "if the federal government came and said it's X amount of dollars per tonne of CO_2, it would be a whole lot easier to figure some of these things out – but we don't know". The environmental benefits of wind energy, such as low emissions and low resource use, are unlikely to factor into energy decisions until carbon pricing creates an incentive to consider such characteristics more genuinely.

2.4.5 Lack of Social Interest in and Support for Wind Energy

Social factors were not identified as barriers to wind energy expansion by a majority of respondents (i.e. only 3 identified definite social barriers). Most argued that wind farms are generally accepted by the public at large and near the project site, especially in a region like Saskatchewan with abundant rural land area where they can be located without encroaching on high-density populations. For example, one academic researcher described the public's positive

response to wind energy as follows: “For a nuclear plant, for example, to get everybody who is within the affected area to agree on it is probably almost impossible – whereas with wind – especially if you put up a community wind project – where the community actually owns a share in the turbine – it can be a model that works very well for getting community buy-in”. Another interviewee from a private energy corporation explained that “[In] Alberta or Saskatchewan or Manitoba – you don’t tend to hear as much stakeholder concern, you tend to get landowners that welcome the supplemental income – because of the broader density where wind-farms are being placed, you typically don’t see the noise issues that you’d see in Ontario”. The one social issue that a few respondents identified as a problem was a lack of public interest and engagement with the issue. One participant from government said “I’m just not totally positive that the public is all that concerned – they go in and they flip their light-switch on in the morning and the power is there – and I don’t think – until the day that they flip the light-switch on and the power doesn’t come on – the light doesn’t come on – then they become concerned”. While the public may not oppose wind energy, a substantial lack of public support may limit opportunities for expansion. For instance, discussion over the subjective value questions described in the agreement section is unlikely to occur without public pressure and debate demonstrating their importance.

2.4.6 Lagging Provincial Political Leadership on the Issue of Wind Energy

Similar to technology, political barriers and opportunities were topics of significant controversy, with roughly half of the participants (i.e. 8) agreeing that political issues were barriers to wind energy expansion in Saskatchewan. While some respondents felt that the level of government action was appropriate given the uncertainty of the intermittency problem, many felt it would be prudent for the government to take the lead in initiating more rapid development of

wind energy; there was an implicit criticism of the provincial government's lack of leadership on renewable energy. For example, one representative of a private energy corporation argued that "the rate of development – it starts with how the government perceives its platform on renewable energy and jobs as a strong policy tool ... Ontario took a position of developing strong policy and, politically, it was reinforced and supported – and so the framework to incorporate wind energy in that province had strength and momentum behind it – and, as a result, there's a lot of activity and energy going into the province" while another from a Saskatchewan university pointed out that "there was a federal Wind Power Purchase Initiative ... the federal government said to SaskPower and the provincial government 'we want to buy wind power, here is some money to build a wind farm so that we can buy wind power for our buildings in Saskatchewan' ... so if it hadn't been for that, we may or may not have seen the first wind farm in Saskatchewan". The interviews, then, revealed that there is room for improvement in Saskatchewan's reactive environmental policy, although some participants noted that politicians may be responding to a disinterested public that is more concerned with economic prosperity than environmental integrity. For instance, an interviewee from a provincial ENGO indicated that "in Saskatchewan, a lot of people's jobs rely on the energy and resource sector – resource extraction – so they see that as more important – the short-term economic needs are probably a priority for them right now". Collectively, respondents demonstrated that increased political momentum surrounding wind energy might not only lead the development of wind energy in Saskatchewan, but also encourage public interest in the issue.

2.5 Implications for Managing Inherent Environmental Complexity

While Saskatchewan experiences some of its own unique resource and environmental problems, the challenge of environmental sustainability is, at its centre, a global issue. The purpose of this paper was to illustrate the problems associated with complexity inherent to environmental issues as directly dealt with by policymakers and influential actors, using large-scale wind energy in Saskatchewan as a case study. As such, the lessons identified from observing Saskatchewan's situation can act as a springboard for generating intuitive solutions to wind energy implementation barriers in Saskatchewan itself and also developing grounded theory for managing the inherent complexity of environmental issues in other regions. Each of the lessons in the previous section thus gives rise to implications for environmental action in all jurisdictions. While the specific lessons will not apply to every resource and environmental problem in every jurisdiction, the following discussion of implications can be used as a guideline for identifying and addressing obstacles to environmental inaction in general.

First, value-based disagreement is a common characteristic of many policy issues – the fact that political parties subscribing to different moral ideologies exist is a testament to that reality. In such cases, opposing sides may never agree because their decisions are made on completely different criteria. However, this stalemate does not mean the problem of disagreement cannot be addressed. As with discourse between political parties, an educated public could democratically decide which set of values best reflects the opinion of society, using such a metric to determine the 'correct' side of a subjective debate. While it would be impractical to hold a referendum on issues as minor as the rate of wind energy development in Saskatchewan, it would be beneficial, in terms of addressing the disagreement barrier, to solicit public opinion on the matter through public hearings or surveys. Alternatively, larger questions

that involve other issues in addition to wind energy, such as “What is the value of a clean environment?” or “What should the province’s goal for greenhouse gas reductions be?” might warrant more substantial initiatives. In general, if decision-makers or experts cannot agree on a set of subjective values for deciding a complex environmental question (e.g. “What is the value of a clean environment?”), public opinion can be used to democratically decide the answer so that the process can move forward without arbitrary debate over irreconcilable differences in opinion, even though consensus is not attained.

Second, because incorrect information can be taken as fact and perpetuated if it fits with the personal biases of the recipient (see Teel et al. 2006), broad public education is a potential solution to knowledge barriers. Experts and decision-makers would benefit from pre-empting the myths and fabrications perpetuated through the media and everyday conversation by distributing transparent information of their own about wind energy; clear explanations that cite reputable sources should hold more credibility in the public eye. That being said, experts would first have to reconcile any discrepancies within scientific and academic understandings of the wind energy issue. In fact, several respondents thought that wind energy research in Saskatchewan needed to be better coordinated among the involved parties. Such clarification could likely be achieved best through a collaborative process between various experts such as a task force or workshop, where the sources for competing claims are examined and the truth is determined where possible. Note that the answers to some objective questions (e.g. ones that are predictive in nature) cannot truly be determined, but in these cases the group of experts could distribute all interpretations, acknowledging they do not know the answer to avoid tension within the information. Broadly, if an environmental question is surrounded by misinformation or misunderstanding (i.e. there is disagreement on objective questions), broad public education facilitated by diverse experts who

reconcile competing information might be used to pre-empt myths and exaggerated facts spread by the media and word-of-mouth among the general public.

Third, resolving technology barriers involves, in part, deliberation among experts with diverse areas of experience to uncover what is really known about the challenges of accommodating wind energy intermittency. If it turns out that such barriers do have viable solutions being used in other jurisdictions (e.g. what methods are the U.S., China, Germany, and Spain using to achieve higher levels of penetration?), such approaches will have to be investigated and brought to the province. Many potential and theoretical technological opportunities were indeed identified throughout the interviews. For the case of wind energy, decision-makers may need to examine other jurisdictions to gain insight regarding more efficient transmission lines, viable storage technology, open energy trade agreements, smart grid technology, diversified wind farm locations, more modern grid infrastructure, and other innovations that might help address the intermittency problem. Generally, if stakeholders disagree over the capabilities of an environmental technology, similar to the knowledge barriers, experts could assist with the reconciliation of competing understandings, which may involve investigating different technological applications and visiting jurisdictions that have more experience with them.

Fourth, while the lack of a federal carbon pricing strategy is not something that Saskatchewan decision-makers have much control over, some intuitive solutions to the problem do exist. Provincial policymakers could, for example, put additional pressure on the federal government to make their plans regarding carbon pricing clearer and more forthright. In addition, if Saskatchewan experts are confident that a federal policy in that regard will be put forward sooner or later, pre-emptively implementing carbon pricing on a provincial level (note that such

a policy has already been put into place in the province of British Columbia – see Meissner 2009) would make environmental decision-making easier in the meantime and facilitate transition when national regulation is implemented. Moreover, all jurisdictions must be involved with environmental action for it to be successful, so it may behove Saskatchewan to take on a leadership role with regards to reducing greenhouse gas emissions instead of waiting for the federal government to tell the province what it needs to do. Broadly, if more environmentally friendly practices, such as the use of renewable energy, cannot compete properly with traditional industries because their non-monetary benefits (e.g. lower environmental impact, lower resource use) are not considered in their price, the jurisdiction should implement appropriate pricing strategies (e.g. carbon taxation or cap-and-trade) or put pressure on higher levels of government to initiate or clarify plans for broader pricing policies.

Fifth, because the benefits of environmental initiatives like wind energy development may, due to their long-term focus, seem obscure to any given member of the public (see Marx et al. 2007), public engagement might be increased through increased expert- or government-directed exposure of the wind energy issue and providing more opportunities for public consultation and education. Even though many interviewees in this study did not see the lack of social support as important, it may be precisely that sentiment that leads to poor engagement between decision-makers and the public. A change in tone that sees the public as an important actor in wind energy decisions may increase social support for wind energy and open up new opportunities for expansion. For instance, it may give politicians an incentive to look more seriously at broader greenhouse gas reduction strategies or carbon pricing initiatives if they can garner public support by doing so. In general, if the public is disengaged with a resource or environmental question and there is thus no momentum behind the issue, experts and decision-

makers should facilitate public participation (e.g. through town-hall meetings or educational campaigns), viewing the general public as an important stakeholder on such issues.

