University of Prince Edward Island
Faculty of Arts
Charlottetown
CERTIFICATION OF THESIS WORK

We, the undersigned, certify that Jocelyn Plourde, candidate for the degree of Master of Arts (Island Studies) at the University of Prince Edward Island, Canada, has presented a thesis, in partial fulfillment of the degree requirements, with the following title: *From Policy to Action – Renewable Energy in Samsø, Denmark*, that the thesis is acceptable in form and content, and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate through an oral examination held on June 19, 2018.

Examiners

Co-Supervisor ______________________________
Dr. Carolyn Peach Brown

Co-Supervisor ______________________________
Dr. Irene Novaczek

Committee member ______________________________
Dr. Don Desserud

External examiner ______________________________
Dr. Hafthor Sigurjonsson

Date June 19th, 2018

UNIVERSITY OF PRINCE EDWARD ISLAND

FROM POLICY TO ACTION – RENEWABLE ENERGY IN SAMSØ, DENMARK

by

JOCELYN PLOURDE

A THESIS

SUBMITTED TO THE FACULTY OF ARTS,

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF MASTERS OF ARTS IN ISLAND STUDIES

CHARLOTTETOWN, PRINCE EDWARD ISLAND

JUNE 2018

Abstract

Addressing the challenges of climate change, while also maintaining modern standards of living, requires a transition from energy sources that burn fossil fuels to low-carbon and renewable energy sources such as wind and solar energy. The purpose of this study was to determine how the Danish island community of Samsø succeeded in such a transition, from 1997 to 2007. To that end, interviews were conducted with citizens of the island community in order to better understand how the transition was implemented and why it was successful. In order to understand how public policies supported the transition, a document review of relevant Danish energy policies was also conducted. Based on the qualitative results obtained, it is possible to conclude that Samsø's transition was first made possible as a result of nation-wide energy policies that discouraged the use of fossil fuels and encouraged energy conservation, energy efficiency, sustainability and the development of renewable sources of energy. Such policies made the transition to renewable energy financially beneficial for the people of Samsø. Beyond the policies, the move to renewable energy required detailed planning, combined with a focus on public participation and public investment in the renewable energy technology that now powers the island.

Acknowledgments

As this journey comes to an end, I would like to acknowledge a few people that have helped me along the way. First, I would like to thank Carolyn Peach Brown, who has, quite literally, been there since day one. When I was contemplating going back to school, she was the first person at UPEI that I spoke to, and she recommended that I consider the MAIS program. Over the past seven (!) years, she has been a professor, a supervisor and a friend. I would also like to thank Irene Novaczek and Don Desserud. Irene has been my Island Studies expert, while Don has been my go-to when it comes to policy. To all three of you, thank for your support, your expertise, and, most of all, your patience.

I would also like to thank the wonderful people who agreed to participate in this study. Thank you for taking the time to speak with me, answer my questions and share your experiences with me.

Lastly, I would like to thank Bertel Meilvang. It was Bertel who helped me find the participants for this study. While I was in Samsø, he was my translator, my guide and even my technical support! But, most importantly, Bertel was a friend who invited me into his home and, along with his wonderful family (Louise, Caya and Marinus), made me feel welcomed in Samsø. *Mange tak til Bertel! Jeg kunne ikke have gjort det uden dig.*

Dedication

This thesis is dedicated to my parents, France and Daniel Plourde. Despite the challenges that they have lived through over the past few years, they have never stopped supporting and encouraging me. *C'est fini! Et je vous remercie du fond de mon cœur!*

Table of Contents

Chapter 1 – Introduction **1**

Overview 1

Topic, Purpose and Significance of Study 2

Chapter 2 – Literature Review **6**

Islands 6

Islands as Laboratories 6

Islands as Social Laboratories 7

Island Society and Development 10

Public Policy and Renewable Energy 12

Public Policy 12

The Necessity of Public Policies for the Penetration of Renewable Energy Systems 14

Policies Needed to Increase the Rate of Penetration of Renewable Energy Systems 17

Formal Energy Policy 17

Deterrents to Increased Fossil Fuel Use 18

Government Mandates 18

Economic Support Systems for Renewable Energy Systems 19

Economic Incentives 21

Increasing Social acceptance 23

Chapter 3 – Methodology **26**

Research Site Description 26

Research Design 29

Part 1: Document Review 29

Part 2: Interviews 31

Advantages and Limitations of the Methodology 33

Chapter 4 – Results **35**
Danish Energy Policies Prior to Samsø's Transition to Renewable Energy 35
Government of Denmark 35
Energy Plans and Policy Motivation Over Time 36
Energy Efficiency and Reduced Energy Consumption 40
Support for Decentralization and Public Participation 42
Support for Wind Energy Production 43
Use of Taxation 45
The Implementation of Samsø's Transition to Renewable Energy 45
The Importance of a Master Plan 46
Community Leaders 47
Initial Focus on Energy Consumption and Energy Efficiency 49
Getting People on Board – Public Meetings and Going Door-to-Door 51
The Unique Role of Farmers 52
Connecting the Dots: Danish Policies and the Transition 53
Basic Motivation 54
Supporting Public Participation 54
Taxation 56
Feed-in Tariff 57

Chapter 5 – Conclusion **59**
Discussion 59
Preparing for the Transition to Renewable Energy 60
How Policies Enabled Samsø's Transition to Renewable Energy 62
The Stick: Taxation 63
The Carrot: Encouraging Energy Consumer Investment 63
In Summary 64

Potential for Further Research 65
Conclusion 66

References **69**
Appendix A - Participant Information Sheet **77**
Appendix B - Consent Form **79**
Appendix C - Interview Guide **80**

Chapter 1 – Introduction

Overview

In 1997, the small Danish island of Samsø began an aggressive transition away from conventional (fossil fueled) sources of energy and towards low-carbon energy sources (Lundèn & Larsen, 2014). Ten years later, that transition was complete (Jørgensen, Hermansen, Johnsen, Nielsen, & Lundèn, 2007). Using a theoretical framework of truth and reality oriented correspondence theory (Patton, 2002), I investigated the link between the policies put in place by the Danish government and the successful deployment of renewable energy technologies in Samsø, Denmark. The framework of truth and reality oriented correspondence theory was chosen for this research because within this theoretical framework, it is possible to find stable relationships between different variables in social phenomena (Miles & Huberman, 1984). At its core, this study is a search for a stable relationship between two variables: public policy and the deployment of renewable energy systems. In addition, within the framework of truth and reality oriented correspondence theory, case studies, such as the one provided by the island community of Samsø, are used to build theories that account for the real world (Miles & Huberman, 1994). Finally, this theoretical framework is commonly used in summative evaluations, medical research and policy studies (Patton, 2002), making it an ideal framework for this research into renewable energy policy.

To explore the link between public policies and the deployment of renewable energy technologies, I used two distinct approaches. First, I completed a content analysis of energy policy documents that were in place before Samsø's transition to renewable energy. Second, I conducted semi-structured interviews with residents of Samsø to understand how the transition to renewable energy was implemented and why citizens were supportive of the transition, including those who invested significant amounts of their own money in support of the transition.

Topic, Purpose and Significance of the Study

> *Today, many people would accept the claim that, short of nuclear Armageddon, climate change is the most serious threat faced by humankind and the planet itself.*
>
> (Stoett, 2012, p. 86)

Based on many lines of evidence, it is certain that humans are changing the Earth's climate (IPCC, 2013; National Academy of Sciences, 2014). This climate change is caused by the increase in the Earth's global mean temperature, which is driven mainly by the emission of anthropogenic (man-made) greenhouse gases (GHG) such a carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) (IPCC, 2013; National Academy of Sciences, 2014). In times when Earth's climate (and its global mean temperature) is stable, the planet radiates into space as much energy as it receives from the sun (Hansen et al., 2013). However, the concentration of GHG in the atmosphere has greatly increased since the beginning of the Industrial Revolution (IPCC, 2013; National Academy of Sciences, 2014). This, in turn, increases the greenhouse effect, allowing less infrared energy to radiate into space (Hansen et al., 2013). The resulting energy imbalance causes the global mean temperature of the planet to rise (Hansen et al., 2013). It has been known for nearly two centuries that CO_2 is the atmosphere's main greenhouse gas. However, since the beginning of the Industrial Revolution, its concentration has gone from 280 parts per million (ppm) to over 400 ppm, making it the main driver of global warming (IPCC, 2013; National Academy of Sciences, 2014). While land use (such as deforestation) and certain industrial activities (such as the production of concrete) release significant amounts of CO_2, the most important source of anthropogenic CO_2 is the burning of fossil fuels such as gasoline, diesel, coal and natural gas (IPCC, 2014). Thus, addressing the threat of climate change, while also maintaining modern standards of living, requires the replacement of energy sources that burn fossil fuels by low-carbon and renewable energy sources such as wind and solar energy.

As is described later in this thesis, there are different reasons why government policies are necessary for the deployment of renewable energy systems. In addition, there are different types of policies that can be put in place to accelerate this deployment. However, to get an understanding of which policies are ideal for the effective deployment of renewable energy technology, I chose to investigate a case study of the Danish island community of Samsø. By 2007, the community of Samsø had completed a transition away from heating oil and coal-fired electricity and towards renewable, low-carbon energy sources (Lundèn & Larsen, 2014). In doing so, Samsø became a model of sustainability and an example to the world. Every year, 5,000 scientists, journalists and politicians from all corners of the globe visit Samsø's Energy Academy in order to "see the sustainable energy island and learn from the local experiences" (Lundèn & Larsen, 2014, p. 2).

The goal of this research project was to develop a more thorough understanding of why and how the community of Samsø could achieve what so few communities have – a transition away from fossil fuels and a significant reduction in CO_2 emissions through an aggressive transition to renewable energy sources. To that end, I put forward the following research questions. First, what governmental policies were in place, as of 1997, that encouraged the production of electricity and building heat from renewable sources of energy? Second, how did the community of Samsø implement their transition from conventional fossil fuels to renewable energy sources? And, third, how did the energy-related public policies put in place support Samsø's transition to renewable energy sources?

From these three questions, I put forward the following hypotheses. First, I hypothesized that energy policies in Denmark (and thus, Samsø) both *discouraged* the use of fossil fuels and *encouraged* the use of low-carbon alternatives such as wind turbines by making the latter more economically viable. Second, I hypothesized that the implementation of Samsø's transition to renewable energy was successful because of a focus on public participation. I understand that considerable effort was aimed at educating the residents of Samsø about energy issues while at the same time encouraging their involvement in the development of a new energy system. And, third, I hypothesized that the implementation of a feed-in tariff in Denmark was crucial to the success of the transition to renewable energy, since it created the necessary incentive for citizens to financially invest in renewable energy technology.

Chapter 2 – Literature Review

Islands

Islands as Laboratories

The concept of using an island as a test site, or a laboratory, is not a new one. Many academic authors have written about the use of islands as laboratories (Baldacchino et al., 2000; Royle, 2001; Wynn, 2016). The two factors that make islands unique and ideal for use as laboratories for the social and bio-physical sciences are isolation and boundedness (Royle, 2001). These two factors make islands closed and manageable systems where different experimental variables can be more thoroughly studied and controlled (Baldacchino, 2006).

Important contributions in the biological sciences have been made using islands as both field examples of general research, and for the study of the effects of insularity (Royle, 2007). As a result, field research done on islands has led to important advances both in ecology and evolutionary biology (Baldacchino, 2006). Arguably the most notable example of the latter has been Charles Darwin's study of the evolution of finch species on the Galapagos Islands (Royle, 2001). This led to the publication of Darwin's theory of evolution by natural selection as described in his 1859 book *On the Origin of Species* (Darwin, 2009).

Islands as Social Laboratories

However, and more relevant to this thesis, studying islands has also lead to important contributions to human sciences (Royle, 2007). Speaking of the famous anthropologist Margaret Mead who studied Pacific Island societies in the 1920's, Mary Pipher wrote, "Mead didn't go to Samoa just to study Samoa. Rather, she wanted to understand the whole human race" (Pipher, 2001, p. XVIII). In other words, by studying human society on islands, we can gain a greater understanding of society as a whole.

The validity of using islands as a test site, or laboratory, for human endeavors lies in the fact that islands are smaller versions of larger states (Baldacchino, 1997). As Holm put it, "an island is a microcosm", the world at large, but shrunk down to a size that can be counted and studied (Holm, 2000, p. 7). Within that microcosm, we find the same structures that make up larger geographical regions, such as society, community, economy and government, only at a smaller scale (Baldacchino, 2006). Because of that smaller scale, economic and political changes can happen much more quickly than on the mainland (Baldacchino, 2004), making islands ideal locations to attempt important social and economic experiments. Novaczek (2015) echoed this concept when she wrote that, "Small islands offer manageably scaled social environments for research, where one can quickly gain insight into many levels of society" (Novaczek, 2015, p. 130). As a result, islands can be seen as "potential laboratories for any conceivable human project, in thought or in action" (Baldacchino, 2006, p. 4).

When it comes to the use of islands as laboratories for human endeavours, the examples are varied. The Tuamotu Archipelago has been a test site for nuclear weapons (Shell, 2014), and the Island of Usedom was used for the testing of rocket designs in World War Two (Royle, 2014). The cultural acceptance of infanticide has been studied on the Solomon Islands (Shell, 2014). The environmental impacts of climate change has been studied in the Maldives (Royle, 2014). Certain authors, such as Sir Thomas More and Shakespeare, used islands as fictional places to establish utopian societies (Royle, 2014). Beyond literary fiction, serious attempts at utopian social experiments were actually attempted on islands. In the mid-17th century, the East India Company of England attempted to create a democratic, landowning, tax paying society on the island of St. Helena (Royle, 2014). Later, in 1816, a British corporal, along with his family and friends, attempted to create a communal sealing business on the island of Tristan da Cunha (Royle, 2014). Unfortunately, neither experiment lasted beyond a few years.