Sixth, while the solutions suggested in the above sections could help address some of the political controversy over the wind energy question, the provincial government might nonetheless benefit from being more active with regards to renewable energy. Given that Saskatchewan policymakers had to be prodded by the Government of Canada to start wind energy development to begin with and, in addition, expect the federal government to push them into a carbon-pricing policy, there may be planning benefits if the province adopts a proactive approach to the issue of wind energy, emulating the leadership of Ontario and British Columbia. Like under the theme of technology, decision-makers can visit and learn from jurisdictions that have been more active and successful in expanding the implementation of renewable energy. Specific policy ideas resulting from the interview process that could be investigated include: provincial carbon pricing (e.g. British Columbia's carbon tax), standing offers for private developers (e.g. the province of Ontario's feed-in tariff program where independent producers can sell any amount of electricity to the Ontario Power Authority at a fixed price), renewable energy capacity targets (e.g. Ontario's renewable portfolio standard), and more frequent requests for proposals from private developers to partner with provincial crown corporations (e.g. a regular 2-year cycle as in British Columbia). Also, because the public seems to notice government activity more than inactivity, the more the provincial government visibly pursues initiatives like these ones, the more the public will necessarily become involved with them. Generally, if the political decision-makers in a jurisdiction are largely reactive towards an environmental question, waiting until the related technology is inexpensive or until a higher level of government forces them to take action before doing so, they might benefit from a more

leadership-centred orientation. Note, however, that they can simplify decisions by emulating the successful policies of jurisdictions who have dealt with similar questions.

While each of the above lessons could be extrapolated individually for application to any given resource or environmental question, many of the specific barriers are highly correlated to one another (e.g. the public may be disinterested because misinformation is making the issue difficult to access) and would benefit from broader solutions. As such, the individual lessons can be synthesized into two simpler, more general steps to the resolution of renewable energy or other environmental policy questions. The first step is to seek experience from jurisdictions dealing with similar problems, utilizing their expertise in the successful application of policy or technology. One ENGO participant in the case study interviews had spoken to people in the wind power field in Denmark and noted that they also started out very cautiously with wind energy, like the power-producers in Saskatchewan, but were pleasantly surprised at how much wind they were able to integrate into the power grid. This step avoids the repetition of research that has already been completed elsewhere, can resolve some speculative disputes over objective questions, provides a better understanding of how the relevant technology can be applied and afforded, and makes it easier for decision-makers to take action using existing policies to model their approach. As such, it may address a number of knowledge, technological, economic, and political barriers. The second step is to carry out a consultation process that involves experts reconciling competing information, distributing that synthesis to the public, and then asking the public for feedback on subjective questions. One interviewee from academia felt that a rational debate quantifying the pros and cons of different energy options and cutting through the rhetoric of the issue would substantially benefit the wind energy discussion. This step involves the public, reconciles contradictory information, answers subjective questions (such as how to quantify the

non-monetary costs of renewable energy sources), and gives guidance to policymakers. It thus deals, in part, with agreement, knowledge, social, and political barriers. This two-pronged lesson is based on specific findings in the local context of Saskatchewan but is general enough to shed light on potential solutions for a variety of environmental problems in different jurisdictions.

2.5.1 Conclusion

In conclusion, because environmental sustainability is a global issue, it requires global solutions, methods that are practically applicable to a wide range of renewable energy problems across diverse regions. The existing literature on the subject proposes solutions that are too narrow, referring only to the problems of one jurisdiction (i.e. not applicable enough), or too broad, suggesting theoretical solutions to apply to all resource and environmental problems (i.e. not practical enough). A balance between the two is needed. This paper identified the specific obstacles to implementation for wind energy in Saskatchewan and then extrapolated intuitive solutions for addressing them. These approaches have been synthesized into more general grounded theory that is likely applicable, in part, to other jurisdictions and environmental issues. The implications discussed in this paper can, then, contribute to our broader understanding of environmental policy barriers in both a practical and applicable manner.

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2.7 Appendix (set of interview topics distributed to potential interviewees)

Questions/topics covered will vary by participant, depending on the nature of their involvement with Saskatchewan's wind energy development. On average, interviews are expected to last 30 minutes to 1 hour.

Current state of affairs

-describe the policies and mandate of your organization/position concerning wind energy
-describe the involvement of your organization/your involvement with wind energy in SK
-describe any major obstacles your organization has/you have encountered with fulfilling your policies/mandate with regards to wind energy to date
-what is your opinion of the current state of large-scale wind energy in SK?
-why is SK in that state right now?

Themes

-I'm going to ask you about six different themes concerning further development
-they are 'agreement', 'knowledge', 'technology', 'economics', 'social perception', and 'political will'

Agreement

-what do you see as the main costs and benefits of wind energy development?
-what is the level of agreement (among involved parties) regarding the costs and benefits of wind energy?
-what is the level of agreement (among involved parties) regarding how to proceed with wind energy?
-how do these issues affect the rate of wind energy development in Saskatchewan?

Knowledge

-what is the level of knowledge and education (among involved parties) about wind energy in Saskatchewan? (i.e. are groups displaying informed or misinformed opinions?)
-how would you describe the current level of research (among involved parties) regarding wind energy?
-how do these issues affect the rate of wind energy development in Saskatchewan?

Technology

-how would you describe the province's current state of technology to support wind energy development or expansion?
-is there sufficient technology to make wind energy comparable to or competitive with the major alternatives? Explain.
-is there sufficient technology for integrating wind with the existing grid? Explain.
-are there other major technological opportunities or limitations to wind energy development in Saskatchewan? Explain.
-how do these issues affect the rate of wind energy development in Saskatchewan?

Economic

-what are the major economic obstacles to and drivers for wind energy expansion?
-is wind energy cost-competitive with other energy options? Explain.
-how affordable is the capital investment required to implement further wind farms?
-how do these issues affect the rate of wind energy development in Saskatchewan?

Social

-does the general public understand wind energy development environmentally, technologically, and economically? Explain.
-how does the general public perceive Saskatchewan's current course of wind energy development?
-how has the public been consulted on decisions regarding current wind energy projects and prospects for future development and investment?
-how do these issues affect the rate of wind energy development in Saskatchewan?

Political

-how would you describe the current state of policy development/goal-setting regarding wind energy development?
-is there political will (and follow-through) for wind energy decisions? Explain.
-are there political considerations that preclude wind energy development? Explain.
-does the nature of Saskatchewan's relevant institutions (e.g. SaskPower) facilitate or constrain wind energy development? Explain.
-how do these issues affect the rate of wind energy development in Saskatchewan?

Other

-are there any other major barriers to wind energy expansion in SK? Explain.

Barrier assessment

-which is the single most significant barrier to wind energy expansion that should first be addressed? Explain.
-in which area is the most progress being made? Explain.

Wrap-Up

-do you have any other comments to make on this issue? Explain.

CHAPTER 3

THE COMPLEXITY OF PUBLIC ENVIRONMENTAL POLICY INFORMATION: A CASE STUDY OF LARGE-SCALE WIND ENERGY IN SASKATCHEWAN

3.1 Introduction

Environmental issues, such as climate change, are often wrought with controversy and ambiguity. They are frequently surrounded by diverse special interests and conflicting opinions compounded by the uncertainty that is characteristic of scientific evidence (Bradshaw and Borchers 2000). Concrete action on such issues is thus likely to occur only if scientists, policymakers, and members of the public are able to grapple successfully with complex information. The more synthesis and simplification of evidence that stakeholders and decision-makers are required to carry out unaided, the more likely it is that they will be able to interpret information broadly and subjectively and the less likely it is that an educated decision will be reached (see Teel et al. 2006, Wilson and Anderson 2006). It stands to reason, then, that information complexity is a substantial barrier to environmental action, and may explain, in part, why global society has experienced such difficulty in meeting long-term sustainability requirements.

Three major groups of actors are usually included in the process of information exchange to address environmental problems: scientists, the producers and verifiers of knowledge (note that this definition includes social scientists as well as non-academic experts); policymakers, the actors involved directly with political decision-making; and the public, individuals operating

in the social arena where policies are implemented (Bäckstrand 2003, Garvin 2001). These groups collectively form a policy community (Pross 1984). While knowledge transfer may occur directly between any of these major groups, a number of other actors complicate the process while facilitating the distribution of information. Groups with specific environmental or economic interests and the mass media, for example, may, purposefully or through their own misunderstanding, ignore the public interest, provide low quality information, exaggerate controversy, and foster bias for influential stakeholders (Boykoff 2008, Boykoff and Boykoff 2004, Miljan et al. 2000, Skodvin and Skjaerseth 2001, Wilson 2000).

The two-way interactions between each of the key groups of actors, however, contribute to information complexity and the resultant lack of action on environmental issues in their own intrinsic ways. For example, problems that characterize the knowledge divide between scientists and policymakers include: disagreement on acceptable levels of certainty, scientific uncertainty leading to false debate among politicians and being used to delay important decisions, environmental science being vulnerable to politicization, and scientists abusing their authority to advance personal agendas (Bradshaw and Borchers 2000, Pielke 2007, Pollack 2007, Sarewitz 2004, Wilson and Anderson 2006). Similar issues persist within the divide between scientists and the public: laypeople interpreting data incorrectly, the perception that science will develop miraculous solutions to environmental problems, discord between analytical and experiential processing, and difficulty in engaging the public with technical information (Bent et al. 2002, Gilovich 1991, Irwin 2007, Marx et al. 2007, Stern 2005). Finally, the divide between policymakers and the public is problematic as well: even as political controversy can lead to arbitrary public opinion the government is expected to provide objective public information, but such initiatives have often failed to engage the public who may continue to have poor access to

policy information (Kavanaugh et al. 2008, Lorenzoni et al. 2007, Owens and Driffill 2008, Teel et al. 2006). Not only is this last interaction examined the least in environmental management literature (see IPCC 2007), the existing studies fail to agree on a solution to the problem.

The purpose of this paper is to illustrate the problems associated with the complexity of information surrounding environmental issues as dealt with by the attentive public. This purpose is accomplished using a case study of policy information on large-scale wind energy development in the Canadian province of Saskatchewan. In the section that follows, relationships between scientists, policymakers, and the public, as described by the environmental management literature, are explored in greater detail. Then an overview of wind energy in Saskatchewan is provided, followed by an analysis of the complexity of related policy information and communication. This paper concludes with a discussion of the broader implications for simplifying environmental policy information.

3.2 Key Actors: Scientists, Policymakers, and the Public

Pross' (1984) concept of a policy community consists of two major segments: the sub-government (the primary policymaking body in the particular field under study – it is made up primarily of policymakers but also includes influential stakeholders such as scientists at the periphery) and the attentive public (those who do not participate directly in policymaking but rather, maintain a perpetual review of the policy process). This model is further broken down by the environmental management literature to be more applicable to resource and environmental problems; the division of information-consuming actors into the three groups of scientists, policymakers, and the public is a commonly used framework. Garvin (2001), for example, examines the different types of epistemology among these same three groups in the field of

environment and health risk analysis, concluding that each group possesses a different yet equally legitimate type of rationality; scientists are defined as those working within the arena of science as knowledge producers and validators, policymakers as those engaged in the decision-making process (elected officials, bureaucrats, technocrats, and consultants), and the public as the groups and individuals operating in the social world. A similar framework is used by Bäckstrand (2003), who illustrates that international discussions on sustainability have traditionally focused on only the relationship between scientists and policymakers. She argues that citizens need to be included as a third group of actors, the triangular interaction between the three groups being the most appropriate way to understand the exchange of environmental information. It is precisely these three groups and their interactions on which this paper focuses.

3.2.1 Facilitating Actors

Before discussing the two-way exchange between each pair of the three key actor groups, it is important to understand that such interaction is not always direct. Other actor groups, such as the mass media, may take charge of facilitating the distribution of information among the three key groups, leading to a number of complexity-related problems. For example, Miljan et al. (2000) argue that the primary goal of any individual media outlet is to sustain the interest of their audience, which requires dramatization, shock, controversy, and personalization. As such, the quality of information reported is often compromised through mistaken emphasis on unavoidable risk, falsely alleged unanimity, use of dubious sources (e.g. relying on interest group releases instead of reputable scientific sources), and ignoring or downplaying contrary evidence. Some of these claims are supported by the works of Boykoff and Boykoff (2004) and Boykoff (2008); content analyses of United States newspapers and television news broadcasts determined that

most media outlets follow a norm of 'balanced reporting' on the issue of climate change. That is, to entertain their subscribers, the media portrays anthropogenic climate change as a controversial subject with half of the experts on each side of the debate even though the vast majority of scientists have come to a consensus on the matter. Also, Wilson (2000) confirms the problem of dubious sources with the results of a survey asking where news reporters acquire their facts about climate change. It was found that other newspapers were the dominant source for information (37%), even more so than the primary sources of scientific journals and interviews with scientists (35%). Thus the media's self-interest, or its own challenges in acquiring scientific information, can compromise the quality of communication, requiring information-consumers to process complex data in order to reach an educated opinion.

In addition to the media, influential interest groups may also seek to put their own interests above society's interest in objective information. Large oil companies, for instance, as detailed in Skodvin and Skjaerseth (2001), have an interest in preventing climate change legislation that would require them to meet stringent emission standards and resulting in a loss of profit – they also possess the resources required to lobby for such interests. For example, ExxonMobil has invested substantial resources in augmenting the climate change debate since the 1980s, sowing seeds of doubt about the conclusions of climate scientists like those involved with the IPCC (Ibid). Influential stakeholders are able to introduce biased information into the decision-making arena, adding complexity to the exchange of knowledge between the three key actor groups. When analyzing the exchange between the key actor groups it should be noted, then, that facilitating actors such as the media and influential stakeholders may, intentionally or accidentally, compound or be entirely responsible for some problems with communication.

3.2.2 The Science-Policy Divide

The first of the two-way interactions between the three key actor groups is between scientists and policymakers. Many policy types, such as environmental or health regulation, must necessarily be based on scientific findings. The interaction of science with policy is thus very important and problems with the related exchange of information can lead to poor decision-making. Wilson and Anderson (2006), for example, illustrate that scientists and policymakers have different understandings of acceptable levels of uncertainty, which leads to arbitrary political debate based on seemingly contradictory scientific evidence; in the current discussion over clean air legislation in the U.S. those who support stricter standards cite epidemiology studies while those who resist them cite studies in toxicology. Epidemiologists and toxicologists make very different conclusions about the effects of air pollution, even though both use sound science; uncertainty is thus a normal part of the scientific method, so scientific conclusions should not automatically be taken as absolute fact. On the other hand, scientific uncertainty can also be abused by policymakers as an excuse to avoid making important policy decisions, as argued by Pollack (2007). Not only can the misunderstandings between science and policy lead arbitrarily to excessive or insufficient action, but policymakers can politicize scientific information, abusing it for their own gains. Sarewitz (2004) posits that politicians may first subscribe to value-based normative frameworks or ethical positions and then look for positive scientific evidence to support their position, instead of gathering information and then forming an opinion. Hence there are a number of problems with the current methods of information exchange between scientists and policymakers.

However, the related literature has extensively examined potential solutions to the science-policy divide. Pielke (2007), for example, argues that scientists can take on a number of

archetypical roles when communicating information to policymakers: the pure scientist, the science arbiter, the issue advocate, and the honest broker. The first three are the roles that traditionally cause decision-making problems because they either convey insufficient understanding of the scientific method or they abuse expert authority to support their own subjective values. Pielke proposes the honest broker role as a solution, where the scientist clarifies the possible options and lets the policymaker carry out the ultimate decision. In concert, while Bradshaw and Borchers (2000) accept the discord between political and scientific understandings of certainty, they suggest that a policy framework which accommodates the full scope of expert predictions will address the problem. Overall, the science-policy divide is addressed fairly comprehensively in the related body of literature, and plausible solutions to the major problems have been suggested.

3.2.3 The Science-Public Divide

Information exchange between scientists and members of the public is the second of the two-way interactions between the three key groups. Scientific findings often suggest changes at the individual behavioural level (e.g. asking households to reduce the cosmetic use of lawn pesticides so that fewer chemicals enter surrounding waterways through sewer runoff) and if changes are suggested at a broader social level, democracy still requires the support of the public for policy to be successful. So the science-public interaction is also important and is subject to its own failings. Gilovich (1991) shows that flaws in individual human rationality can lead to seeing statistical trends where there are none, over-interpreting incomplete data, biased evaluation based on expectation or desire, over-reliance on second-hand information, and imagining the agreement of others; laypeople often misunderstand scientific findings. Science also tends to rely

on analytical information processing, whereas the public uses experiential modes of processing, as illustrated by Marx et al. (2007) in a review of climate change forecasting information. The public tends not to act on scientific predictions, but rather in reaction to anecdotal events that evoke an emotional response. Because the interpretation of data is different between scientists and laypeople, Bent et al. (2002) argue that people may place an unrealistic expectation on science to solve critical problems without public involvement; the warnings of scientists are systemically ignored. It is no surprise, then, that Irwin (2007) contends engaging with the public about science and technology concerns is difficult for policymakers. He states that governments will fail to harvest public support for policy issues that include a science component if public attitudes, values, and interests are not weighed alongside science in an open, transparent way. In this case, laypeople see public opinion and scientific information as opposing forces, which makes the science-public divide even more apparent. The interaction between scientists and members of the public is thus complicated by many factors.

Approaches to mitigate the negative effects of such factors have also been suggested in the body of related literature. Stern (2005), exemplifying the coverage of solutions to the science-public divide in the literature, suggests various methods of deliberation to facilitate better public discourse about environmental science and problem-solving. He recommends that governments take an experimental approach to the following guidelines in maintaining effective interaction between scientists and the public: commitment to scientific quality, broad-based participation, transparency of deliberative processes, explicit attention to values, and rules for closure and reconsideration. The science-public exchange of information is addressed, at least in part, by existing academic literature, including viable solutions to the various problems identified.

3.2.4 The Policy-Public Divide

The last of the two-way exchanges of information is between policymakers and members of the public. In a democratic system, the public is charged with keeping policymakers accountable, for which they require transparent information about the activities and opinions of political actors. Conversely, policymakers need to know the public's opinion on any given issue in order to ensure they are acting in the public interest. Such information exchange is, again, important; factors that complicate this interaction can lead to poorly educated opinions for either group of actors. Lorenzoni et al. (2007) suggest that barriers to public action on issues like climate change can be addressed through targeted and tailored information provision by policymakers. However, government efforts to educate the public on environmental issues have often failed due to a poor political understanding of public opposition and demands, often mischaracterized as NIMBYism (i.e. "Not In My Back Yard" – the idea that an individual opposes projects primarily due to negative personal consequences for them, such as construction near their home), as argued by Owens and Driffill (2008). In concert, Teel et al. (2006) show that arbitrary public opinion can result from the exaggerated, politicized information that is characteristic of policy debates. In their experiment, participants were asked for their opinions on drilling for oil in the Arctic, and then asked to assess data from both sides of the debate. Both sets of information were exaggerated and un-objective, but each respondent tended to identify bias only in the information that opposed their initial stance; they were able to justify virtually any opinion on the issue. Kavanaugh et al. (2008) demonstrate that one reason most citizens do not engage sufficiently in political activities is because they cannot easily access appropriate background information and context about certain issues, perhaps in part because policymakers are sometimes poor providers of information, as established above.