Islands have also been the sites of energy-related experiments in reaction to the Energy Crisis of 1973-1974. On October 19th of 1973, oil ministers from several Arab nations placed a full embargo on oil to the United States of America (USA), along with purposeful decreases in oil production (Nojeim & Kilroy, 2011). These actions came as a reaction to the discovery that the USA had heavily resupplied the country of Israel during the ongoing Arab-Israel war (Nojeim & Kilroy, 2011). While the war ended on October 26th, the embargo stayed in place until spring of 1974 (MacEachern, 2003). As a result of the embargo and reduced production, oil prices quadrupled in weeks and the resulting energy crisis “shocked the world economy worse than anything since the Great Depression” (Nojeim & Kilroy, 2011, p. 166).

In Prince Edward Island, Canada, the Energy Crisis was seen as an opportunity to put the province on the proverbial map by making it a laboratory for renewable energy. To that end, in 1975, the provincial government of Premier Alex B. Campbell proposed the creation of the Institute of Man and Resources (IMR) (MacEachern, 2003). The IMR was a private organisation, supported by public and private funds, meant to lead the effort to create societal change to sustainability and self-sufficiency (MacEachern, 2003). Through research, demonstrations, the development of alternative energy sources, as well as the dissemination of information locally and internationally, the intention was that the IMR would make the island of PEI an example for the rest of the world (MacEachern, 2003). Unfortunately for the IMR, fears associated with the energy crisis faded over time in Canada. The Federal Government's policies of manipulating oil prices allowed Canadians to maintain their pre-Crisis energy consumption practices, and interest for alternative energy sources waned (MacEachern, 2003). As a result, support for PEI's social experiment declined, and by 1982, the Institute of Man and Resources was "all but dead" (MacEachern, 2003, p. 9).

Other nations reacted to the shock of drastically more expensive oil in different ways. As we will see in greater detail later on, the Energy Crisis of 1973-74 began Denmark's decades-long transition away from imported fossil fuels. In the USA, then President Nixon announced "Project Independence", whose goal was to make the United States completely energy independent by 1980 (Nojeim & Kilroy, 2011, p. 166). Realizing their common vulnerability to high oil prices, several Western nations created the International Energy Agency (IEA), through which nations could coordinate energy policies in the hope of better coping with the economic impacts of the Energy Crisis (Türk, 2014).

Island Society and Development

The concept of islands as a laboratory for social change can seem contradictory to the fact that island communities often seem resistant to change. Take PEI as an example. The province resisted the creation of a permanent link to the mainland for most of the 20th century (Novaczek, 2015). Its provincial government chose not to invest in nuclear power in the 1970s (Stuart, 2016). PEI even once banned automobiles (Stuart, 2006). However, examples of PEI's *openness* to new ideas and important changes, such as the creation of the Institute of Man and Resources, also exist. And so, like many stereotypes, the reality is more complicated than it seems.

In fact, many islands have demonstrated their openness to dialogue and the adoption of new ideas, seeing such new ideas as paths to successful development (Fürst, 2015). However, they have also shown their ability to reject ideas that "seemed irrelevant, inappropriate or downright dangerous" (Stuart, 2016, p. 286). Additionally, new ideas cannot come at the cost of "subjection to off-island control", which islands fear (Connor, 2008, p. 45). In order to assuage such fears, conversation among all stakeholders must happen (Fürst, 2015). Without such conversation, without local involvement in decision making, social capital acts as a defence mechanism by only looking within (Wynne, 2008). In other words, an island's closely-knit social networks (described further in this section) can be used to quickly build objection to change that is imposed on an island community.

As Baldacchino wrote in 2005, “An island is a nervous duality” (Baldacchino, 2005, p. 248): local, versus global; openness, versus closure; a laboratory for social experiments of all types, versus the fear of change. Yet, an ability to change and to adapt is what has led to the success of islands around the world. Critics believe that islands, especially small islands, are burdened by “a whole raft of weaknesses, vulnerabilities and chronic dependency” (Baldacchino & Stuart, 2008, p. 11). However, the survival of small island states shows “underlying elements of strength that are inherent in small, often island societies” (Baldacchino & Bertram, 2009, p. 142). This strength stems from the fact that the economy of small societies is not passive, but rather adaptable and proactive (Baldacchino & Bertram, 2009). When facing economic challenges, business units, households and even individuals develop the flexibility to adapt to those challenges (Baldacchino & Bertram, 2009). Such adaptability allows small economies to more easily respond to both threats and opportunities (Baldacchino & Bertram, 2009).

This flexibility and adaptability is borne out of the characteristics of island societies and their governments. The ever-present maritime barrier forges tight bonds within an island community (Péron, 2004), while isolation and limited resources lead to “mutual assistance” when facing economic challenges (Novaczek, 2015, p. 147). Social networks on small islands are closely knit and the spread of information through word-of-mouth at all levels of society is easier than on the mainland (Baldacchino, 1997). In addition, the strategic perceptions of key individuals can be crucial in changing the views of many in small island societies (Baldacchino & Bertram, 2009).

“Closely knit” is a term that can also be used to describe island political culture. Unlike in most jurisdictions, members of island governments tend to be relatively few, well known and easily accessible (Baldacchino, 1997). This makes lobbying government for change easier to accomplish (Baldacchino, 1997). On one hand, such easy access to government officials can create opportunities for misuse and abuse. On the other hand, it also creates a situation where positive change can be brought about more quickly than on the mainland. This is in addition to the fact that small size and isolation are advantages in gaining public support for any endeavour (Connor, 2008).

Public Policy and Renewable Energy

Public Policy

In simple terms, public policies are decisions made by a government (Sabatier & Weible, 2014) and can come in various forms, such as statutes, laws, regulations and government programs (Birkland, 2016). Such government decisions are made in response to a perceived problem, on the public’s behalf, and are oriented towards a goal, a desired state, or a solution to that perceived problem (Birkland, 2016). Ideas for policies, and influence on the policy-making process, can come from both inside and outside of government, with various individuals, collectives, groups and countries wanting to have their say on any given issue (Sabatier & Weible, 2014).

In his book *An Introduction to the Policy Process*, Birkland (2016) describes the traditional "textbook model" of the policy process (see Figure 1). According to this model, the policy process begins with the emergence of a public problem to be addressed. Once this problem has gained enough attention, it is made part of the government's agenda, and alternative solutions to the problem are developed. Next, a choice is made among those alternatives, policy is enacted, and then implemented. After a time, the policy put in place is evaluated, potentially leading to the identification of a new public problem, and the beginning of another policy process cycle.

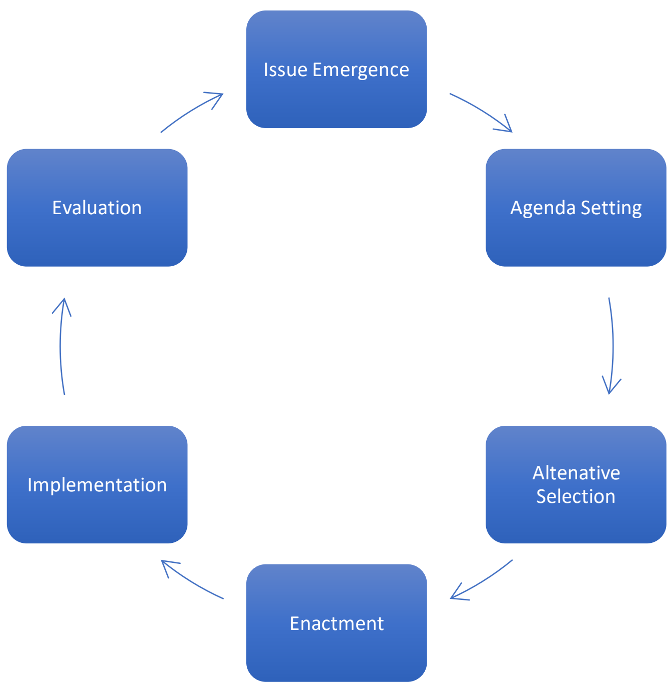

Figure 1. The Textbook Model of the policy process. (Birkland, 2016).

The Necessity of Public Policies for the Penetration of Renewable Energy Systems

> *"It is easier to accept some extra noise and the view of a turbine if it reminds you of the fact that the turbine gives you money when the wind blows."*
>
> (Meyer, 2007, p. 351)

There are two general reasons why it is critical for governments to create policies that support the production of energy from renewable sources: our *need* for renewable energy and the *obstacles* that renewable energy systems currently face.

Our need for renewable energy is motivated by our need to limit our emissions of GHGs while maintaining a certain level of quality of life. As a result, it is in our best interest to make dramatic changes to how we produce the energy that powers our society by moving away from fossil fuels and towards low-carbon, renewable energy systems (RES). These include wind turbines, photovoltaic panels, solar thermal systems, small-scale hydropower, tidal power, and many others.

Unfortunately, the high penetration of RES faces both economic and social obstacles. From an economic perspective, RES have two important disadvantages when compared to fossil-fueled energy systems. First, conventional "market forces" focus on short-term economic gain (Meyer, 2007). This is a benefit for fossil-fueled systems in which costs are more evenly spread throughout the lifetime of the systems, since you must continuously pay for the coal, natural gas or diesel to power them. However, for RES, much of the costs are at the beginning since wind, waves and the sun's energy are free. And so, without government intervention, our economic system disadvantages renewable energy systems even though they “are more environmentally benign, have higher supply security and are less costly in the long run” (Meyer, 2007, p. 348). Such a failure of our economic system is reinforced by a human tendency to focus on the initial cost of products and services as opposed to lifetime costs (Geller, 2003).

The second economic obstacle for the penetration of RES comes in the form of pricing. Fossil fuels are often described as an inexpensive form of energy. However, the price of oil, natural gas and coal is kept low through subsidization. In 2011, the fossil fuel industry was globally “supported by subsidies that amounted to $523 billion” (IEA, 2012, p. 1). This amount was six times greater than subsidies to renewable energy sources (IEA, 2012). In addition, the cost of fossil fuels does not include the negative environmental, health, social and economic impacts that are associated with the burning of fossil fuels. Such impacts are considered externalities and are not reflected in the price of fossil fuels. However, if such negative externalities were considered, 2011 fossil fuel subsidies would have totaled $1.9 trillion (IMF, 2013). Such subsidies distort the market and create a competitive disadvantage for the development of renewable energies (Geller, 2003; IEA, 2011; Reiche & Bechberger, 2004; Wüstenhagen, Wolsink, & Bürer, 2007).

The final obstacle to the penetration of RES is social acceptance of renewable energy technology. There are three dimensions to the social acceptance of renewable energy technology: sociopolitical (meaning the acceptance of policies and technology by the public, stakeholders and policy makers); market adoption of the technology; and community acceptance (meaning acceptance of siting decisions by local stakeholders) (Wüstenhagen et al., 2007).

Social acceptance of RES is important because of the features of renewable energy. Conventional power plants (such as coal-fired plants) are relatively large and can produce a relatively large amount of electricity. This has led to a “centralized” energy system where a small number of (centralized) power plants feed electricity to many customers. Renewable energy power plants are much smaller – a set of photovoltaic panels fits on your roof and a farmer can fit a large sized wind turbine in one of his or her fields. As a result, a system powered by renewable energy technology needs to be “decentralized” so that the many relatively small (decentralized) power plants can feed electricity to many customers (Breukers & Wolsink, 2007). As a result, RES are built closer to homes and businesses and have a greater visual impact (Wüstenhagen et al., 2007). In addition, because they rely on energy sources such as the sun and wind, RES are much more location dependent (Breukers & Wolsink, 2007). These traits of RES, combined with the economic advantages of fossil fuels described earlier, make the social acceptance of RES a critical factor.

The need for RES because of the threat of climate change, the uneven economic playing field between fossil fuels and RES and the importance of the social acceptance of RES creates the need for governmental policies that will support the growth of renewable energy systems. And without such targeted policies, “renewable energy sources in all likelihood will remain niche technologies that contribute relatively little to world-wide energy supply in the next few decades” (Geller, 2003, p. 44).

Policies Needed to Increase the Rate of Penetration of Renewable Energy Systems

Changing our energy system from fossil fuels to renewable sources of energy is a monumental transformation that goes beyond simply changing the fuel we put in our power plants. As described above, it is a change from a centralized energy system to a decentralized one. Market forces alone cannot accomplish such a change. It requires a new form of societal planning, new energy regulations and new forms of energy development (Meyer, 2007). For such changes to happen, the right policies must be put in place. In the following pages, I will be describing the different aspects of policies that can lead to greater penetration of RES. I have divided the discussion into five sections: formal energy policy; deterrents to increased fossil fuel use; government mandates; economic support systems for RES; and social acceptance.

Formal Energy Policy

The aim of a government's formal energy policy must be to change the energy market from fossil fuels to renewable energy systems (Geller, 2003). Such a transformation will not happen overnight. Rather it requires long term planning on the order of decades (Meyer, 2007). To reduce risk and uncertainty for investors, businesses and consumers through such a transition, it is critical that the formal energy policy define long-term renewable energy targets (Meyer, 2007). Also critical is that the tools used to achieve the long-term targets be predictable and stable over decades (Geller, 2003; Reiche & Bechberger, 2004). There must also be a monitoring system in place to evaluate the success of the policy tools and the renewable energy transition (Geller, 2003).

Deterrents to Increased Fossil Fuel Use

Because of subsidies and externalities, the energy market is currently biased towards fossil fuels. Despite this uneven playing field, government policies can be used to discourage the use of fossil fuels. First and foremost, would be the elimination of fossil fuel subsidies where they exist. This can be combined with a fee on carbon (such as a carbon tax) that reflects the value of the externalities associated with the burning of fossil fuels. These changes alone would increase the cost of fossil fuels, reflecting its true value and making renewable energy systems comparatively more affordable (Geller, 2003) and reducing global energy demand and CO_2 emissions (IEA, 2011; IMF, 2013).