All of the interactions amongst the key actor groups are evidently complex, but the policy-public divide is the only one of the three areas of exchange where the relevant literature lacks plausible suggestions for addressing the associated problems. While Lorenzoni et al. (2007) do propose higher quality information provision as an answer, the other studies on the policy-public divide show that, because the government is a poor choice of distributor for objective information, the solutions are not so simple. In addition, the collective body of environmental management literature provides inadequate coverage of the public as a key actor in decision-making, as argued by Bäckstrand and demonstrated by the public's lack of mention in the most recent report by the IPCC (2007). It is clear that an information gap exists around the environmental policy-public divide and as such, further study in the area is an appropriate step to understanding better the complexity of environmental information that is communicated to the attentive public by central decision-makers and other influential actors. Through a case study of policy information on large-scale wind energy in Saskatchewan, this paper attempts to provide insight on the failings of government and media information distribution and on how the public struggles to process the complex environmental policy knowledge that is communicated.

3.3 Case Study: Policy Information on Large-Scale Wind Energy in Saskatchewan

Saskatchewan is a western prairie province (Figure 3.1), covering 6.5% of Canada with an area of about 650 000 square km, which is comprised of prairie, boreal plains, boreal shield, and taiga shield ecozones. The climate is continental, characterized by wide-ranging seasonal temperatures and low precipitation. Its population was estimated at just over 1 million people in 2009 and is located largely in the southern (prairie) half of the province. Saskatchewan's economy, in recent years, has been characterized by rapid growth; the province led the nation in

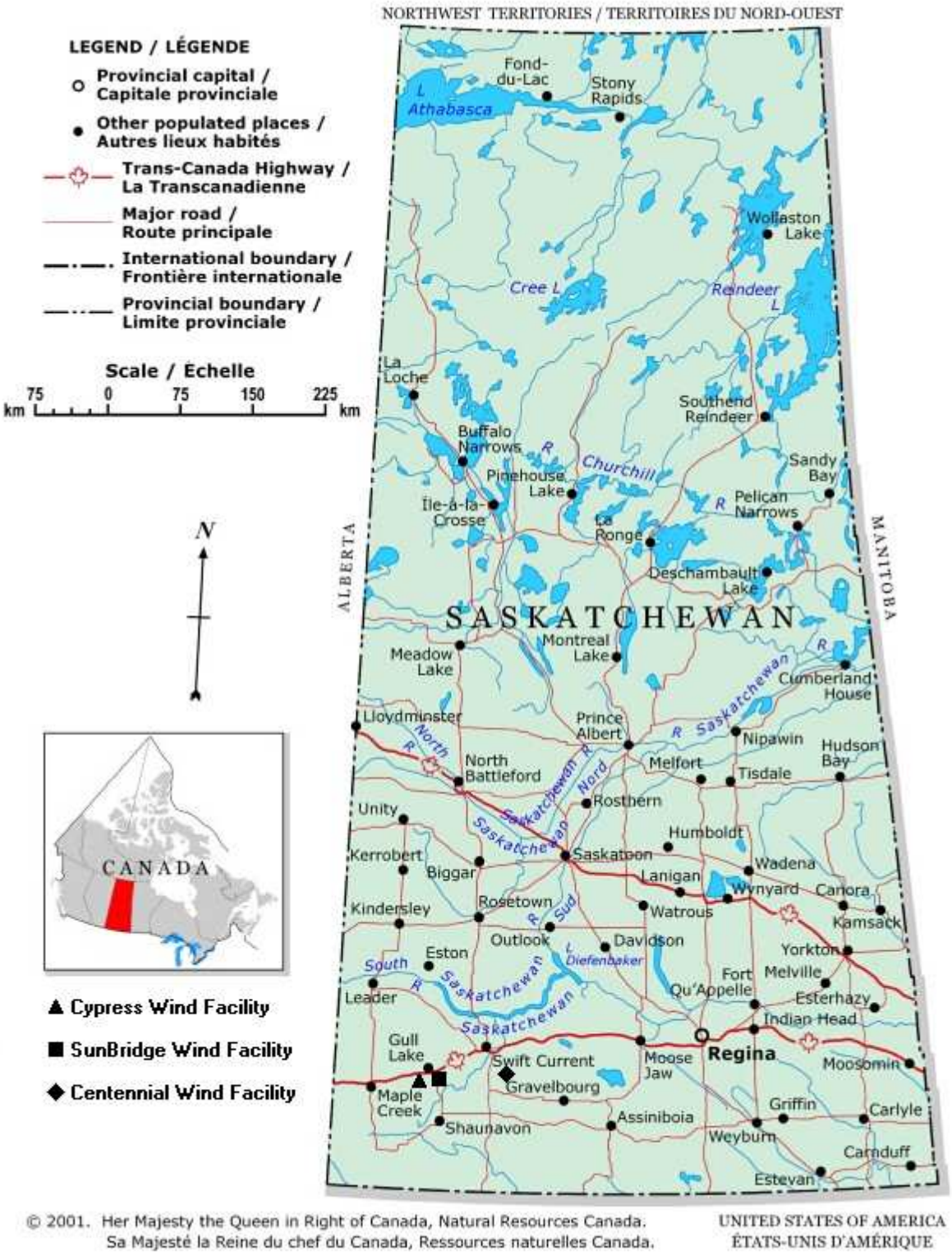

Figure 3.1 – Map of Saskatchewan Including Locations of Existing Wind Farms (http://atlas.nrcan.gc.ca/site/english/maps/reference/provincesterritories/saskatchewan, edited by the author)

growth of real GDP per capita, growth of productivity (real GDP per employed person), growth of personal income, and growth of disposable income in 2008. This expanding economy is based primarily on the agriculture, mining, and petroleum industries (Government of Saskatchewan 2010). Because of the provincial economy's dependence on and success with non-renewable resources, the development of wind energy in Saskatchewan is an important and perhaps controversial issue.

Saskatchewan's energy requirements are met by a range of non-renewable and renewable energy sources, including wind. The energy sources that comprise the province's electricity generation capacity of 3641 MW are 46% coal, 25% natural gas, 23% hydroelectric, 5% wind, and 1% other sources (SaskPower Environmental Programs 2009). The portion of Saskatchewan's electricity supply met by wind is provided by three wind farms located in the southwest region of the province (Figure 2.1): Saskpower's 11 MW Cypress facility constructed in 2002 and 2003, Suncor's and Enbridge's 11 MW Sunbridge facility constructed in 2002, and Saskpower's 150 MW Centennial facility constructed in 2006 (SaskPower 2010). The natural wind resource in Saskatchewan is rich enough that provincial wind farms can operate at an annual generating capacity of about 40%, a performance superior to that of turbines in most other areas of the world where the rate is 20 to 30% (Ibid). Thus, the province has a significant amount of large-scale wind energy potential.

A number of actors are responsible for decision-making regarding Saskatchewan's wind energy situation. The Saskatchewan Power Corporation (SaskPower), a provincial crown corporation, is the principal supplier of electricity in the province. As a crown, it has a monopoly on the energy market – all large-scale wind energy in the province is either produced or purchased by SaskPower for distribution (SaskPower 2010b). However, SaskPower is

accountable to the Crown Investments Corporation (CIC), a branch of the provincial government, and is sometimes required to submit decisions for review and approval; CIC is given broad authority by the province to set the direction of SaskPower (SaskPower 2010a). Through its board of directors, SaskPower is also accountable to the Minister Responsible for SaskPower, a member of provincial government cabinet (Ibid). Most supply decisions, then, are made directly by SaskPower, but the government of Saskatchewan has the ultimate authority should it choose to exercise it. As such, various policymakers, along with the general media, are responsible for communicating wind energy policy information to the public of Saskatchewan. This case study examines the complexity of that communication.

3.3.1 Methods

The research approach was designed to emulate the information gathering process that attentive members of the public would have to undergo to attain a thorough understanding of Saskatchewan's wind energy policy, thereby assessing the complexity of information surrounding this environmental issue. This study adopted an exploratory case study approach (Yin 1994) to the policy-public information divide, where inductive, rather than deductive (hypothesis-driven), research was conducted. Broadly, a 'grounded theory' method was used, which involves three major phases: first, qualitative data regarding a phenomenon of interest are collected; second, the data are broken down, conceptualized, and put back together in new ways in a process known as 'coding'; finally, the resulting grounded theory should be faithful to the everyday reality of the phenomenon under study, be comprehensible, be abstract enough for application to a variety of issues related to the phenomenon, and be useful in guiding action addressing the phenomenon (Strauss and Corbin 1990). This method was used primarily because

it is appropriate for case study research; it allows sufficient focus by examining a single case (or phenomenon) independently but generates findings that are broadly applicable to related issues, proposing future theories or policy implications. In addition, it permits the researcher to be creative and flexible during the process, adjusting data collection procedures to be more relevant as theory emerges (Ibid).