Government Mandates

Before addressing the different economic support systems that are used to support RES, it must be noted that governments can use mandates to encourage growth in renewable energy systems. Such mandates usually come in the form of Renewable Portfolio Standards (RPS). An RPS is a regulation that requires utilities to purchase and supply specified amounts of renewable energy, either as a fixed amount or a percentage of total energy delivered (Delucchi & Jacobson, 2013). Such a mandate creates certainty in the market that there will be a demand for renewable energy, which encourages investment, and creates the potential for competition between different renewable energy producers. Governments can also mandate the use of RES through the building code (Geller, 2003), mandating that new buildings produce "*x*" amount of renewable energy. Irrespective of the type of mandate, such regulations are most effective if they are combined with training programs for building designers and construction firms as well as promotional campaigns for the technologies and rigorous enforcement of the regulations (Geller, 2003). Training, promotion, information dissemination, even demonstration and testing of RES can be effectively done through the creation of renewable energy centers (Geller, 2003).

Economic Support Systems for Renewable Energy Systems

There are a variety of economic tools used to directly support the penetration of RES. However, the most successful of these tools have certain common characteristics. First, they must be available over long periods of time. Such stability creates certainty and encourages investment into RES (Geller, 2003; Reiche & Bechberger, 2004). Whenever there is a lack of certainty in the energy market, due to a lack of long term regulation (including financial support), growth in renewable energy development is weak (Maruyama, Nishikido, & Iida, 2007; Meyer, 2007).

The example of Spain in the 1980s and 1990s demonstrates the effect of uncertainties around economic tools to support renewable energy. In 1980, Spanish law had no regulation in place regarding the length of feed-in tariff contracts (described below), and the value of tariffs was set annually. In 1986, the focus became research and development of renewable energy technology, without any specific targets for renewable energy production. Because of the uncertainty created by these laws, the growth of renewable energy in the 1980s was slow (Meyer, 2007). However, a 1994 law stated that tariffs contracts had minimum lengths of five years. This was followed in 1998 by higher tariffs, which included environmental premiums. The certainty created by the longer contracts, combined with more generous tariffs, resulted in very rapid growth in wind energy. In fact, from 1995 to 2006, wind energy development in Spain was second only to Germany (Meyer, 2007).

Second, while long-term stability is important to encourage investment, policy tools should still be updated regularly as different barriers to renewable energy development are overcome (Geller, 2003). For example, if RES targets are being met years in advance, targets should become more ambitious. Or, if tariffs for a specific technology were originally given a high value due to the cost of the technology, these tariffs should be reduced if technological developments lead to a reduction in the cost of that technology. Third, policy tools should not be wedded to a particular technology. The technology that is most suitable to particular local conditions should be used (Gallagher, 2013). To that end, it is important that resource mapping be done (especially for wind) in order for investors to know where best to develop different technologies (Meyer, 2007).

To meet renewable energy targets, governments can utilize a variety of economic support systems. Such financial incentives can help get RES established in the market, encourage early adoption and encourage widespread adoption of these systems (Geller, 2003; Meyer, 2007). In addition, in the absence of reforms to fossil fuels subsidies (described above), financial incentives help RES become economically competitive. To make these economic support systems most effective, and to minimize their cost, "incentives should be performance based and scaled back as technology matures and approaches competitiveness" (Geller, 2003, p. 57).

Economic Incentives

There are two types of economic incentives that can be utilised by governments, the first of which is support for the purchasing of RES. Since the typical payback period of RES is often measured in years, access to low-interest loans is every important (Geller, 2003; Reiche & Bechberger, 2004). To address this challenge, governments can create "green" banks that will offer public-private financing for the purchase of RES (Delucchi & Jacobson, 2013). Alternatively, governments can offer long-term, low interest loans, or require that certain banking institutions offer such loans. (Delucchi & Jacobson, 2013). Governments can also support the purchasing of RES by directly subsidising the purchasing cost of the technology (Delucchi & Jacobson, 2013; Meyer, 2007; Reiche & Bechberger, 2004), or by creating tax credits for such investments (Delucchi & Jacobson, 2013; Geller, 2003; Reiche & Bechberger, 2004). Finally, the public sector can help bring down the cost of initial investments in RES by making a large-scale purchase of a particular technology. Such bulk procurement can be done with households and businesses that wish to invest in that technology. If done at a large enough scale, the technology can be purchased at lower, wholesale, prices (Geller, 2003). One of the most important economic challenges of renewable energy systems is that their payback periods can be relatively long (usually measured in years). Such long payback periods make access to low-interest loans very important.

Rather than supporting the purchasing of RES, government can offer incentives for the production of renewable energy. Such incentives can come in the form of renewable energy certificates (RECs), net metering, or feed-in tariffs. RECs are certificates that are traded inside of the renewable energy market (Gallagher, 2013; Meyer, 2007). In order to create such a market, the government begins by setting a specific target for the quantity of renewable energy it wants on the power grid by a particular date. Then, the value of an REC is set and the number of RECs created to reflect that value and the renewable energy target. As an example, I will use the situation in Australia, as described by the company Energy Matters (2012). The government of Australia had set a target of 45,000, 000 MWh (megawatt-hour) for the renewable energy market. Since each REC was equivalent to one MWh (megawatt-hour), 45,000,000 REC would be created in order to meet the government's target. Certified producers of renewable energy could trade their REC's for cash, with the value of the REC being dependant on market conditions.

In a net metering program, a household's energy meter can run "backwards" when a renewable energy system is producing more energy than the home is consuming. At the end of a billing period, if the household has produced more energy than it has consumed, the household is credited or paid for that energy difference (Yamamoto, 2012). Different net metering regulations will have different policies regarding how long credits can be kept (or banked) and the value of those credits.

In a feed-in tariff system, a contract is created that guarantees a preferential, technology-specific price at which the utility company will pay for the renewable energy produced (Commission of the European Communities, 2008). A household that generates renewable electricity sells all of it to the grid at the preferential contract rate and purchases all its electricity at standard rates (Yamamoto, 2012). Independent of the type of renewable energy being produced, the value of the tariff diminishes over time. This encourages early participation since those that invest in renewable energy systems early in the program will be paid a higher tariff than those that invest later. Contracts for feed-in tariffs are long term agreements that usually last eight to 15 years, but can last as long as 20-30 years (Lipp, 2007). The cost of the tariff is passed on to all the consumers in the form of an energy price premium.

Despite the advantages and disadvantages of these different policy tools, “well-adapted feed-in tariff regimes are generally the most efficient and effective support schemes for promoting renewable electricity” (Commission of the European Communities, 2008, p. 3). This is in great part because properly designed feed-in tariffs make RES financially viable and provide long term certainty for developers (Gallagher, 2013; Geller, 2003; Reiche & Bechberger, 2004). Feed-in tariffs are also successful because they give the people living near RES the ability to economically benefit from the systems. This is believed to be a critical factor in creating widespread and sustained social acceptance of RES (Gallagher, 2013; Jobert, Laborgne, & Mimler, 2007; Maruyama et al., 2007).

Increasing Social Acceptance

To increase social acceptance, or decrease local resistance to RES, renewable energy policies must aim to facilitate local ownership (Breukers & Wolsink, 2007) and institutionalize local participation in project planning (Breukers & Wolsink, 2007; Gross, 2007). As described earlier, renewable energy systems have a greater visual impact than conventional energy systems. This makes local ownership critical since “It is easier to accept some extra noise and the view of a turbine if it reminds you of the fact that the turbine gives you money when the wind blows” (Meyer, 2007, p. 351). In countries like Germany and Denmark, where renewable energy has been successful, governments encourage local ownership of RES by families, guilds and co-operatives, creating wide public support (Delucchi & Jacobson, 2013; Geller, 2003). In a comparison between Sweden and Denmark, Meyer (2007) describes how the Swedish government gave the responsibility of wind energy development to large utilities. However, with little incentive to change their current practices, the utilities were not committed to a move to wind energy and results were poor. In contrast, a generous feed-in tariff, combined with other policies aimed at public participation, led to 150,000 Danish households owning 80% of Danish wind turbines as of 2001 (Meyer, 2007). Local ownership through feed-in tariffs has the additional advantage of guaranteeing local economic benefits and local involvement (Breukers & Wolsink, 2007).

Finally, policies that aim to educate and include the public in the decision-making process will have greater success than those that impose renewable energy projects. Public objection to such projects is often described as a case of NIMBY-ism ("not in my back yard"). Simply put, most citizens support the *idea* of renewable energy systems, but not if the solar panels or wind turbines are visible from their backyard. However, according to Breukers &Wolsink (2007), the perceived visual impacts are actually reinforced by dissatisfaction with the top-down decision-making process that is imposed on the citizenry. In fact, "Consultation after a plan has been announced is more of a trigger for opposition than an incentive for the proper design of acceptable projects" (Breukers & Wolsink, 2007, p. 1205).

And thus, to reduce this NIMBY-ism, it is critical to create policies that allow for high levels of public participation through a bottom-up process that includes local citizens and companies, starting at the planning phase of the project (Breukers & Wolsink, 2007; Gallagher, 2013; McLaren Loring, 2007; Wüstenhagen et al., 2007). Such a process has the added benefit of bringing in local knowledge and experience that can improve the project's plan and design (Breukers & Wolsink, 2007).

Chapter 3 – Methodology

Research Site Description

Samsø is a Danish island community of approximately 3,700 residents, living in 22 villages (VisitSamsø, 2017). Most of the population is in the southern part of the island, where the largest villages are Tranebjerg, Onsbjerg, Brundby, Ballen and Kolby Kås. Geographically, the 114 km^2 island is located in the Kattegat strait, east of the Jutland peninsula and northwest of the large island of Zealand (Collins, 2011). Of those 114 km^2, 23 km^2 are recognized as protected area and 81 km^2 is cultivated land (VisitSamsø, 2017). Samsø's economy depends largely on agriculture, tourism and fisheries (Clifford, 2011). The island has a low topography and being surrounded by water, this creates a conducive environment for generation of wind energy. Samsø's transition away from

Figure 2. Image of Denmark (light colour), with Samsø highlighted (Rotsee, 2009).

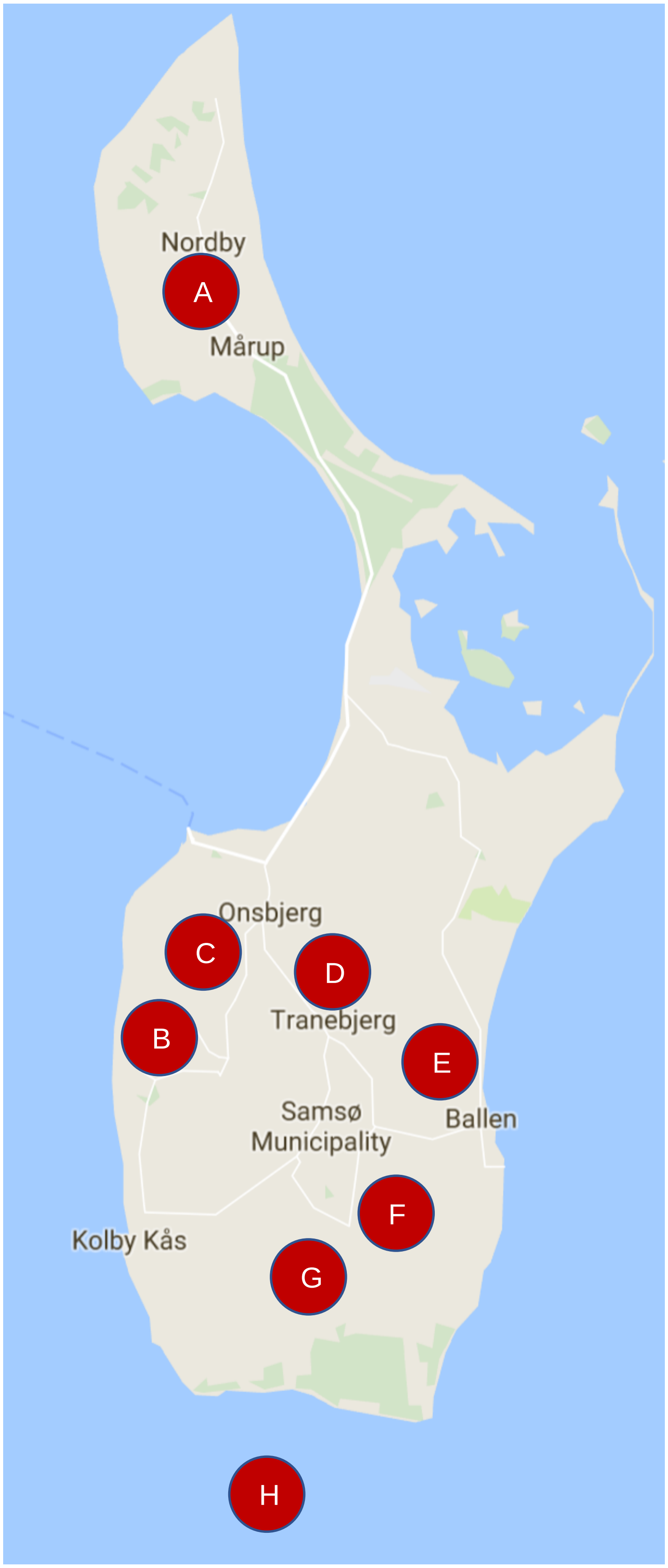

Figure 3. Renewable energy systems on the island of Samsø. (A) Solar heat and wood chip district heating plant in Norby/Mårup. (B) Three wind turbines near Tanderup. (C) Straw-fired district heating plant in Onsbjerg. (D) Straw-fired district heating plant in Tranebjerg. (E) Straw-fired district heating plant in Ballen/Brundby. (F) Five wind turbines near Brundby. (G) Three wind turbines near Permelille. (H) Ten offshore wind turbines.

fossil fuels was made possible by exploiting this wind energy, as well as other energy sources including solar, locally grown straw and sustainably harvested wood.

The island's electricity needs are met by 11 onshore wind turbines, spread over three sites (Lundèn & Larsen, 2014). There are three turbines located near the community Tanderup (Fig. 3B), five near Brundby (Fig. 3F) and three turbines near Pemelille (Fig. 3G) (Energy Academy, 2011). Of the 11 turbines, two are owned by local co-operatives with a total of 450 members (Energy Academy, 2011), while the rest are owned privately, by local farmers (Sperling, 2017). Each of these turbines is rated at one MW and is capable of producing the annual electricity need of 630 homes (Energy Academy, 2011).

The community's heating needs are met by four different district heating systems. The heating plant in Norby/Mårup (Fig. 3A) uses a combination of solar collectors and the burning of sustainably harvested wood chips, while the plants in Onsbjerg (Fig. 3C), Tranebjerg (Fig. 3D) and Ballen/Brundby (Fig. 3E) all burn locally farmed straw (Energy Academy, 2011). The plants at Norby/Mårup and Tranebjerg are commercially owned and operated by the Danish utility company NRGi (Energy Academy, 2011). The plant in Onsbjerg is owned by local entrepreneurs and run by a board consisting of consumers, owners and municipal officials (Energy Academy, 2011). The plant in Ballen/Brundby is completely owned by the consumers (Energy Academy, 2011).

During the transition to renewable energy, it became evident that not all of Samsø's energy needs could be met with renewable alternatives. Some homes, not connected to the district heating plants, were still being heated with furnace oil. Also, the technological limitation of electric vehicles and alternative fuel sources left the transportation and agricultural sectors still powered by fossil fuels (Energy Academy, 2011). As a result, the decision was made to offset the CO_2 from these sources by erecting 10 offshore wind turbines (Fig. 3H), the electricity from which is sold to European countries such as Germany (Lundèn & Larsen, 2014). Of these 10 turbines, five are owned by the municipality of Samsø, three are owned by external investors and two are owned by co-operatives (Sperling, 2017). As a result of all these changes, Samsø is considered 100% CO_2 neutral (Lundèn & Larsen, 2014).

Research Design

The research was conducted in two separate parts. The first was a document review where the goal was to develop an understanding of Denmark's energy and climate change mitigation policies. The second was a series of interviews with residents of Samsø who were involved in the transition to renewable energy.

Part 1: Document Review

Like many Western nations, Denmark was hard-hit by the energy crisis of the 1970s. Its reaction to the increase in oil prices, combined with Denmark's near-complete dependence on imported petroleum, was a "call for the introduction of long-term planning and control within the energy sector" (Ministry of Commerce, 1976). And while renewable energy sources were only a small part of Denmark's energy mix in the 1970s, recognition of their importance to Denmark's long-term energy security was apparent in the country's first energy policy document, *Danish Energy Policy – 1976*. As a result, the focus of my document review was on energy policies from the 1970s until the late 1990s, giving me an understanding of the policies that were in place when the transition to renewable energy began in 1997. From 1976 to the beginning of the transition to renewable energy in 1997, the Danish government released four energy policy documents. The Danish government has translated all of their energy policy documents into English and so they became an important part of my document review.

In addition to these official policy documents, I researched various peer-reviewed journal articles, and reports regarding Denmark's energy and climate change policies. The majority of these articles and reports were found using the OneSearch database on the UPEI's (University of Prince Edward Island) library website (https://library-upei-ca.proxy.library.upei.ca/). The OneSearch database gives access to several hundred other databases in a variety of subjects, including, and most relevant to this research, "environmental studies" and "political sciences". OneSearch also gives access to UPEI's catalogue of books, as well as that of other libraries, which are available through interlibrary loans. A variety of search terms were used, from the general (such as "Denmark Renewable Energy Policy") to the more specific (such as "Feed-in tariff"). Reading through the articles and reports found through OneSearch led to finding useful secondary (and tertiary) sources as well.

After gaining a better, general, understanding Danish energy policies, I chose to separate my document review into the following topics:

- Energy Plans and Policy Motivation Over Time;
- Energy Efficiency and Reduced Energy Consumption;
- Support for Decentralization and Public Participation;
- Support for Wind Energy Production;
- Use of Taxation.

These topics were most relevant to understanding the policies that led to Samsø's transition to renewable energy.

Part 2: Interviews

Before beginning the process of finding interviewees, it was necessary to complete a Research Ethics Board (REB) process. This process included completing the *Ethical Conduct for Research Involving Humans Course on Research Ethics* (TCPS2: CORE). In addition, it was necessary to have the following documents approved: my interview guide, as well as the consent form and participant information sheet that would be shared with participants of my study (See Appendices A, B and C).

After obtaining REB approval, I began searching for potential interviewees. To begin this process, I reached out to Samsø's municipal government, through the contact e-mail address on the Samsø Kommune website (https://www.samsoe.dk/), which I found through a search on Google. In this e-mail, I introduced myself and described how I wished to conduct interviews in Samsø to research the community's transition to renewable energy. The person who replied acted as my local contact.

With the help of my contact, I created a list of potential interviewees. My goal was to speak with individuals who were involved in the transition in one of the following ways: planning, organizing or implementing the transition; investing in energy efficiency for their home or in renewable energy systems; and contractors who worked on energy efficiency or who were involved in building/installing renewable energy systems. In the end, most of my participants fit into more than one of these categories.

Using e-mails and phone calls, my contact and I reached out to the possible participants and invited them to participate in my study. Initial contact with participants was made while I was still in Canada. Final dates, times and locations of interviews were determined after my arrival in Samsø. With each potential participant, we also inquired as to whether they had any suggestions for additional participants. In the end, 10 individuals agreed to participate in the study, and were available at the time of my visit to Samsø. I travelled to Samsø by plane, train and ferry, in the summer of 2015. Interviews with the participants of my study occurred over a three-week period, in the month of July. Information from these 10 interviewees are referenced as being "P1" (Participant 1) to "P10" (Participant 10) in Chapter 4 of this thesis.

Prior to the interview, each participant was given a copy of the "Participant Information Sheet" (see Appendix A), which informed them about the reason for the study, their role and any risks involved. On the day of the interview, participants also signed a consent form (see Appendix B) which detailed how the data from their interview was to be managed and protected.

The interviews were conducted, in person, at a location that best-suited the interviewee. The interviews were semi-structured, using an interview guide (see Appendix C) with key questions, and possible probes. Out of the 10 interviews, eight were conducted completely in English, one was conducted partly in English and partly in Danish, with the help of a translator, and one interview was conducted completely in Danish with the help of a translator. The interviews, which were recorded by two digital recorders, lasted between 20 and 57 minutes. Certain participants were more closely involved in the transition than others and so their interviews took longer. Also, the need for (or lack of) translation also affected the length of the interviews.

Once the interviews were completed, their audio recordings were transcribed by the researcher. Every participant was sent a copy of the transcript of their interview to review and make any possible changes or additions. No such changes were required.

Advantages and Limitations of the Methodology

Studying both the policies that supported the transition (through the document review) as well as the implementation process led to a more complete understanding of *why* Samsø was successful in their transition. In addition, having the opportunity to communicate with various stakeholders in the community revealed a wide range of perspectives. This has informed me about the parts of the transition that were effective, which were challenging, and how another community might make a similar transition even more effectively.

However, the number of participants in my study was limited, involving a small fraction of the stakeholders, in a small community. This created the possibility that certain challenges, successes, or complaints were not mentioned.

Another limitation to my research and its methodology is the time frame. I have studied a process that began two decades ago. Since then, renewable energy systems have become more common, more efficient and less expensive. This could affect the way policies now need to be developed to encourage energy efficiency/energy conservation and the deployment of renewable energy systems. In addition, since the late 1990s, atmospheric CO_2 concentrations have risen drastically. One would assume that this would increase the urgency with which governments would want to implement policies to reduce GHG emissions.

Finally, by only studying one island, I have a limited sample of policies and implementation procedures to consider. Also, not every island has the same jurisdictional organization as Samsø. Samsø is a small part of a country with forward thinking policies on climate change mitigation. And so, their example may not be easily replicable on small island nations or subnational jurisdictions whose central government has less ambitious climate goals.

Chapter 4 – Results

Danish Energy Policies Prior to Samsø's Transition to Renewable Energy

Government in Denmark

The country of Denmark has been a constitutional democracy since the passing of its first Constitutional Act in 1849 (Ministry of Foreign Affairs of Denmark, 2018). The country's monarch is the head of state; however, the Crown is not involved in politics (Fitzmaurice, 1981). The Constitutional Act of 1849 created three independent branches: The parliament, the government and the courts (Ministry of Foreign Affairs of Denmark, 2018). The courts have judicial power (Ministry of Foreign Affairs of Denmark, 2018). The government has executive power and is responsible for proposing measures to parliament (Fitzmaurice, 1981). The government is also responsible for foreign policy and budgets (Fitzmaurice, 1981). Finally, the *Folketing* (parliament) is the legislative assembly, passing acts that apply to Denmark (Folketinget, 2012).

Denmark has a multi-party structure, with several parties represented in the *Folketing* at any one time (Ministry of Foreign Affairs of Denmark, 2018). There has not been a majority government in Denmark since 1909 (Ministry of Foreign Affairs of Denmark, 2018). Rather, minority governments are usually formed with support from one, or many, parties (Ministry of Foreign Affairs of Denmark, 2018). As a result, decision-making is based on consensus, with government pursuing policies that will get support from a majority of members in parliament (Folketinget, 2012). Such cooperation has the added benefit of allowing Danish governments to create long-term policies that have less risk of being changed when a new government comes to power (Folketinget, 2012).

Energy Plans and Policy Motivation Over Time

Since 1997, Denmark has become more than self-sufficient in terms of energy supply (Danish Energy Agency, 2012). In addition, it is arguably one of the world's most sustainable nations (Sovacool, 2013). These achievements did not occur by chance, but by design. As discussed earlier, politics through consensus in the Danish parliament allowed for the development of long-term energy policies that remained consistently in support of energy efficiency, energy conservation and the use of renewable energy systems.

Long-term planning of Denmark's energy sector began as a response to the 1973-1974 energy crisis during which purposeful decreases in oil production by Arab nations led to a drastic increase in oil prices (Nojeim & Kilroy, 2011). At the time of the crisis, more than 90% of Denmark's total energy consumption depended on imported petroleum (Danish Energy Agency, 2012). Concerns over long-term energy prices and the nation's reliance on energy imports were the main motivations behind the creation of Denmark's first energy policy document: *Danish Energy Policy – 1976* (Ministry of Commerce, 1976).

From 1976 until the beginning of Samsø's transition to renewable energy in 1997, the Danish government published four energy plans. Each plan was a policy document through which the government described its vision for the Danish energy sector. In addition to providing direction, the plans were comprehensive and included objectives and mechanisms for achieving those objectives (Lipp, 2007). The energy plans, and policies that were later passed in the Danish parliament, created a framework for reaching energy objectives through the engagement of private industry and the public (Lipp, 2007).

In the energy plan of 1976, the Danish government set about reacting to the energy crisis by putting in place policies that would secure the country's energy supply and decrease its dependence on imported oil (Ministry of Commerce, 1976). To do this, reducing energy consumption and diversifying the energy supply were prioritized (Danish Energy Agency, 2012). In order to achieve the latter, power plants would be transitioned from oil to coal, in the short term (Krohn, 2002), with plans to incorporate nuclear power over the next ten years (Ministry of Commerce, 1976). In addition, local sources of oil and natural gas would be developed (Ministry of Commerce, 1976).

In 1976, renewable energy sources had only a small role to play in Denmark's energy mix (IRENA, 2013). However, in the energy plan of 1976, the Danish government recognized the necessity for renewable sources of energy to guarantee the nation's energy supply beyond the exhaustion of non-renewable sources (Ministry of Commerce, 1976). To that end, the energy plan of 1976 began Denmark's steady funding of research and development (R&D) for renewable energy sources, with 15% of its R&D budget being allocated to wind energy (Ministry of Commerce, 1976).

Environmental and health concerns were also a part of the Plan of 1976. With increased use of coal, and the eventual incorporation of nuclear power into the energy mix, concerns were focused around dust and sulfur compounds being released into the atmosphere, as well as the risk of ionizing radiation (Ministry of Commerce, 1976). The plan of 1976 also mentioned the environmental risks associated with wind energy, specifically its potential to become “the ruin of natural beauty” (Ministry of Commerce, 1976, p. 76).

Five years after the release of its first energy plan, the Danish government published *Energy Plan – 1981*, which aimed to build on the Energy Plan of 1976. The priority of decreasing Denmark’s reliance on imported fuels remained (McBryan, 2009). This was to be done by rapidly developing Denmark’s own oil and gas resources (IRENA, 2013), as well as by bringing nuclear power online (Meyer, 2004). However, as a preview of what would become a central part of future energy policy plans, *Energy Plan – 1981* put emphasis on socio-economic and environmental considerations (Danish Ministry of Environment and Energy, 1996). This was most likely due to public concerns over the environmental impacts of Denmark’s increasing use of coal for electricity production (Krohn, 2002).

Energy Plan - 1981 came under intense criticism due to public concerns over the continued plans to develop nuclear power. As a result, and in opposition to the government’s policies, a group of independent energy experts created and published an alternative energy plan in 1983 (IRENA, 2013). This plan, entitled *Energy for the Future: Alternative energy plan*, put forward a strategy to power Denmark without nuclear energy and with a greater reliance on sustainable energy sources. Strong public opposition to nuclear energy eventually led the Danish parliament to vote to remove nuclear power from energy planning in 1985 (Meyer, 2004).

The third energy plan, *Energy 2000*, was released in 1990. Its aim was to "introduce the goal of sustainable development of the energy sector" (Danish Ministry of Environment and Energy, 1996, p. 9). The plan set aggressive targets for 2005, including targets to reduce overall energy consumption (McBryan, 2009), which would be achieved through greater connection of homes to district heating systems and increased use of combined heat and power plants (CHP) (Danish Ministry of Energy, 1990).