A document review of policy information on Saskatchewan's large-scale wind energy comprised the first phase, the collection of data, and was carried out during the period of August 2009 to March 2010. The document review was conducted to determine how difficult it is for the public to access policy information regarding large-scale wind energy in Saskatchewan. While interviews might have resulted in up-to-date, more accurate, and better nuanced data than a document review, the public at large tends not to use interviews as a means of gathering information. A document review is more convenient; documents function as records for events that the data-seeker could not observe directly and the recorder is likely a more expert observer as well (Stake 1995). As is consistent with the grounded theory approach to research, the review was a constantly evolving procedure, whereby the researcher analyzed data throughout the process and decided what data to collect next depending on the emerging findings (Glaser and Strauss 1967). The initial guidelines for the document review were to investigate sources of information from the policy actors listed above (i.e. SaskPower and the provincial government) and to organize collected information under three broad categories (i.e. physical, institutional, and planning characteristics) to aid in analysis and comparison. As the review unfolded, new sources of information became relevant and key terms of which the researcher was not previously aware emerged as important – this challenge was dealt with by incorporating the

Table 3.1 – Sources Accessed and Key Terms Investigated During Document Review

INFORMATION SOURCES ACCESSED	KEY TERMS INVESTIGATED
-Canadian Centre for Energy Information Website -Canadian Electricity Association Website -Canadian Wind Energy Association Website -Crown Investments Corporation of Saskatchewan Website -EcoLogo Website -Enterprise Saskatchewan Website -Environment Canada Wind Energy Atlas -Global Wind Energy Council Reports -Government of Saskatchewan News Releases -Government of Saskatchewan Throne Speeches -Government of Saskatchewan Website -Ministry of Energy and Resources Annual Reports -Natural Resources Canada Reports -North American Electric Reliability Corporation Website -NorthPoint Energy Solutions Website -SaskPower Annual Environment Reports -SaskPower Annual Reports -SaskPower News Releases -SaskPower Website -Standing Committee on Crown and Central Agencies Reports -Western Producer Newspaper	<u>Physical Characteristics</u>: -Benchlands Wind Power Project -Centennial Wind Power Facility -Cypress Wind Power Facility -Provincial Energy Mix -Provincial Wind Resource -Red Lily Wind Power Project -Sunbridge Wind Power Facility -WindSwept Wind Power Project <u>Institutional Characteristics</u>: -ATCO Power Partnership -Canadian Electricity Association -Crown Investments Corporation -EcoLogo -Minister Responsible for SaskPower -Minister of Energy and Resources -North American Electric Reliability Corporation -NorthPoint Energy Solutions -Saskatchewan Power Corporation -Saskatchewan Research Council -SaskPower International <u>Planning Characteristics</u>: -Energy and Climate Change Plan -Environmentally Preferred Power -Green Options Plan -Green Power Portfolio -Green Strategy -GreenPower -Power Plan -Provincial Energy Plan -Standing Committee on Crown and Central Agencies Energy Hearings -Wind Power Integration and Development Unit

information that surfaced in the review process (see Table 3.1). Such evolution of qualitative research methods is consistent with the grounded theory approach (Glaser and Strauss 1967).

The collected data was categorized under the key terms above in March 2010 to complete the second phase of the grounded theory method: the coding process. By verifying collected information across different sources and making comparisons between each characteristic, coding allowed the researcher to group the raw document data into more accessible and understandable themes (Corbin and Strauss 2008) – each concept was given a name as a key term for large-scale wind energy policy information in Saskatchewan (see appendix for the synthesized information collected under each relevant key term). These smaller analyzable units were derived through the intuition of the researcher. Because the data was collected before the concepts were derived, this method would be considered a process of 'coding up' (see Lockyer 2004). The coding up process allowed the researcher to take a flexible approach to the document review, following leads and defining concepts in a way that would make sense to anyone attempting the same synthesis of information. This approach left the data organized into small, distinct groups to facilitate analysis. To complete the third phase of the grounded theory method, complexity-related problems encountered during the synthesis of data were summarized in the form of grounded theory for improving policy-public communication, as detailed in the following sections.

3.4 Results and Discussion

The document review and coding up processes uncovered a number of problems with the pattern and presentation of policy information on large-scale wind energy in Saskatchewan. The difficulties of non-intuitive, misreported, obsolete, and absent information were found, likely

complicating communication between policymakers and members of the public. In the following sections, each of these general findings is illustrated using examples of key terms defined through the synthesis of information in the previously described coding procedure.

3.4.1 Non-Intuitive Information

The key terms 'Provincial Energy Mix and 'Ministry of Energy and Resources' illustrate the problem of non-intuitive information, where reasonable assumptions made by the researcher were proven wrong with further investigation. A cursory search for statistics on Saskatchewan's current wind energy production uncovered the oft-cited fact that "wind energy comprises 5% of Saskatchewan's energy capacity" (e.g. CCEI 2010). Note that there is a difference between energy capacity and the gross amount of electricity supplied, especially in the case of wind energy. Energy capacity is the rate (in MW) at which a power plant supplies electricity when operating at maximum efficiency. Gross electricity supplied is how much power was actually produced over a given period of time (usually GWh per year). Wind energy technologies are much less efficient than traditional power plants because they depend on the unpredictable nature of the wind and, as such, rarely operate at capacity. Consequently, wind will make up a much higher percentage of the mix when measured as capacity (5%) than as gross supply (3% - see SaskPower 2009). However, the common knowledge that "wind energy comprises 5% of Saskatchewan's energy capacity" is likely to be internalized and repeated as "wind energy comprises 5% of Saskatchewan's energy production" by someone who does not understand the difference, on the SaskPower website itself for example (SaskPower 2010b). This mistake is especially prevalent since the fact that "wind energy actually comprises only 3% of Saskatchewan's energy production" can only be found in less visible places, such as in

SaskPower's annual reports (see SaskPower 2009). Relying on capacity numbers to convey energy statistics may cause public confusion about Saskatchewan's energy situation.

Members of the public looking for government information about energy in Saskatchewan might seek data from the Ministry of Energy and Resources, whose mandate is the development of energy, mineral, and forestry resources in the province (Government of Saskatchewan 2010). This notion is understandable since links to the Ministry appear on SaskPower's website (SaskPower 2010a) and on the Saskatchewan section of the Canadian Centre for Energy Information (CCEI) website (see CCEI 2010). However, the Ministry of Energy and Resources concentrates almost solely on the mineral and forestry sectors; the only one of its six core business areas related to energy is the 'Resource and Energy Policy' branch which merely monitors the impacts of market trends, policy, and legislation on the energy industry and provides analysis and recommendations on issues such as climate change (Saskatchewan Ministry of Energy and Resources 2009). Decision-making and the publication of information regarding Saskatchewan's energy situation is primarily carried out by SaskPower – the Ministry of Energy and Resources has little involvement with such responsibilities, despite its name. This disparity between the Ministry's title and its role may be confusing to members of the public who are not familiar with such subtleties.

3.4.2 Misreported Information

Several instances were discovered where facilitating actors exaggerated facts or used speculation in lieu of them, as demonstrated by the key terms of 'Saskatchewan Research Council' (SRC) and 'Provincial Energy Plan'. A 2009 article in the *Western Producer*, Canada's largest agricultural newspaper, describes Saskatchewan's net-metering program for small-scale

wind installations: it mentions that residents can apply for an installation rebate in exchange for allowing SRC access to their power generation data for 10 years which will be used to study the feasibility of wind generation in different areas of the province (Cross 2009). This study is coincidentally similar to SaskPower's Saskatchewan Wind Data Study, designed to determine the benefits and feasibility of building future wind farms in diverse locations throughout the province (see SaskPower 2009). Given this information, it seems that there should be some overlap between the SRC and SaskPower studies if they are not indeed the exact same one, especially since SaskPower is mentioned a number of times in the *Western Producer* article. However, the SaskPower and SRC databases could neither verify such a partnership nor confirm the existence of the SRC study. It is possible, then, that the author of the article was speculating about the use of the power generation data acquired by SRC or was simply too general in his statement about wind generation (i.e. perhaps the data will simply be used to advise residents wishing to install small-scale turbines). Alternatively, SaskPower and SRC may have failed to distribute any information about this seemingly important study and, as such, no opportunity exists for them to clarify the details for interested members of the public.

In addition, the Canadian Wind Energy Association (CWEA), a non-profit organization promoting suitable wind energy development and policy, has published a fact sheet about provincial and federal wind energy initiatives that is available online, allegedly updated in February of 2010. It states that Saskatchewan has a provincial energy plan that seeks to install 300 MW of wind energy capacity by 2011 (CWEA 2010). No source is given for this information, nor is such a plan verifiable in either of the public SaskPower or Government of Saskatchewan databases. Assuming the information is not available only to CWEA internally,

they may be recycling or misreporting out-of-date information. Members of the public might take these initial media claims as fact, forming broad opinions on false evidence.

3.4.3 Obsolete Information

'Benchlands Wind Power Project', 'SaskPower International', 'WindSwept Wind Power Project', 'ATCO Power Partnership', 'Energy and Climate Change Plan', and 'Green Strategy' are key terms that exemplify the problem of obsolete information, where accounts of now-irrelevant events still turn up frequently during database searches. In some cases this problem was explicable: for example, while 'Benchlands Wind Power Project' and 'SaskPower International' were found only in older Government of Saskatchewan and SaskPower reports and news releases, reasoning for their discontinued use was available in publicly accessible documents. The abolition of SaskPower International, a wholly-owned investment subsidiary of SaskPower, was verified by the 2008 SaskPower Annual Report (see SaskPower 2009), and the withdrawal of the Benchlands project, a plan by the Benchlands Wind Power Corporation to partner with SaskPower under the Environmentally Preferred Power (EPP) program to build a wind farm near the municipality of Tompkins, was confirmed by a 2006 SaskPower news release (see SaskPower 2006). While an information-seeking member of the public may not search for an explanation regarding terms that cease being used, finding such a phenomenon confusing, the relevant facts are at least accessible to the public in some way.