Through *Energy 2000*, Denmark also became one of the world's first nations to officially commit to reducing its emissions of CO_2 (Meyer, 1995). The initial target was for emissions to be reduced by 20%, from 1988 emissions levels, by the year 2005 (Danish Ministry of Energy, 1990). This target would be achieved through greater use of natural gas and renewable sources of energy such as biomass and wind (Danish Ministry of Energy, 1990). Regarding wind power, a target was set that by 2005, 10% of Danish electricity consumption would be met by wind power (Co-operatives UK, 2004).

The fourth energy plan, *Energy 21*, officially confirmed Denmark's two energy goals: reduce CO_2 emissions and develop a sustainable energy system (Meyer, 2007). *Energy 21* continued the aim of sustainable development, adding an emphasis on a consumer-oriented structure for the energy sector (Danish Ministry of Environment and Energy, 1996). The goals of this fourth energy plan were to further develop renewable energy systems, continue to increase energy efficiency, and keep the future need for imported energy "to an absolute minimum" (Danish Ministry of Environment and Energy, 1996, p. 5).

In *Energy 21*, the Danish government set aggressive targets for renewable energy production and CO_2 emissions reductions. By 2005, 12-14% of Denmark's total energy consumption would be met by renewable energy sources, increasing to 35% by 2030 (Danish Ministry of Environment and Energy, 1996). Regarding specifically wind energy, the targets were that wind would provide 10% of Denmark's electricity by 2005 and 50% of its electricity by 2030 (Meyer, 2004). As for CO_2 emissions, the target was a 50% reduction, relative to 1994 emissions levels, by 2030 (Danish Ministry of Environment and Energy, 1996).

Interestingly, it was in the 1996 energy plan that the Danish government officially introduced the idea of a "Renewable Energy Island" (Danish Ministry of Environment and Energy, 1996, p. 44). According to the Danish Ministry of Environment and Energy, the Renewable Energy Island would be a government designated area that would undergo a drastic shift to 100% renewable energy in order demonstrate the possibility of such a transition, and to act as an "effective demonstration project for Danish renewable energy technology" (Danish Ministry of Environment and Energy, 1996, p. 44).

Energy Efficiency and Reduced Energy Consumption

Reducing energy consumption and improving energy efficiency have been a central part of Danish energy policy from the first energy plan, published in 1976. At the production end of the energy system, the use of combined heat and power (CHP) plants was an important factor in improving energy efficiency (Danish Ministry of Climate and Energy, 2009). As opposed to conventional power plants, where waste heat is completely released into the atmosphere, CHP power plants capture as much of the waste energy as possible and use it to heat buildings. Such power plants began to be subsidized in 1972 (IEA, 2004). Making better use of this waste heat was emphasized in the energy plan of 1976, where a goal was set that 20% of interior heat would come from CHP plants by 1985 (Ministry of Commerce, 1976). As the sources of heat have changed from oil, to coal to natural gas and biomass, CHP plants have remained an important part of the Danish energy system. In fact, since 1980, all new thermal power plants (those that use the burning of a substance to produce energy) have been CHP plants, even in small communities (Krohn, 2002).

On the consumption end of the energy system, focus has been put on making Denmark's buildings as energy efficient as possible. In the 1976 energy plan, the government recognized the vital role that consumers, official institutions and industry had to play in decreasing energy consumption. Energy efficiency was to be encouraged through "incentives in the form of subsidies, special financial provisions, guarantees, etc." (Ministry of Commerce, 1976, p. 72). At the same time, energy consumption was to be discouraged through "the fixing of prices for the different forms of energy by means of taxes and duties" (Ministry of Commerce, 1976, p. 72). Energy requirements for new buildings were actually first released before the first energy plan, in 1961, and further tightened in 1977 (IEA, 2004). From 1978 to 1984, the government offered subsidies for energy improvement for existing buildings (Danish Energy Agency, 2012). In

Energy 2000 (1990), insulation standards for new buildings were tightened so that, by the year 2000, heat demand would be reduced by at least 50% (Danish Ministry of Energy, 1990). Also, energy standards for existing buildings were improved (Danish Ministry of Energy, 1990). Those same energy efficiency standards in buildings were increased by 50% only six years later in the 1996 energy plan (Danish Ministry of Environment and Energy, 1996). The 1996 plan also introduced energy labeling for buildings. It required that public and private sector buildings have an energy label at the time of sale, creating transparency in the real-estate market (Danish Ministry of Environment and Energy, 1996). As a result of these efforts, from 1980 to 2009, Denmark's energy consumption remained flat, while its economy grew by 79% and its CO_2 emissions decreased (Danish Ministry of Climate and Energy, 2009).

Support for Decentralization and Public Participation

Internationally, including in Denmark, energy systems have historically been centralized: a small number of large power plants sending power to large numbers of customers. Part of Denmark's long-term planning was to move to *de*-centralization, where a large number of relatively small power plants send power to the grid, to be distributed to customers. The progressive move from centralized to decentralized allowed for greater public involvement in the energy sector.

The push to decentralize both heat and power production was first highlighted in the 1976 energy plan (McBryan, 2009) with the development of fiscal incentives for the decentralization of CHP plants (Krohn, 2002). Initiatives in the energy plan gave power to local governments to create municipal district heating plans, allowing municipalities more fuel flexibility (Co-operatives UK, 2004). In 1981, support for community ownership of wind-turbines came in the form of tax incentives aimed specifically at co-operatives (Co-operatives UK, 2004). Government support of local ownership of energy systems continued in subsequent energy plans.

As a result, by 2001, approximately 150,000 Danish households were members of co-operatives that owned wind turbines (Meyer, 2004). Co-operatives also owned a large share of CHP and district heating plants, with farmer co-operatives managing the fuel supply chains for many of those plants (Co-operatives UK, 2004).

Support for Wind Energy Production

Denmark is one of the few countries that has steadily supported renewable energy systems since the 1970s (Lipp, 2007). Much of that support has been put towards the production of electricity using wind power and came in the form of both financial and non-financial support. Knowing where to place wind turbines was a challenge in the late 1970s due to limited meteorological data. To counter this, the government published Denmark's first wind atlas in 1981 (Meyer, 2004). From 1981 to 1986, a more extensive study was done by the Danish government in order to identify possible suitable sites for wind turbines (Meyer, 2004). With this information in hand, government would later require that each municipality allocate suitable areas for onshore turbines (Danish Energy Agency, 2012).

In the 1990 energy plan, the Danish government simplified the process of getting turbines connected to the grid by guaranteeing grid connection for new turbines and mandating that utilities purchase wind-based electricity (IRENA, 2013). Grid connection costs were to be shared between the turbine owner(s) and the utilities (Sovacool, 2013). The utilities were responsible for upgrading the power grid to support decentralised power generation (Sovacool, 2013). The costs of these improvements were to be transferred to the customers through increases in power rates (Sovacool, 2013). Financial support for the installation of wind turbines began in 1979, when government offered citizens a grant of 30% of the cost of purchasing and installing a wind turbine (Meyer, 2004). This subsidy was gradually reduced as the cost of turbines decreased and was eventually eliminated in 1988 (IRENA, 2013).

However, arguably the most important policy in support of wind energy was the introduction of a feed-in tariff (FIT) in 1993. The FIT was a guaranteed rate at which utilities had to purchase wind power from independent producers. The rate was set by government at 85% of the utility's production and distribution cost (Meyer, 1995). This tariff is not technically a government support mechanism since it is paid for by an increase in electricity rates paid by customers (Krohn, 2002). In addition to the FIT from the utilities, producers also received an additional tariff, paid by the government, in the form of an environmentally friendly energy source refund (Meyer, 1995). Combined, the two tariffs resulted in a payback rate of 150% of the utility's net price, in 1994. Finally, income from the wind energy was tax-free for the first 7,000 kWh of production, each year, and the rest of the year's income was taxed at a lower rate than regular income (Meyer, 2007).

Use of Taxation

Throughout the 1970s, 1980s and 1990s, taxation of energy was used to both discourage the use of fossil fuels, and encourage the use of environmentally-friendly alternatives. Energy taxes on oil and electricity were introduced in 1977 as a reaction to the 1973-1974 energy crisis (Danish Energy Agency, 2012). In 1985, as gas prices fell, oil taxes were actually increased to discourage an increase in energy consumption (Sovacool, 2013). Additional taxes were imposed on coal (in 1982), CO_2 (in 1992), natural gas and sulfur (in 1996) (Sovacool, 2013). To protect Danish electricity imports and exports, fuels used for electricity production were exempt from taxes (Danish Energy Agency, 2012). Instead, an energy tax on electricity was levied (Danish Energy Agency, 2012). By 2002, the effective tax rate on energy products such as gasoline, natural gas and heating oil was 200% (IEA, 2004).

The Implementation of Samsø's Transition to Renewable Energy

In the late 1990s, Denmark's Minister of the Environment was a progressive politician who realized that his country had a role to play in the fight against climate change. During the Conference of Parties (COP 3) to the United Nations Framework Convention on Climate Change (UNFCC) meetings, the minister (along with representatives of other countries) pledged that Denmark would reduce its CO_2 emissions 21% from 1995 levels (P2). And while the decision was criticized with arguments of loss of competitive ability and the impact that such reductions in emissions would have on the cost of living in

Denmark, the minister, backed by the Danish government, argued for green growth, based on sustainable sources of energy (P2).

The Importance of a Master Plan

As part of the efforts put forward by the Danish government to reduce its country's carbon emissions, the Renewable Island competition was put in place by the Environment Minister, to showcase how an island could completely move away from fossil fuels in a relatively short period of time (P1 and P2), having access to the same programs and subsidies to which everyone on Denmark had access to (P2). Interestingly, it was an engineering company, PlanEnergi, from the mainland that informed the community of Samsø of the existence of the competition (P5). After the closing of a slaughter house, which had employed 100 people, the Renewable Island competition was seen as an opportunity to bring about positive change in Samsø (P2).

The next step would be the creation of a "Master Plan" detailing how Samsø would "change the energy patterns over 10 years, from fossil fuels to renewable energy" (P2). This Master Plan, which was created on behalf of the local government by an engineer from PlanEnergi, was essentially a recipe for the transition and detailed what resources were available on the island; what the current energy consumption patterns were; how consumptions patterns could be changed; and how renewable sources of energy could be put in place to reduce the use of fossil fuels (P2). Funding for the creation of the Master Plan came from the Danish government, as part of the Renewable Island competition (P8).

The presence of such a Master Plan was extremely important for the transition (P4, P7 and P8). First and foremost, the Master Plan allowed the individuals leading the transition (details below), and the community of Samsø, to stay on track throughout the transition (P4). Secondly, the information provided by the Master Plan was used to educate the citizens of Samsø about how the transition would occur (P4), and, ultimately convince the people of Samsø of the feasibility of the move to renewable energy. (As we will see later, getting the citizens of Samsø on board with this transition was crucial to its success.) Thirdly, the Master Plan allowed contractors to stay "faithful" to the transition. For example, knowing that certain households would hopefully be connected to a district heating plant, contractors would avoid selling these households alternative heating systems, such as heat pumps (P5). Finally, the fact that the plan had realistic and achievable goals made it easier to convince the public about what was possible through this transition to renewable energy (P6 and P7).

The realistic and feasible nature of the Master Plan was thanks, in great part, to two factors. First, as we will see in more detail later, governmental policies regarding energy were very supportive of the development of renewable energy. Second, the engineer hired to help put together the Master Plan was able to accurately calculate energy requirements, cost of technology and required investments (P2).

Community Leaders

However, the Master Plan was only a road map. A critical part of making this Plan a reality was dialogue between community leaders and the citizens of Samsø. Citizens needed to be convinced that this transition would be good for the community and good for them as individuals, families and business owners (P1). As we will discuss later, the most important argument was financial. People needed to see how they would save, or even make, money through this transition (P1). However, to gain trust and support, you need a team of people, which are referred to as community leaders, willing to spend countless hours “talking to, and drinking a lot of coffee” with members of the community (P1).

The first of these community leaders was the “Island Project Leader” (IPL). The IPL was a position created by the local government in order to lead the Samsø transition. While not being a part of the local government, the IPL’s role was to work from the “bottom-up”, in order to “communicate, to engage and to activate the projects” (P2). Beyond the IPL, other leaders in the community had to be brought on board to speak to citizens about the transition and gain their support. As the process went on, well respected citizens of Samsø (P7, P8 and P9), who were strong believers in the transition (P4), were invited to become leaders themselves. The work of these community leaders led to a “snowball” of support that spread throughout the island community, where others became convinced and supportive of the project, convincing others, and so on (P10).

Initially, people were sceptical of the move to renewable energy. People who feared change had negative opinions of the project (P2). Some supported the idea, but did not wish to get involved. Their view was, “Yeah, that’s fine. You can do that”, as though they wanted to wait and see progress before getting involved (P2). Some originally believed that the transition was an idea for the “green idiots” (P4). And many had concerns about how the move to renewable energy would affect the cost of electricity and heating (P10).

However, when trusted leaders showed support for the project, people joined in (P2, P5 and P10), and the “snowball” effect continued. According to Participant 3, “as it progresses, it’s kind of like a disease.” People got on board because they saw others doing so. Even people who objected on a political level – objecting to the Danish Government’s subsidizing of wind energy, for example – ended up buying shares in wind turbines (P2). People who did not initially participate in projects such as the district heating plants eventually regretted it since being connected to the plant made a property more appealing to potential homebuyers (P4).

Initial Focus on Energy Consumption and Energy Efficiency

Samsø’s move away from fossil fuels did not include a single “magic bullet”. There were a variety of renewable energy solutions (P4, P6 and P7), and ownership schemes (P2). Also, the solutions were based on the available resources (P7), which were determined as part of the development of the Master Plan. However, the initial focus was on reducing energy consumption through energy conservation and improving energy efficiency (P2).