Similar to the above terms, 'WindSwept Wind Power Project', 'ATCO Power Partnership', 'Energy and Climate Change Plan', and 'Green Strategy' arose often during the document review, but in archives only – never in recently-updated sources. Unlike the above terms, however, reasons why these ones appeared to be obsolete could not be directly confirmed

through public documents. As such, during the synthesis and coding process it was assumed that the WindSwept project under the EPP program had been discontinued or renamed, that the ATCO partnership with SaskPower International in developing the Centennial facility was discontinued or interim, and that the Energy and Climate Change Plan and Green Strategy for increasing Saskatchewan's percentage of renewable energy and reducing greenhouse gas emissions were policies of the previous provincial government and thus discontinued. Because the available policy information does not address these gaps, the public might assume that obsolete information is still relevant or become apathetic about the issues due to frustration.

3.4.4 Absent Information

Finally, for the problem of absent information, where intuitive questions about existing documentation are not easily answered, 'GreenPower' and 'Wind Power Integration and Development Unit' (WPIDU) are demonstrative key terms. It is clear that the GreenPower program, which effectively allows SaskPower customers to purchase wind-generated electricity by paying a premium on their electricity bill, has supported the Sunbridge and Cypress facilities (SaskPower Environmental Programs 2009), but that the much larger Centennial Facility was never mentioned in relation to this program is curious. Reasons for this omission cannot be confirmed by publicly available sources, so it had to be assumed during the synthesis of information that the Centennial facility was sufficiently funded through the Wind Power Production Incentive (WPPI), a federal government program supporting renewable energy development across the country, and did not need assistance through GreenPower - its WPPI funding per MW is indeed higher than the Cypress facility's (SaskPower 2003, SaskPower 2007).

Because this explanation is not provided by policymakers, members of the public are left to piece the facts together for themselves, potentially making errors in their assumptions.

Similarly, SaskPower created WPIDU in 2008 to study the effects of wind energy on the provincial electricity grid – it was supposed to conduct a data study and release a deployment strategy in 2009 (SaskPower 2009), but public information on what became of these initiatives is not available. It is unlikely that such plans were simply abandoned immediately after they were announced, especially since they are mentioned in numerous other sources (see SaskPower Environmental Programs 2009 and SaskPower 2008), although these sources do seem to disagree on the year WPIDU was formed. It was presumed that these initiatives were completed and had influenced the decision to implement the Green Options Plan and Green Options Partners Program, recent strategies for building 200 new MW of wind energy capacity in Saskatchewan (Government of Saskatchewan 2009). This example is especially telling of the absent information problem since policymakers assured the release of a report and then failed to follow through, offering no justification. This lack of transparency may cause members of the public to become disenchanted with the issue of wind energy in the province.

3.5 Conclusion

A policy community's sub-government, the group of key decision-makers and other influential actors, relies on the attentive public to keep the policy process in check (Pross 1984), which requires that policy information be readily available and easily understood by the public. This research uncovered a number of problems with, and recommendations for, policy-public interaction regarding the case of large-scale wind energy in Saskatchewan, each of which can be applied more generally to the larger problem of environmental policy communication.

First, the confusion around the differences between energy capacity and gross energy production as well as the disparity between the Ministry of Energy and Resources' role and name demonstrated the problem of non-intuitive policy information. The grounded theory resulting from these observations is that policy-public communication often fails to take into account the intuitive assumptions that might be made by the public, leading to confusion and misinformation if complex information is not clarified. In Saskatchewan's case, solutions could include pairing capacity numbers with gross supply numbers and an explanation of each in addition to giving the Ministry of Energy and Resources a more suitable name or more explicitly describing the differences between seemingly similar government agencies. More generally, the lesson is that policymakers should describe the nuanced differences between similar terms and use appropriately depictive titles to avoid the problem of non-intuitive information.

Second, the miscommunication of information about SRC's wind data study by the *Western Producer* and about Saskatchewan's provincial energy plan by CWEA illustrated that policy information is often misreported. Saskatchewan exemplifies that public misunderstanding caused by the influence of facilitating actors (e.g. the media and interest groups) on policy information is likely a problem that affects policy issues in all jurisdictions. The province should clarify the role of SRC and SaskPower in studying Saskatchewan's wind resource and should be forthright with information about its changing energy plans or demand accuracy in CWEA's publications. In a broader sense, the grounded theory lesson illustrated by Saskatchewan is that, to circumvent the problem of misreported information, policymakers should be aware of potential misinterpretation or fabrication by facilitating actors, responding to or pre-empting their reports with clear information that is difficult to misinterpret.

Third, the problem of obsolete policy information was demonstrated by wind energy projects, institutions, partnerships, plans, and strategies that are no longer relevant in Saskatchewan but still show up much more frequently in archival searches than indications or clarifications of their desuetude. For members of the public to determine the history of policy issues in general, then, is likely difficult if policy communication does not explicitly include it. In Saskatchewan, for example, SaskPower could publish a summary of all the wind projects and partnerships started in the province, indicating whether each was successfully completed or not and why. In general, policy-public communication should be transparent enough that questions about the omission of previously-used terms are easily answered (e.g. through the occasional release of summaries that explicitly describe the history of changing or out-of-date terms) – it should clearly be stated when partnerships, projects, policies, or programs are overturned or discontinued to prevent problems related to obsolete policy information.

Fourth, the lack of publicly available answers to the questions of why the Centennial Wind Power Facility receives no support from the GreenPower program and what became of the WPIDU wind data study indicated a problem of absent policy information about wind energy in Saskatchewan. That the public may become disengaged with certain policy issues if related information is not made easily accessible by policymakers is the consequent grounded theory lesson from the case study. The province could have better engaged the public on the issue of wind energy by anticipating the puzzling nature of and providing an explanation for the exclusion of the Centennial Facility from the GreenPower program and by following through on its promise to make the results of the wind data study available in 2009. More generally, the lesson is that, to avoid the problem of absent policy information, policymakers should strive to be comprehensive, transparent, prompt, and reliable in their communication to the public.

While each of these lessons can be applied separately depending on the unique problems with policy information on any given issue, a possible way forward would be for policymakers to deal with the range of difficulties at once. For example, the summaries suggested in the third lesson could be expanded to meet the requirements of each potential solution – they would describe the nuanced differences between similar terms, clarify information to prevent misinterpretation, detail the history of policy terms as they change or become obsolete, and be provided promptly to anticipate public questions and concerns. The above literature review established that some communication problems may be intrinsic to the nature of policymakers. For example, politicians may not want to admit when they have discontinued initiatives started by the previous government. As such, information summaries could be completed on behalf of the government by more independent actors, like universities (the summaries used in this study and included in the appendix are possible examples). A partnership between academics and policymakers could also confirm or deny assumptions made in areas where information is lacking, unlike in this paper, where the researcher was restricted to publicly accessible documents in emulating the process an interested member of the public would have to go through. This broad solution could potentially address, at least in part, all of the general problems identified with policy-public information distribution.

In conclusion, environmental policy information is rife with complexity such that the public may become misinformed or find it difficult to engage with policymakers. However, a pro-active and comprehensive system of policy-public communication, such as the one suggested above, would result in a more complete exchange of information among the groups of actors involved with environmental problem-solving and thus more informed environmental decisions.

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3.7 Appendix (definitions of relevant key terms for large-scale wind energy in Saskatchewan)

The following list described the current large-scale wind energy situation in Saskatchewan through definitions of relevant key terms. The process of generating this list (finalized in March of 2010) was used to analyze the gaps in policy information about Saskatchewan's wind energy situation. Note that this list excludes terms that were found to be out-of-date or could not be verified by primary sources (see the results and discussion section for information on the omitted terms). The publicly available sources accessed to generate the list are referenced in endnotes.

KEY 'PHYSICAL' TERMS

Centennial Wind Power Facility: A SaskPower International (a now-obsolete investment subsidiary of SaskPower) project completed in 2006 (with federal funding assistance through the Wind Power Production Incentive), the facility is the newest and largest of Saskatchewan's three wind farms and is the second largest wind farm in Canada. Its 83 turbines (Vestas V80s) have a total generation capacity of approximately 150 MW and are located 25 km southeast of Swift Current[1].

Cypress Wind Power Facility: A SaskPower project completed in two phases in 2002 and 2003 (with federal funding assistance through the Wind Power Production Incentive). Its 16 turbines (Vestas V47s) have a total generation capacity of approximately 11 MW and are located 12 km southwest of Gull Lake[2].

Energy Mix: Saskatchewan's electricity generation capacity is about 3641 MW (46% coal, 25% gas, 23% hydro, 5% wind, 1% other)[3]. This capacity would be the per hour rate of electricity generated if all power plants were operating at maximum efficiency or 100% capacity. However, no power plant is that efficient on a yearly basis (e.g. SK's wind turbines operate at an average of 40% capacity) so the gross amount of electricity supplied in a year has a different composition: 20480 GWh (55% coal, 20% hydro, 19% gas, 3% wind, 3% imports, <1% other)[3]. It is often said that Saskatchewan has 5% wind capacity but this claim does not mean 5% of the province's electricity comes from wind.

Sunbridge Wind Power Facility: A partnership project between Enbridge Inc. and Suncor Energy Inc. completed in 2002, the facility is currently the only private sector wind farm in Saskatchewan although all of its generated electricity is purchased by SaskPower before being distributed through the province's grid. Its 17 turbines (Vestas V47s) have a total generation capacity of approximately 11 MW and are located 5 km southeast of Gull Lake[4].

Red Lily Wind Power Project: A forthcoming partnership project between Red Lily Wind Power Limited Partnership and Gaia Power – Algonquin Power Inc. scheduled to be completed in 2011[5], the private sector facility will be the second to enter into a power purchase agreement with SaskPower. The proposal was initially selected by SaskPower (under the EPP program) in 2006 and the agreement finalized in 2008. When complete, the facility will have a generation capacity of 25 MW and will be located northwest of Moosomin[3].