The logic of starting with reducing energy consumption is simple. If you can reduce energy consumption by 30%, you have 30% fewer solar panels and wind turbines to purchase and install to achieve your transition to renewable energy, reducing the cost of the transition to the consumer (P2). Also, investing in insulation for your home gets you a better return on your investment than purchasing solar panels, or shares in a wind turbine (P3).

Since the first step of the transition was to reduce energy consumption, one of the first roles of the IPL was to educate households on how they could make changes in how they used energy in their household. While doing so, it was important to show households how these changes would save them money on their energy bills. The IPL convinced the population of the validity of the transition by explaining how households could profit financially (P4).

Participant 2 shared this example of a widow, living alone in the family home:

> *Like old ladies... they lived alone in a big farm house. I mean, like, way too big for them, and they spend a lot of money on oil every year. Say to them 'Maybe we should change this'. So show them the figures. And make calculations on how you can, say, put more insulation in the roof. Maybe close part of the house off. Do different things and then end up being more wealthy than you were before.*

Local contractors (craftsmen, blacksmiths, carpenters) were an important part of the work towards reducing energy consumption. They became community leaders by promoting energy efficiency to homeowners and business owners (P10). This not only increased support in the community for the transition, it also became an important part of their business. Their training allowed them to advise their clients on the different solutions available to suit their clients' needs. (P1 and P10). The argument was simple:

if you make an investment now, the payback period will be short since you will save on electricity and/or heating bills (P1).

Getting People on Board – Public Meetings and Going Door-to-Door

With the IPL hired and the other community leaders on board, the next step was to convince the population of Samsø. Support for the transition, and the individual projects within the transition, was gained through public meetings, as well as door-to-door efforts.

The public meetings began early on, and continued throughout the transition. As the transition was done in "steps" (build a heating plant, then a wind farm, etc.), it was important to keep the citizens informed about the progress of each "step" (P5 and P9) as well as making them comfortable with the upcoming steps and needed investments (P2). Interestingly, during meetings, people were asked to sit in a circle. It was felt that such an arrangement put everyone on common footing, allowed everyone to be heard, and allowed everyone to evaluate or comment on all opinions and thoughts that were shared (P2). Meetings were announced in local newspapers (P2, P6, P9 and P10) and were aimed at all the citizens of Samsø, as well vacation home owners (P3). Citizens were also kept updated about the progress of the transition through announcements in the local newspaper as well as a website dedicated to the transition.

When it came to gaining support for individual projects, the IPL and other community leaders sometimes went directly to peoples' homes to discuss the projects. Take for example the district heating plant in Norby. In addition to a general meeting for all residents who could potentially connect to the heating plant, community leaders went door-to-door to give residents additional information about the proposed heating plant and collect signatures in support of the project (P4). Even the households that were just outside of the range of the district plant were informed about alternatives to heating oil such as heat pumps (P10). Because of the constant flow of information between the community leaders and the residents, the project went ahead with the support of 80% of households (P10).

The Unique Role of Farmers

Samsø's farmers played a critical part in the community's transition to renewable energy. First, they grew the straw that would power certain district heating plants (P7). Second, and more importantly, their land was an ideal place to put wind turbines. By their very nature, a farmer's fields are a fair distance from households, creating little to no risk of noise or vibration complaints (P2). In addition, getting farmers to agree to have the turbines on their land was not difficult. In fact, farmers had to be "talked down" since they wanted to have the turbines on their land, and they wanted to own all the turbines themselves to get the most from their investments (P2). However, the IPL and community leaders knew that other members of the community needed the opportunity to invest in these turbines, or else they would object to the project (P2). According to Participant 2, the complaints come when the people of a community do not gain from the presence of the turbines:

> *We need to get people on board with this. Otherwise then they'll be run over by eager farmers who want to own everything. And then, we'll have this conflict and*

> *the local community and local people that says 'Oh, we hate these wind turbines. They make too much noise.'*

In the end, a compromise was reached where the farmers owned the land on which the turbines were installed, but "invited" local co-operatives to place turbines on their land (P2). When Participant 7, a farmer, was asked why it was a good idea for him to allow the construction of wind turbines on his land, his answer was simple, "Because I earn good money."

Connecting the Dots: Danish Policies and the Transition

Before delving into the effects of Danish energy policy, it is important to note that the community of Samsø did not receive any special grants to achieve their transition to renewable energy. As part of the competition, the community was given 150,000 DKK (just over $20,000) in order to pay for the creation of its Master Plan (P5). Beyond that, the community had access to the same programs and subsidies to which everyone on Denmark had access (P2). In other words, the transition to renewable energy happened in the context of policies that had already been established by the Government of Denmark.

Having said that, it is also important to note that the transition itself was a government idea that was proposed in the *Energy 21*, Denmark's energy plan of 1996 (Danish

Ministry of Environment and Energy, 1996). While it would have been better for the motivation for the transition to be intrinsic (P9), chances are that the transition would not have happened without that government push. Government policy also gives direction to industry and society (P8). And a reading of Danish energy policy, particularly starting in the late 1980s, reveals a concerted effort to support and encourage development in the renewable energy sector.

Basic Motivation

Simply put, Danish energy policies supported Samsø's transition to renewable energy sources by allowing it to make financial sense. For most people in Samsø, environmental considerations such as climate change were a secondary motivation (P1). Instead, it was the economic aspect that motivated citizens into taking part in the transition (P1, P5, P9, P10). As Participant 1 stated, "You have to convince people that this is a good idea and you will actually either save or earn money doing it". Without the proper incentives from the state, significant investments by the community of Samsø would not have occurred (P3, P7, P8, P9, P10). In the following pages, we will look at three ways in which Danish energy policy allowed the transition to be economically profitable for the residents of Samsø: supporting public participation in the energy system, taxation and the feed-in tariff.

Supporting Public Participation

A critical policy change for the transition in Samsø was part of the energy plan of 1990, *Energy 2000*. In this plan, the Danish government guaranteed connection to the grid for all new wind turbines and mandated that utilities purchase wind-based electricity

(IRENA, 2013). This change allowed anyone to become a generator of electricity. However, not everyone could afford to purchase a wind turbine. This is where co-operatives came in. Denmark has a history of public ownership through co-operatives (Co-operatives UK, 2004). In such an ownership scheme, the cost of owning a turbine is distributed across a wide group of people, making it financially possible for a greater number of individuals or families to make the invest. To purchase shares in the turbine-owning co-operatives in Samsø, the cost was approximately 650 USD per share. People could buy any number of shares. However, seven shares was a common number since it represented approximately one household's annual energy consumption, or 7,000 kWh (P2). Purchasing seven shares would allow a family to claim that they were "self-supplied" in electricity (P2). In the end, approximately 10% of Samsø's citizens invested in the wind turbines (P2). Even people who lived off-island bought shares (P7, P9).

Giving Samsø residents the opportunity to invest in wind turbines made their presence acceptable (P4). At the beginning of the process, there were concerns regarding wind turbines. Some people thought that they "looked horrible" (P4). Others were concerned that the presence of turbines would negatively affect the tourism industry (P10). However, as Participant 10 rightly put it, "Ownership does a lot of good things to people". In the end, concerns over the visual impact essentially disappeared when residents were given the ability to invest in a wind turbine (P4 and P10). In addition, the local government purchased several turbines, with income from those turbines being used to make important investments back in the community, including a new dock and ferry. This meant that every citizen of Samsø, at least indirectly, has gained from the presence of the turbines.

Overall, only a fraction of the money that was invested in the transition to renewable energy came from direct government grants (P10). In fact, 70% of the 58 million Euro that was invested in sustainable energy was personally invested by the local residents of the island (Lundèn & Larsen, 2014). This included most of the participants of my study. Participant 1 invested in better insulation for their home. Participant 3 invested in solar heat and a heat pump for their home. Participant 4 connected their home to a district heating plant. Participant 6, a farmer, invested in solar photovoltaic panels, converted their tractor to run on rapeseed oil, bought shares in both the onshore and offshore wind turbines, and purchased an electric car. Participant 7 owns one and a half wind turbines and made important investments in solar photovoltaic panels. Participant 9 owns shares in wind turbines. And finally, participant 10 invested in a wood pellet stove, solar heat and a small wind turbine that sits on their property.

Taxation

As mentioned previously, by 2002, Danes were paying an effective tax rate of 200% on heating oil and electricity. And while this seems like quite a burden, it did have many benefits when it came to Samsø's transition. First, the people of Samsø saw the transition as an opportunity to end their dependence on imported and expensive fuels, by producing their own energy (P2).

Second, proper taxation of energy makes alternative sources like solar and wind more interesting (P5 and P7). When it comes to home heating in Samsø, the alternative was the district heating plants. To encourage connection to the plants, households were guaranteed that heating from the district heating plant would cost less than heating with oil (P5). This guarantee was possible because of the high price of heating oil, thanks to the high rate of taxation. Early connection to the plant was also encouraged. Early connectors to the plant were offered a connecting fee of only 100 DKK (approximately $20). Households that connected after the plant came online had to pay a minimum of 4,000 DKK (approximately $800) (P4 and P5). For households that lived beyond the range of the heating plants, alternatives such as electric heat still led to savings on the energy bill (P10).

Third, such high taxes discouraged the wasting of energy and encouraged energy efficiency and conservation (P5). Along the same vein, high taxation on oil makes the payback period for improvements in energy efficiency much shorter. Participant 1 mentioned how their investment in home insulation paid for itself quickly. Participant 10 was even more specific, stating that “Every investment we’ve made has paid for itself within five years”. As a result, most new windows and improved insulation in Samsø date to the Renewable Energy Island project (P10).

Feed-in Tariff

The presence of the FIT was a crucial part of the transition. Without it, investment into the wind turbines would probably not have happened (P6, P10). Or, as Participant 3 put it, “If there was no guaranteed price, it was hopeless”. The FIT the residents of Samsø took advantage of had two important characteristics: its duration and its value. Participant 2 described the FIT as a “steady policy” that told potential investors that the price at which electricity would be purchased from their turbines would be guaranteed for 10 years. This long-term price guarantee gave citizens the confidence to “spend their money on it” (P2). The guarantee also made it easy to obtain loans to make the investments (P9 and P10). From a bank’s perspective, the fixed price gave them the security of knowing that the loans would be paid back.

While the duration of the FIT offered security to investors, its value made investing in wind turbines a much more profitable proposition. According to Participant 3, investing in the wind co-operatives gave you a better return than investing through banks. In fact, people who bought shares in wind turbines made their money back in six to seven years (P3). For individuals who could invest approximately one million dollars to purchase an entire turbine, the payback period was less than five years (P4).

Chapter 5 – Conclusion

Discussion

The purpose of this thesis was to develop a more thorough understanding of Samsø's transition to renewable energy. More specifically, I endeavoured to better understand what was done in the community, and to understand how public policy regarding energy affected the success of this transition. To that end, I put forward three research questions:

1) What governmental policies were in place, as of the beginning of the transition, that encouraged the production of electricity and building heat from renewable energy?
2) How did the community of Samsø implement their transition from conventional fossil fuels to renewable energy sources?
3) How did the energy-related public policies in place support Samsø's transition to renewable energy sources?

Based on my previous understanding of energy policies and renewable energy systems, I made three hypotheses – one for each research question. First, I hypothesized that Danish policies economically discouraged the use of fossil fuels and economically encouraged the production of energy from renewable sources. Second, I hypothesized that the success of Samsø's transition to renewable energy was due to a focus on public participation. And, finally, I hypothesized that the feed-in tariff was a key government policy in enabling that transition. The results of my research show that my hypotheses were correct. However, they also show that my hypotheses were over-simplifications. For example, while the FIT was a critical aspect of Danish energy policy in the success of Samsø's transition, it is only one aspect of a comprehensive energy policy.

To get a more complete understanding of Samsø's transition to renewable energy, the following discussion is separated into two sections: 1) Preparing for the transition to renewable energy, and; 2) How policies enabled the transition.

Preparing for the Transition to Renewable Energy

The first step in Samsø's move to renewable energy was the creation of the "Master Plan". Created by a qualified engineer, the Master Plan was a road map detailing how energy consumption and energy production would need to change over time in order to move Samsø away from fossil fuels. The Plan detailed current energy patterns, how those patterns could be changed, and how fossil fuels could be replaced by renewable energy sources. However, rather than immediate investments in renewable energy technology, the plan called for an initial focus on reducing energy consumption through conservation and energy efficiency. Finally, the Plan was based on the sources of energy that were available on the island, including wind, sun, wood and agricultural waste. As a result, the Master Plan was a realistic plan with achievable goals.

The creation of the Master Plan was crucial for two reasons. First, it allowed the community of Samsø to take the necessary steps at the right time, and in the right order during a process that lasted 10 years. Second, the existence of a realistic plan helped convince the population of the feasibility of the transition. The move to renewable energy was not an abstract idea, but rather a series of changes that citizens could understand, imagine, and support.

The second, and arguably most important, step in Samsø's transition to renewable energy was convincing the island's citizens to support the transition. This was, in no way, an easy task. However, island communities have shown their openness to new ideas, especially when those new ideas are seen as a path to development (Fürst, 2015). And in the case of Samsø, the move to renewable energy was seen as a means to rebound from the loss of employment following the closure of the slaughter house. When facing economic challenges, an island community will work together in order to pull through (Novaczek, 2015), and this is exactly what happened.

Gaining that public support required a lot of time, effort and patience. In the beginning, it was important to obtain the support of key, well-respected individuals in the community. These individuals reached out to the community at large, through public meetings and door-to-door visits. In closely-knit communities, information can quickly spread by word of mouth (Baldacchino, 1997), which is what happened in Samsø. The result was a "snow-ball effect", where individuals who became supporters of the transition turned around and convinced others, and so on. However, interacting with the community did not stop after the gaining of public support for the transition. Throughout the 10 years of the process, the public was encouraged to share its thoughts on the transition during regular public meetings. Also, newspapers and the internet were utilised to keep the community up to date with the progress of the transition.