Wind Resource: Saskatchewan has a rich wind resource (the best wind regimes being located largely in the southwest region of the province) such that the expected annual generating capacity of each of its three wind farms is around 40%. Although the wind resource of neighbouring regions (like Alberta) is comparable[6], this level of efficiency is relatively high compared to many other areas of the world, where the average generating capacity is 20% to 30%[7]. Because of this abundant resource, the Centennial Wind Power Facility ranks in the top 10% in the world for productivity[8].

KEY 'INSTITUTIONAL' TERMS

Canadian Electricity Association (CEA): A national organization founded in 1891 to facilitate exchange among and collectively represent the electricity industry in Canada, corporate utility member companies like SaskPower make up its core[9]. It recently launched its 'Sustainable Electricity' program, which requires members to adhere to 10 guiding principles (including economic value, energy efficiency, security of supply, minimizing local environmental impacts, and mitigation of and adaptation to climate change) and report on indicators of sustainable development[3].

Crown Investments Corporation (CIC): The holding company for Saskatchewan's commercial crown corporations, it is given broad authority to set the direction of SaskPower through *The Crown Corporations Act*. SaskPower is sometimes required by legislation or policy to submit investment and performance management decisions to the CIC for review and approval[10].

EcoLogo: A national organization founded by the federal government in 1988 and now the largest of its kind in North America, it provides customers (through its certification process) with the assurance that products bearing its logo meet strict environmental leadership standards[11]. SaskPower has used this certification to guarantee the environmental quality of the wind-generated electricity sold to consumers through the GreenPower program[3].

Minister Responsible for SaskPower: An MLA from the governing party appointed to a provincial cabinet position, serving as the link between SaskPower and the provincial government. The SaskPower board of directors is accountable to the minister through its chair, who is an external director[10]. In meeting its responsibility for stewardship and setting corporate direction the board works with SaskPower management to develop and approve strategic plans, operating goals, annual budgets, and business plans[12].

Ministry of Energy and Resources: A provincial government ministry whose mandate is to achieve full and sustainable development of Saskatchewan's energy, mineral, and forestry resources. The 'Resource and Energy Policy' branch (one of six core business areas) monitors the impacts of market trends, policy, and legislation on the energy industry and provides analysis and recommendations on issues such as climate change[13]. Only peripherally related to wind energy policy this ministry often appears in related documents because the Minister of Energy and Resources and the Minister Responsible for SaskPower are often the same person (at the moment, it is Bill Boyd).

North American Electric Reliability Corporation (NERC): An international organization founded in 1968 subject to oversight by both the U.S. Federal Energy Regulatory Commission and governmental authorities in Canada. Its main function is to ensure the reliability of the bulk power system in North America by developing and enforcing reliability standards[14]. Because Saskatchewan is part of this interconnected electrical network and participates in energy trading through the Open Access Transmission Tariff (which allows out-of-region energy producers to sell power to large users in the province – paying a fee to use Saskatchewan's transmission lines), SaskPower is required to meet those standards of reliability[15] (there is a limit to how much electricity Saskatchewan can import from other jurisdictions – for example, in offsetting the intermittency of wind energy).

NorthPoint Energy Solutions: A wholly-owned subsidiary of SaskPower founded in 2001 in response to the Open Access Transmission Tariff offering, it provides electrical energy marketing and trading services for SaskPower and is responsible for the economic dispatch of SaskPower's generation facilities[16]. Essentially, NorthPoint ensures low electricity prices for Saskatchewan consumers by dispatching the least expensive power available at any given time (whether it be coal, gas, hydro, wind, or imports), and selling excess power to other regions when prices are high.

Saskatchewan Power Corporation (SaskPower): A wholly-owned subsidiary (a crown corporation) of the CIC established as the Saskatchewan Power Commission in 1929, it is the principal supplier of electricity in Saskatchewan. Its mandate is to provide safe, reliable, sustainable, cost-effective power to the province[17].

Wind Power Production Incentive (WPPI): A federal government renewable energy program introduced in 2002 designed to provide $260 million over 15 years to support the installation of 1000 MW of new wind energy capacity across the country. Energy producers, like SaskPower, could apply under the WPPI for a subsidy of about $0.01 per kilowatt hour of production over 10 years[18]. Through this incentive, Saskatchewan's Cypress Wind Power Facility has qualified for $2.6 million over 10 years[19], while the Centennial Wind Power Facility has qualified for $54 million over 10 years[20].

KEY 'PLANNING' TERMS

Environmentally Preferred Power (EPP): An initiative introduced by SaskPower in 2003 as part of the Green Power Portfolio to assist with meeting new load requirements until 2010 through environmentally friendly energy production[21]. It was designed to allow SaskPower to acquire 45 MW of electricity through power purchase agreements with private producers that successfully applied to the program. The Red Lily Wind Power Project was the only wind energy project to have been facilitated through EPP[22].

Green Options Plan: The most recent initiative for adding more wind-generated electricity to Saskatchewan's grid. Under it, SaskPower will partner with one or more independent power producers (determined through a competitive process), building up to 175 MW of new wind power. Furthermore, the Green Options Partners Program will enable SaskPower to purchase up

to 25 MW of wind power (and 25 MW from other environmentally friendly sources) from the private sector[23] in what is essentially a renewed version of the EPP initiative.

Green Power Portfolio (GPP): A SaskPower strategy introduced in 2003 to ensure new electricity supply requirements were met by environmentally-friendly sources until 2010[21]. The key aspects of this strategy included the EPP initiative, direct generation pilot projects (such as biomass power facilities), the construction of the Centennial Wind Power Facility[24], energy conservation programs, and new run-of-the-river hydro projects[22].

GreenPower: A SaskPower program introduced in 2002 to allow energy customers to purchase EcoLogo-certified wind-generated electricity from the Cypress and SunBridge facilities (at a rate of $2.50 per 100 kWh block per month). The demand for the program has been high enough that SaskPower customers have exhausted the GreenPower supply and no new applications are being accepted while the program is under review[3]. GreenPower basically allows customers to support wind energy development (relatively more expensive but more environmentally friendly than traditional technologies) by subsidizing it. The Centennial Facility was presumably excluded from the GreenPower program because it was heavily funded by the WPPI and did not need the subsidy.

Power Plan: SaskPower's long-term electricity supply plan, designed to address a projected gap of 4100 MW by 2030 (due to increased energy demand and the need to retire or life-extend older power plants). The plan is broken into three periods: a supply requirement of about 1000 MW between 2009 and 2014 (the decisions for filling this gap have already been made), a supply requirement of about 1000 MW between 2015 and 2022, and a supply requirement of about 2000 MW between 2023 and 2032[25]. Long-term energy supply decisions could involve any mix of energy technologies (including wind) and there is ample opportunity for all stakeholders to provide input on what the mix should look like.

Standing Committee on Crown and Central Agencies Energy Hearings: In April of 2009, the Standing Committee on Crown and Central Agencies (an all-party agency of MLAs with a mandate to consider matters regarding the province's crown corporations) received an order from the legislature to gather public opinion concerning how the government should best meet the growing energy needs of the province. Written submissions were collected until October, and public hearings for witness presentations were held in October and January. A final report on the emerging themes is expected before the end of the current session of the legislature[26].

Wind Power Integration and Development Unit (WPIDU): Due to the natural variability of wind energy, SaskPower has been experiencing grid operating challenges in managing the 172 MW of currently installed wind power capacity and developed this research unit in 2007 to address the problem[27]. In 2008, the WPIDU undertook an initiative called the 'Saskatchewan Wind Data Study', inviting developers with experience in wind monitoring in the province to help determine the benefits and feasibility of building future wind facilities in diverse locations throughout Saskatchewan (making our collective wind energy production more reliable). This study was to result in a 'Wind Power Deployment Strategy' that was supposed to be released in 2009[28]. Very little information is publicly available regarding the outcome of the study or the strategy, but both presumably fed into the Green Options Plan.

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CHAPTER 4

CONCLUSION

4.1 Introduction

By many accounts, Saskatchewan's level of investment in large-scale wind energy is appropriate (see CCEI 2009, Government of Saskatchewan 2009, Prebble 2006, SaskPower 2010). According to others, the level of large-scale wind energy development in the province is insufficient (see CWEA 2010, Enterprise Saskatchewan 2010, Environment Canada 2010, GWEC 2010, IEA 2009, SES 2007). Given the diversity of opinions and data contributing to this debate, understanding why Saskatchewan has not expanded the development of large-scale wind energy more rapidly in recent years is difficult. It may be the complexity of the problem itself, exacerbated by misinformation and miscommunication, which instigates the persistent controversy and inaction.

Resource and environmental issues of all kinds are beset by the challenge of managing a unique kind of complexity (see Mitchell 1997). For example, the complicated mechanics of air pollutants have lead scientists of different disciplines to legitimately come to contradictory conclusions about whether clean air standards in the U.S. should be tighter (see Wilson and Anderson 2006). In this case, the complexity was inherent to the problem itself, but complexity can also manifest itself in the information surrounding a resource or environmental issue. For example, one study showed that providing people with exaggerated information on both sides of a controversial environmental issue only encouraged them to cement their original opinion (see

Teel et al. 2006). When key actors (i.e. decision-makers, influential stakeholders, and members of the public) cannot agree about an environmental issue due to its inherent complexity or that of the surrounding information, inaction on the issue is often the result.