How Policies Enabled Samsø's Transition to Renewable Energy

According to Meyer (2007), to move a nation's energy system from fossil fuels to renewables requires long-term planning, over decades. In addition, in order for such a transition to be successful, government policies must make the move towards renewable energy an explicit goal (Geller, 2003). And so, it comes as no surprise that the long-term planning of the Danish energy system began in the 1970s, two decades before Samsø's transition. However, in the initial goal was not sustainability, but energy independence. At the time of the 1973-1974 Energy Crisis, Denmark was almost completely reliant on imported oil (Danish Energy Agency, 2012). This made the country's economy vulnerable to the drastic oil price increases that followed the Energy Crisis. As a result, Danish energy policy in the 1970s and 1980s was focused on developing the country's fossil fuel reserves in order to become energy self-sufficient. And while renewable energy was only a small part of Denmark's energy mix at the time, the eventual necessity of renewable energy sources was recognized in official policy documents (Ministry of Commerce, 1976).

The explicit move towards renewable energy began in 1990. It was then that sustainability became an official part of Danish policy and that the government began to set aggressive targets for reducing energy consumption, reducing CO_2 emissions and increasing the production of wind energy (Danish Ministry of Environment and Energy, 1996). Beyond the explicit goal of moving the energy system to renewable energy and the setting of targets, Danish energy policy used both a "stick" to discourage the use of fossil fuels and a "carrot" to encourage the development of renewable energy.

The Stick: Taxation

An important aspect of the move to renewable energy in Samsø was decreasing energy consumption through energy efficiency and conservation. Part of this is done through strict efficiency requirements for buildings. However, the “big stick” that discouraged wasting of energy was taxation. By 2002 (five years into Samsø’s transition), the effective tax rate on energy products such as gasoline, natural gas and heating oil and electricity was 200% (IEA, 2004). The resulting increase in the cost of energy made conservation a better bargain. It also made investment in energy efficiency, such as better home insulation and more energy efficient windows, easier to justify by shortening the pay-back period. And for households that were considering connecting their homes to the local heating plant, the high cost of heating oil guaranteed that connecting to the heating plant would reduce heating costs.

The Carrot: Encouraging Energy Consumer Investment

Putting in place policies that allow individual consumers to invest in the energy was very important to Samsø’s transition. Allowing people to invest in (and profit from) renewable energy systems such as wind turbines is necessary for the social acceptance of RES. As was quoted earlier in this thesis, “It is easier to accept some extra noise and the view of a turbine if it reminds you of the fact that the turbine gives you money when the wind blows” (Meyer, 2007, p. 351). Danish policies allowed for such investments in several ways. First, it offered financial incentives for local ownership through co-operatives (Co-operatives UK, 2004). Also, government policies guaranteed grid connection for any turbine and mandated the purchase of wind power by utilities (IRENA, 2013).

However, the policy that made such investments profitable was the feed-in tariff. At the time of the transition, the FIT, a generous price at which utilities had to purchase wind energy, was guaranteed for 10 years. The literature on economic tools for the support of RES states that the best tools are available for long periods of time in order to create stability and encourage investments (Geller, 2003; Reiche & Bechberger, 2004). This is exactly what the FIT did in Samsø. Thanks to the 10-year price guarantee, obtaining bank loans in order to purchase shares in a wind turbine co-operative (or in some cases, an entire turbine) was easy. At the same time, the generous value of the FIT made the pay-back period relatively short. The focus on consumer investment and the nature of the FIT go a long way to explaining why the majority of the 58 million Euro invested in sustainable energy was invested by local residents.

From a policy perspective, convincing the population of Samsø of the feasibility of this transition to renewable energy was possible because it made sense *financially*. Because of the high energy prices (due to heavy taxation) and the steady support of wind energy (in the form of the FIT), the people of Samsø could see how moving away from the status quo would either save them money, or become a source of income.

In Summary

When considering such an important change as a transition to renewable energy, an island community will have concerns regarding the relevance of the project and its appropriateness for the community (Stuart, 2016). There will also be concerns over the possibility of off-island control, which island communities fear (Connor, 2008). The tireless efforts made to work with the citizens of Samsø and gain their support, combined with public policies that encouraged customer investment alleviated both of those concerns. Those same efforts and polices also addressed a critical obstacle specific to the deployment of RES, that of social acceptance. Not only that, but it addressed that obstacle in exactly the way that literature says it should be done: policies that facilitate local ownership (Breukers & Wolsink, 2007), and local participation in project planning (Breukers & Wolsink, 2007; Gross, 2007).

Potential for Further Research

Conducting this study answered many questions that I had regarding energy policy and its impact on a transition to renewable energy. However, during the conducting of interviews, new questions appeared that could potentially become the starting point for further research. All of these questions revolved around the *downsides* of local ownership of wind turbines. I've addressed how the governmental policies can encourage local investment in wind turbines and the advantages of a generous FIT. But, nothing is perfect, including ownership of a wind turbine.

There are a variety of ownership schemes for the many wind turbines in Samsø. Some are owned by cooperatives. Some are owned by individual investors. Some are owned by the local government. This variety of ownership schemes allowed many different people to invest, and gain, from the installation of the wind turbines. However, these are complex, and expensive, pieces of equipment. How do small communities and groups of investors tackle the long-term challenges of owning wind turbines? For example, how do you budget for, or fund regular maintenance of the turbines? If there is damage to the turbines, how are repairs paid for? And how do those costs affect the profitability of the investment in the wind turbines. On the question of profitability, the value of the FIT is ideally set for a long period of time. But it will most likely last the life time of the turbine. How do small communities and groups of investors deal with changes in the value of the FIT? However, possibly the biggest question, and one that the people of Samsø are already considering, how do small communities and groups of investors handle the situation at the end of the life of the turbines? Some owners are considering selling the turbines to large companies who can better afford the higher maintenance costs. These same companies may choose to replace the current turbines with larger, more powerful turbines. In either case, how will such changes affect the community? How will it affect public perception of the turbines, or their perception of renewable energy?

Conclusion

Samsø's successful transition from fossil fuels to renewable energy was successful for a variety of reasons. The process began with a competition set up by the Danish government. Guided by a detailed and realistic Master Plan, the leaders of the transition worked tirelessly to gain the trust and the support of the population, and to convince them of the feasibility of the endeavour. This feasibility was thanks in large part to the policies in place by the Danish government, which discouraged the use of fossil fuels and encouraged energy conservation, energy efficiency, sustainability and the development of renewable sources of energy. And after 10 years of hard work, countless hours of meetings and discussions, and tens of millions of dollars in local investment, Samsø succeeded in becoming 100% carbon neutral.

However, for the people of Samsø, the impacts of the transition go beyond well-insulated homes and the presence of a few wind turbines. The popularity associated with becoming the Renewable Energy Island, has led to important increases in tourism, with people from around the world wanting to see what Samsø has done. The name "Samsø" has become a brand onto itself, having positive impacts in various industries. For example, farmers will sell "Samsø vegetables" because of the positive connotation that it elicits. Individuals and households that made investments in energy efficiency and/or share in wind turbines have seen those investments turn into profit. The local government also made important investments in renewable energy technology during the transition. The profits from those investments have been re-invested back into the community, funding major projects such as the purchase of a new ferry, and the construction of important infrastructure. Most importantly, the transition has brought a sense of pride and optimism to a community that, only two decades ago, feared for its survival as globalization took away an important source of employment; all while doing its part in taking on the challenge of climate change. For all of these reasons, Samsø experience is one that can and should be learned from.

It is impossible to completely replicate what has been done on Samsø. Whether in a small island developing state (SIDS), on a provincial island such as Prince Edward Island, or on a larger scale at the level of a nation such as Canada, differences will exist that limit the level to which Samsø's experience can be applied. Different structures of government, different types of politics, different natural resources, and other factors, all make different jurisdictions unique. However, there are certain policy recommendations that should be considered critical to a transition to renewable energy.

1) A long-term energy policy that aims to replace fossil fuels with renewable energy sources;
2) An institutionalized emphasis on customer participation in planning and customer investment in renewable energy systems;
3) Ending subsidies for fossil fuels and/or levying taxes on fossil fuels and electricity;
4) Placing an emphasis on energy conservation and energy efficiency;
5) Putting in place feed-in tariffs for renewable energy systems that is steady (over many years) and generous, but whose value is reviewed regularly;
6) Guaranteed access to the grid and mandated purchasing of renewable energy by utilities.

Supported by the literature regarding renewable energy policy, these are the policy lessons that can be learned by Samsø's example. It may not be possible to simply copy what has been done in Samsø to different jurisdictions around the world, but it is possible to learn from their example in order to create our own versions of Samsø, Denmark.

References

Baldacchino, G. (1997). *Global tourism and informal labour relations: The small-scale syndrome at work*. London; Washington: Mansell.

Baldacchino, G. (2004). The coming of age of island studies. *Tijdschrift voor Economische en Sociale Geografie (Journal of Economic & Social Geography), 95*(3), 272-283.

Baldacchino, G. (2005). Editorial: Islands: Objects of representation. *Geografiska Annaler. Series B, Human Geography,* (4), 247.

Baldacchino, G. (2006). Islands, island studies, Island Studies Journal. *Island Studies Journal, 1*(1), 3-18.

Baldacchino, G., & Bertram, G. (2009). The beak of the finch: Insights into the economic development of small economies. *Round Table, 98*(401), 141-160.

Baldacchino, G., Milne, D. A., Bartmann, B., Srebrnik, H., Paterson, R., & Jolliffe, L. (2000). *Lessons From the political economy of small islands: The resourcefulness of jurisdiction*. New York, NY: St. Martin's Press.

Baldacchino, G., & Stuart, E. K. (2008). *Pulling strings: Policy insights for Prince Edward Island from other sub-national island jurisdictions*. Charlottetown, PE: Island Studies Press.

Birkland, T. A. (2016). *An introduction to the policy process: Theories, concepts, and models of public policy making* (Fourth Edition). New York, NY: Routledge.

Breukers, S., & Wolsink, M. (2007). Wind power implementation in changing institutional landscapes: An international comparison. *Energy Policy, 35*(5), 2737-2750.

Clifford, J. (2011). *Fantasy and reality, or, why Denmark is awesome: Lessons from Samsø*. Retrieved from http://niche-canada.org/2011/10/30/fantasy-and-reality-or-why-denmark-is-awesome-lessons-from-samso/

Co-operatives UK. (2004). *Co-operative energy: Lessons from Denmark and Sweden*. Retrieved from https://energiayhistud.ee/wp-content/uploads/2015/01/Co-operative-energy.-Lessons-from-Denmark-and-Sweden.pdf

Collins. (2011). *Collins world atlas*. Glasgow: HarperCollins Publisher.

Commission of the European Communities. (2008). *The support of electricity from renewable energy sources*. Retrieved from http://iet.jrc.ec.europa.eu/remea/sites/remea/files/files/documents/sec_2008_57_support_res_electricity.pdf

Connor, H. (2008). The capacity for sub-national island jurisdictions to increase autonomy: The example of Prince Edward Island. In *Pulling strings: Policy insights for Prince Edward Island from other sub-national island jurisdictions*. Charlottetown, PE: Island Studies Press.

Danish Energy Agency. (2012). *Energy policy in Denmark*. Copenhagen.

Danish Ministry of Climate and Energy. (2009). *The Danish example*. Copenhagen.

Danish Ministry of Energy. (1990). *Energy 2000 - A plan of action for sustainable development*. Copenhagen.

Danish Ministry of Environment and Energy. (1996). *Energy 21 - The Danish government's action plan for energy*. Copenhagen.

Darwin, C. (2009). *On the origin of species: By means of natural selection* (6th ed). Auckland: The Floating Press.

Delucchi, M. A., & Jacobson, M. Z. (2013). Meeting the world's energy needs entirely with wind, water and solar power. *Bulletin of Atomic Scientists*, *69*(4), 30-40.

Energy Academy. (2011). *Energy map*. Retrieved from https://energiakademiet.dk/en/vedvarende-energi-o/energikort/

Energy Matters. (2012). *Renewable energy certificates*. Retrieved from http://www.energymatters.com.au/carbon-trading/recs/

Fitzmaurice, J. (1981). *Politics in Denmark*. New York, NY: St. Martin's Press.

Folketinget. (2012). *The Danish system of government*. Retrieved from http://www.thedanishparliament.dk/Democracy/The_separation_of_powers/The_Government/The_Danish_system_of_government.aspx

Fürst, B. (2015). Newcomers at the gates: Place and space in small island context. In *Place peripheral: Place-based development in rural, island, and remote regions*. St. John's, NL: Memorial University.

Gallagher, K. S. (2013). Why and how governments support renewable energy. *Daedalus, 142*(1), 59-77.

Geller, H. (2003). *Energy revolution: Policies for a sustainable future*. Washington, DC: Island Press.

Gross, C. (2007). Community perspectives of wind energy in Australia: The application of a justice and community fairness framework to increase social acceptance. *Energy Policy, 35*(5), 2727-2736.

Hansen, J., Kharecha, P., Sato, M., Masson-Delmotte, V., Ackerman, F., Beerling, D. J., . . . Zachos, J. C. (2013). Assessing "dangerous climate change": Required reduction of carbon emissions to protect young people, future generations and nature. *PLoS One, 8*(12), 1-26.

Holm, B. (2000). *Eccentric islands: Travels real and imaginary*. Minneapolis, MN: Milkweed Editions.

IEA. (2004). *Renewable energy: Market & policy trends in IEA countries*. OECD/IEA

IEA. (2011). *World energy outlook 2011: IEA analysis of fossil-fuel subsidies*. Retrieved from http://www.iea.org/media/weowebsite/energysubsidies/ff_subsidies_slides.pdf

IEA. (2012). *World energy outlook 2012*. Retrieved from http://www.iea.org/textbase/npsum/weo2012sum.pdf

IMF. (2013). *Energy subsidy reform: Lessons and implications*. Retrieved from http://www.imf.org/external/np/pp/eng/2013/012813.pdf

IPCC. (2013). Summary for policymakers. In *Climate change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Pannel on Climate Change*. Cambridge, and New York, NY.