The theory of policy communities (see Pross 1984) provides a model for understanding the roles and relationships of these key actors as they operate in any given policy field. The sub-government (inner circle) is the primary policymaking body, consisting of central decision-makers as well as (at the periphery) other influential actors like interest groups. The attentive public (outer circle) includes those who are interested, but do not participate regularly, in policymaking. Inherent environmental complexity must be managed directly by the sub-government, while complex communication and information about environmental issues must be dealt with primarily by the attentive public; understanding the implications of environmental complexity requires an exploration of both its manifestations (inherent and information) and both sectors of the policy community. The purpose of this thesis was to explore complexity as a root cause of environmental inaction, accomplished using a case study of large-scale wind energy development in the Canadian province of Saskatchewan, and was examined in two manuscripts which targeted the specific objectives of this thesis:

i. to illustrate the problems associated with complexity inherent to environmental issues as dealt with by policymakers and influential actors; and
ii. to illustrate the problems associated with the complexity of information surrounding environmental issues as dealt with by the attentive public

4.2 The Inherent Complexity of Resource and Environmental Issues

The complexity of the issue of large-scale wind energy development in Saskatchewan itself was analyzed using interviews with central decision-makers and influential stakeholders who possessed expertise regarding potential obstacles to wind energy expansion. Not only did the interviewees collectively reveal a number of agreement, knowledge, technology, economic, social, and political barriers to the accelerated implementation of large-scale wind energy (e.g. having to accommodate the intermittent nature of wind-generated electricity, the lack of social interest in wind energy, etc.), there also existed substantial disagreement among the pool of participants over many of the identified barriers (e.g. some respondents felt that provincial political leadership on the issue was severely lacking, while others thought the government was proceeding with appropriate caution). The fact that so many barriers to expansion were identified illustrates the complexity of large-scale wind energy development in Saskatchewan and the fact that the interviewees disagreed about many of those barriers suggests that such complexity has resulted in a lack of expert consensus on the issue; it is difficult for Saskatchewan to make significant progress in expanding its large-scale wind energy. The interviews did result in some intuitive solutions to the problem of disagreement due to complexity (e.g. experts could reconcile contradictory information in a workshop format and openly identify questions of pure value or opinion), which might help elucidate the problem of environmental complexity in general. Wilson and Anderson (2006), for example, spoke to the competing understandings of U.S. clean air regulations from the disciplines of epidemiology and toxicology leading to political stagnation on the issue, as cited in the thesis introduction. One way to move forward in this case, as suggested by the findings of the wind energy case study, would be to open up dialogue between the epidemiologists and toxicologists to reconcile the apparent tensions in their research.

The two groups of scientists could tie their research together and explain what the collective findings really mean (i.e. if both sets of findings are really legitimate, they cannot actually contradict one another directly), defusing the potential for advocacy groups to use only one set of data to support an argument for or against tighter standards. In this situation, politicians, who have a poorer understanding of the science, do not have to attempt to reach consensus on the scientists' behalf and can instead focus on questions of ideology (e.g. are the environmental benefits of tighter clean air regulations worth the economic costs?). Understanding that consensus on complex issues may be easier to achieve when experts speak transparently to one another instead of third parties (i.e. policymakers and members of the public) might help some environmental initiatives move forward.

4.3 The Complexity of Public Environmental Policy Information

The complexity of information surrounding large-scale wind energy development in Saskatchewan was examined through a review of available public documents on provincial policy related to the issue. The collective articles, publications, and reports demonstrated several problems that might be intrinsic to environmental policy information in general: non-intuitive information (e.g. the Ministry of Energy and Resources having very little to do with energy), misreported information (e.g. the Canadian Wind Energy Association listing information about a Saskatchewan provincial energy plan when no such plan exists), obsolete information (e.g. references to the old subsidiary SaskPower International being much more common than any indication of its termination), and absent information (e.g. the missing results of the Saskatchewan Wind Data Study). Such problems confirmed a high level of complexity in environmental information distributed by policymakers and likely, due to the magnitude of effort

required to simplify such information, a subsequent lack of accessibility and comprehension by the general public. While the discovery of these problems with the complexity of environmental information leads to some intuitive solutions (e.g. policymakers could release periodic summaries to clarify the history and implications of any given issue), its greater use is to shed some light on the general problem of environmental information complexity. For example, Teel et al. (2006) identify the problem of biased processing of information: when conflicting interest groups present contradictory environmental evidence to the public, very few people actually change their opinion because they are unable to evaluate the information objectively, as cited in the thesis introduction. The case study of policy information surrounding wind energy in Saskatchewan reveals that confusing and conflicting information is also apparent even when no one is purposely exaggerating or introducing bias into the information. The nature of communication regarding complex environmental issues lends itself to perplexing and thus, less useful, public information. Understanding this cause, instead of placing the blame on the biasing influences of the media and interest groups, may allow for more effective solutions to public misunderstanding of resource and environmental issues to be devised.

4.4 Conclusion

While both manuscripts independently illustrate a number of problems with environmental complexity, the connections between them implicate complexity as a root cause of environmental inaction even more strongly. Of the two types of complexity examined, information and inherent, either can be the chief factor in the overall complexity of an environmental issue. Inherent complexity can cause information complexity and vice versa. Each reinforces the other and makes the complexity problem worse.

An example of how the inherent complexity of a problem can lead to information complexity is the disagreement between participants in the first manuscript over whether Saskatchewan could accommodate high penetration rates of wind energy in a manner similar to other jurisdictions, such as Spain or Denmark. This debate is complicated because while Saskatchewan has access to similar policy and technology tools as the leading wind energy jurisdictions, it has a less interconnected and much sparser energy grid. While proponents of accelerated wind energy development in Saskatchewan argue that the leading regions started out cautiously but were surprised at how much wind energy they were able to accommodate, those who think the current rate of implementation in the province is appropriate argue that countries like Denmark can only achieve such high levels due to their integration with the rest of Europe. Although the second manuscript, being concerned primarily with policy information on the current state of wind energy development, did not investigate information on how feasible high levels of penetration might be, the findings of the manuscript apply equally well to this example. If a member of the public were to look for information on the feasibility of accommodating high levels of wind, they would likely find some information on both sides of the question since various experts, who have conflicting understandings of the issue, are involved with information distribution process. Thus, since this individual could simply choose to believe the evidence supporting whichever answer they were hoping for, they effectively would not have become any more informed, not to mention that frustration with finding contradictory information might disenchant them with the issue altogether. Again, all actors involved with decision-making for an environmental issue, whether they are members of the attentive public, central decision-makers in the policy community, or distributors of information, should be aware that expert opinion is not automatically true.

On the other hand, the confusion between the terms ‘percentage of energy capacity’ and ‘percentage of net energy production’ in the second manuscript is an example of how information complexity can cause the issue itself to become more complex, even among expert understanding. ‘Energy capacity’ and ‘net energy production’ are defined differently, such that wind comprises about 5% of Saskatchewan’s capacity but only 3% of the province’s net production. However, as illustrated in the second manuscript, these terms are often used interchangeably in publicly available documents. In the first manuscript, it was confirmed through interviews that even experts on Saskatchewan’s wind energy situation tend to use such terms interchangeably or at least without clarifying the difference between the two. It was common for participants to use the capacity number if they thought wind was developing at an appropriate rate and the net production number if they thought development had been insufficient. Note that while some respondents may have been aware of the difference and chose to use the term that better supported their position, others may have been unaware of the difference. Either way, this example demonstrates how complexity in information leads to complexity of the problem. If decision-makers and influential actors are using this kind of information to inform or make recommendations or decisions, it is no surprise that they disagree about policy questions such as targets for wind energy implementation; both sides may have a completely different impression of the facts. All actors involved with management of an environmental problem, not just those responsible for information distribution, would thus benefit from recognizing the implications of conflicting, false, or vague information.

There exists a strong two-way link between the inherent complexity of an environmental issue and the information surrounding it. One may cause the other which may, in turn, feed back into the first. The existence of this loop provides strong evidence that either type of complexity

may be a root cause of societal inaction on environmental initiatives, either because of the direct confusion and controversy it produces or because it leads to the other type of complexity, causing inaction indirectly. The findings of this thesis provide insight into grappling with such complexity by illustrating the implications of each manifestation of complexity and thus, how they might be addressed and understood.

4.4.1 Further Work

To strengthen the findings and applicability of this thesis, there are a number of research initiatives that could be undertaken corresponding to each manuscript independently and the thesis as a whole. The investigation of inherent environmental complexity in the first manuscript could be complimented by experimenting with some of the intuitive solutions proposed. Future research might directly ask experts in jurisdictions that have been more successful with implementing high levels of wind energy how they were able to accomplish such penetration and whether they think Saskatchewan's grid could do the same. In addition, discourse between wind energy experts could be facilitated as part of an academic study to find out how difficult it would be to open a dialogue between opposing groups, achieving consensus on and reconciliation of information for the issue of wind energy development.

In regards to the second manuscript and the examination of information surrounding environmental issues as a source of complexity, future research could look at other types of information besides publicly available policy information. For example, an investigation of technical information about wind energy (e.g. the environmental impact of a turbine, the cost of electricity generated per kWh from wind compared to fossil fuels, how well a turbine functions at different temperatures, etc.) would verify the insights gleaned by exploring policy information

and might lead to the discovery of new complexity issues inherent to technical information. A future study might also survey public reactions to non-intuitive, misreported, obsolete, and absent information to validate the suggestion that such occurrences are harmful.

Finally, with respect to the thesis as a whole and the overall issue of environmental complexity, further work might entail developing a framework, one more detailed than the policy communities model, for pinpointing source areas of complexity for any given environmental management issue. The framework could involve the types of complexity from both manuscripts, the related sectors of environmental decision-making where barriers might present themselves from the first manuscript (i.e. agreement, knowledge, technology, economic, social, and political barriers), groups of relevant actors from the second manuscript (i.e. facilitating actors, policymakers, the public, and scientists or experts as a separate group), and any other facets uncovered as relevant. Such a framework would synthesize the findings of this thesis into a format that is more applicable in addressing environmental inaction caused by complexity.

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