IPCC. (2014). Summary for policymakers. In *Climate change, 2014. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, and New York, NY.

IRENA. (2013). *30 Years of policies for wind energy - Lessons from 12 wind energy markets*. Retrieved from http://www.irena.org/publications/2013/Jan/30-Years-of-Policies-for-Wind-Energy-Lessons-from-12-Wind-Energy-Markets

Jobert, A., Laborgne, P., & Mimler, S. (2007). Local acceptance of wind energy: Factors of success identified in French and German case studies. *Energy Policy*, *35*(5), 2751-2760.

Jørgensen, P. J., Hermansen, S., Johnsen, A., Nielsen, J. P., & Lundèn, M. (2007). *Samsø: A renewable energy island. 10 years of development and evaluation*. Retrieved from https://energiakademiet.dk/wp-content/uploads/samso-renewable-energy-island.pdf

Krohn, S. (2002). *Wind energy policy making in Denmark status 2002*. Retrieved from http://www.energybc.ca/cache/denmarkwind/web.archive.org/web/20070927011

857/http_/www.windpower.org/media(492,1033)/wind_energy_policy_in_denmark__status_2002.pdf

Lipp, J. (2007). Lessons for effective renewable electricity policy from Denmark, Germany and the United Kingdom. *Energy Policy, 35*(2007), 5481-5495.

Lundèn, M., & Larsen, G. (2014). *Enegy Academy info folder*. Retrieved from http://arkiv.energiinstituttet.dk/504/

MacEachern, A. A. (2003). *The Institute of Man and Resources: An environmental fable*. Charlottetown, PE: Island Studies Press.

Maruyama, Y., Nishikido, M., & Iida, T. (2007). The rise of community wind power in Japan: Enhanced acceptance through social innovation. *Energy Policy, 35*(5), 2761-2769.

McBryan, J. (2009). Denmark energy policy: Success in achieving energy independence and establishing an international wind energy industry. *University of Florida Journal of Law & Public Policy, 20,* 329-345.

McLaren Loring, J. (2007). Wind energy planning in England, Wales and Denmark: Factors influencing project success. *Energy Policy, 35*(4), 2648-2660.

Meyer, N. I. (1995). Danish wind power development. *Energy for Sustainable Development, 2*(1), 18-25.

Meyer, N. I. (2004). Development of Danish wind power market. *Energy and Environment, 15*(4), 657-673.

Meyer, N. I. (2007). Learning from wind energy policy in the EU: Lessons from Denmark, Sweden and Spain. *European Environment, 17*(5), 347-362.

Miles, M. B., & Huberman, A. M. (1984). *Qualitative data analysis: A sourcebook of new methods*. Beverly Hills, CA: Sage Publications.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.

Ministry of Commerce. (1976). *Danish energy policy*. Coppenhagen

Ministry of Foreign Affairs of Denmark. (2018). *Government and politics*. Retrieved from http://denmark.dk/en/society/government-and-politics/

National Academy of Sciences. (2014). *Climate change: Evidence and causes. Set of 5 booklets*. The National Academies Press.

Nojeim, M. J., & Kilroy, D. P. (2011). *Days of decision: Turning points in U.S. foreign policy* (1st ed). Washington, DC: Potomac Books.

Novaczek, I. (2015). We live differently than the others: Culture, islandness, and alternative economies on Chiloé and Prince Edward Island. In *Place peripheral : Place-based development in rural, island, and remote regions*. St. John's, NL: Memorial University.

Patton, M. Q. (2002). *Qualitative research & evaluation methods*. Thousand Oaks, CA: Sage Publications.

Péron, F. (2004). The contemporary lure of the island. *Tijdschrift voor Economische en Sociale Geografie (Journal of Economic & Social Geography), 95*(3), 326-339.

Pipher, M. (2001). Introduction to the Perennial classics edition *Coming of age in Samoa*. New York, NY: HarperCollins.

Reiche, D., & Bechberger, M. (2004). Policy differences in the promotion of renewable energies in the EU member states. *Energy Policy, 32*(7), 843-849.

Rotsee. (2009). *Denmark location Samso*. Retrieved from https://commons.wikimedia.org/wiki/File:Denmark_location_samso.svg

Royle, S. A. (2001). *A geography of islands: Small island insularity*. London; New York, NY: Routledge.

Royle, S. A. (2007). Islands: Definitions and typologies. In *A world of islands: An island studies reader*. Charlottetown, PE: Institute of Island Studies; Malta: Miller House.

Royle, S. A. (2014). *Islands: Nature and culture*. London: Reaktion Books.

Sabatier, P. A., & Weible, C. M. (2014). *Theories of the policy process* (Third edition). Boulder, CO: Westview Press.

Shell, M. (2014). *Islandology: Geography, rhetoric, politics*. Stanford, CA: Stanford University Press.

Sovacool, B. K. (2013). Energy policymaking in Denmark: Implications for global energy security and sustainability. *Energy Policy, 61*, 829-839.

Sperling, K. (2017). How does a pioneer community energy project succeed in practice? The case of Samsø Renewable Energy Island. *Renewable and Sustainable Energy Reviews, 71*(2017), 884-897.

Stoett, P. J. (2012). *Global ecopolitics: Crisis, governance, and justice*. North York, ON: University of Toronto Press Inc.

Stuart, E. K. (2006). *The influence of islandness on energy policy and electricity supply*. (M.A. Island Studies dissertation). Charlottetown, PE: University of Prince Edward Island.

Stuart, E. K. (2016). Two centuries of energy on Prince Edward Island. In *Time and a place: An environmental history of Prince Edward Island*: Montreal; Kingston; London; Chicago: McGill-Queen's University Press.

Türk, H. (2014). The Oil Crisis of 1973 as a challenge to multilateral energy cooperation among western industrialized countries. *Historical Social Research/Historische Sozialforschung, 4*(150), 209.

VisitSamsø. (2017). *Facts about Samsø*. Retrieved from https://www.visitsamsoe.dk/en/inspiration/facts-about-samsoe/

Wüstenhagen, R., Wolsink, M., & Bürer, M. J. (2007). Social acceptance of renewable energy innovation. *Energy Policy, 35*(2007), 2683-2691.

Wynn, G. (2016). Museums, laboratories, showcases: Prince Edward and other islands in environmental history. In *Time and a place: An environmental history of Prince Edward Island*. Montreal; Kingston; London; Chicago: McGill-Queen's University Press.

Wynne, B. G. (2008). Social capital and the social economy in a sub-national island jurisdiction. In *Pulling strings: Policy onsights for Prince Edward Island from other sub-national island jurisdictions*. Charlottetown, PE: Island Studies Press.

Yamamoto, Y. (2012). Pricing electricity from residential photovoltaic systems: A comparison of feed-in tariffs, net metering, and net purchase and sale. *Solar Energy, 86*(9), 2678-2685.

Appendix A - Participant Information Sheet

From Policy to Action - Renewable Energy in Samsø, Denmark

Invitation

You are invited to participate in a study about Samsø's transition to 100% renewable energy. The study is being conducted by Jocelyn Plourde, a Masters degree candidate from the University of Prince Edward Island, in Canada. He is working under the supervision of Dr. Carolyn Peach Brown and Dr. Irene Novaczek from the University of Prince Edward Island.

Jocelyn Plourde
Researcher
P.O. Box 20003, RR1
Cardigan, PEI
Canada
C0A 1G0
Telephone: 902-583-2873
Email: jplourde@upei.ca

Dr. Carolyn Peach Brown
Supervisor
426 Duffy Science Centre
University of Prince Edward Island
Charlottetown, PEI
Canada
C1A 4P3
Telephone: 902-620-5066
Email: hcpbrown@upei.ca

Dr. Irene Novazcek
Supervisor
3944 Dixon Rd.
Breadalbane, PEI
Canada
C0A 1E0
Telephone: 902-964-2781
Email: inovaczek@upei.ca

1. What is the purpose of this study?

The purpose of this study is to develop an understanding of Samsø's transition to renewable energy. More specifically, the goal is to understand the importance of government policies and role of the different groups (citizens, investors, government officials) in the transition.

2. Why have I been invited to participate in this study?

You have been asked to participate in this study because you were involved, in one way or another, in Samsø's transition to renewable energy.

3. What does this study involve?

This study involves an interview with Jocelyn Plourde who will ask you about your role and your opinions regarding Samsø's transition to renewable energy. The interviews will be approximately 45 minutes in length and will be carried out at a time and place that is convenient for both you and the interviewer. Your responses will become part of a Masters thesis, and transcriptions of the interview may be included as an appendix. Your data will remain anonymous throughout the thesis. To maintain your anonymity, you data will be designated by a number. The list linking your number to your identity will be stored on a password-protected computer.

It is important that you understand that your involvement in this study is voluntary. While I would be pleased to have your participate, I respect your right to decline. There will be no consequences to you if you decide not to participate. If you decide to discontinue participation at any time, you may do so without providing an explanation. If you decide to participate, know that steps will be taken to insure that your identity remains private. All of the research will be kept in a locked cabinet in the office of Dr. Carolyn Peach Brown and/or in secure computer accessible only through password.

4. Are there any possible benefits from participation in this study?

There will be no direct benefits from participating in this research. However, the results of this study may create important information for other communities and governments that also want to make a transition to renewable energy. In addition the information may lead to published articles, books, websites, or other media.

5. Are there possible risks from participation in this study?

The risks attached to the interview will be minimal and are no greater than the risks you would face in everyday conversations. I will ask your permission to digitally record the interview. You have the ability to refuse any questions you do not want to answer. You have the ability to end the interview at any time without any repercussions.

6. What if I have questions about this research?

If you would like to discuss any aspect of this study, please feel free to contact the researcher Jocelyn Plourde (jplourde@upei.ca), or his supervisors Carolyn Peach Brown (hcpbrown@upei.ca) and Irene Novaczek (inovaczek@upei.ca). If you would like a more direct means of discussion, a conversation by phone or Skype/Facetime can also be arranged. Any of us would be happy to discuss any aspect of the research with you. Once we have analyzed the information, we will be mailing/e-mailing you a summary of our findings. A digital copy of the completed thesis will also be offered to you. You are welcome to contact us at that time to discuss any issues relating to the research study.

The University of Prince Edward Island Ethics Board has approved this study. If you have concerns or complaints about the conduct of this study, you should contact the University of Prince Edward Island Research Ethics Board by telephone (902-620-5104) or by e-mail (reb@upei.ca).

Thank you for taking the time to consider this study.
If you wish to take part in this study, please sign the attached consent form.
This information sheet is yours to keep.

Appendix B - Consent Form

From Policy to Action - Renewable Energy in Samsø, Denmark

1. I have read and understood the 'Participant Information Sheet' for this project.

2. The nature and possible effects of the study have been explained to me.

3. I understand that the study involves one (1) semi-structured interview about my experience in Samsø's transition to renewable energy. Also, I understand that my information will be given anonymously.

4. I understand that I will be given the opportunity to review the transcript of my interview and request that changes be made.

5. I understand that throughout the study, all research documentation, including recordings and scripts of interviews will be stored on a password-protected computer. Also, I understand that a second copy of the documentation will be kept in the locked office of Dr. Carolyn Peach Brown, of the University of Prince Edward Island. Also, I understand that only the researcher (Jocelyn Plourde) and his two supervisors (Dr. Carolyn Peach Brown and Dr. Irene Novazcek) will have access to the data. Also, I understand that all research data will be destroyed 5 years following the completion of the final report.

6. Any questions that I have asked have been answered to my satisfaction.

7. I agree that research data gathered from me may be published. However, I understand that my identity will not be published with the data.

8. I understand that information I supply to the researcher will be used only for the purposes of the research.

I agree to participate in this investigation and understand that I may withdraw at any time without any effect, and, if I so wish, may request that any data I have supplied to date be withdrawn from the research.

Name of participant: ____

Signature: ____ Date: ___________________________

Statement by investigator

☐ I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

Name of investigator: ____

Signature: ____ Date: ___________________________

Appendix C – Interview Guide

Note: The numbered questions are those to be used in the interview. Questions in italic are planned probes to be used if necessary.

Citizen/Investors in renewable energy technology

1. How did you participate in Samsø's transition to renewable energy (RE)?
   How did you first learn about the transition?
   Did you support the idea of moving to renewable energy?
      Reasons?

2. When you first learned about the plan to transition to 100% RE, did you support the idea?
   Why/Why not?

3. Did your opinion change over time? If so, what caused your change in opinion?

4. Were you encouraged to participate in the transition?
   Were you asked for your opinion?
   How were you encouraged to participate?
   How was this done?
   Were you encouraged to invest in RE tech?
      Did you invest?
      Why?
      Are you happy with your decision to invest/not invest?

5. Do you feel that your opinion about the transition was important?

6. In the 10 years that it took to transition to 100% RE, do you feel that you were regularly informed about how the transition was progressing?
   If so, how were you informed?
   Did you appreciate being informed?
   Were you encouraged to voice your opinion?

7. A lot of people on Samsø have participated in a district heating plant like the one at Norby/Mårup. What was done to get to make the initial investment and have their homes connected to the heating plants?

8. Do you believe that investments by residents would have been as high without the feed-in tariff? If heating oil prices were lower?
   Were there other sorts of energy policies or programs that supported the transition?

9. Do you believe that the transition to 100% RE has been good for Samsø?
   Why/Why not?

10. From your perspective, how could the transition to 100% have been done differently (better)?

11. Besides the investments made (community heat, wind turbines), have there been additional financial costs to residents?

    Increased cost of heating or electricity?

12. What suggestions do you have for other islands that wish to transition to renewable energy like Samsø has?

13. From your point of view, have there been economic benefits from Samsø becoming self-sufficient in electricity and heating?

14. Is there anything else you would like to add that I haven't asked you about?