Renewable energy in oil-intensive jurisdictions: a comparative study of wind energy growth in Texas and Alberta

by

Jorge Amigo

B.A., University of British Columbia, 2009

A Thesis Submitted In Partial Fulfillment Of The
Requirements for the Degree of

Master of Arts

in

The Faculty of Graduate Studies

(Political Science)

The University of British Columbia
(Vancouver)

February 2011

Abstract

The state of Texas has experienced an enormous growth in its wind energy sector in recent years. By contrast, growth in Alberta's wind sector has remained comparatively moderate. This study seeks to explain what has caused this relative lag in wind energy development. To do so, this thesis addresses two questions: first why did two similar sub-national jurisdictions adopt very different policies for wind energy development? Second, did these policies result in asymmetric growth of wind power capacity between Texas and Alberta? On the first question, this thesis argues that a combination of decades-old policy decisions and natural resource endowments played a central role in prompting Texas legislators, but not their counterparts in Alberta, to adopt renewable energy mandates. Specifically, a shortage of coal in Texas led to an increased reliance on imported coal in the 1990s, which became a source of concern for Texas officials who had long pursued a policy of energy independence. With near unanimous support from diverse sectors and on the recommendation of state officials, Texas legislators adopted a Renewable Portfolio Standard to mandate development of alternate sources of electricity. Although Alberta also has long pursued a policy of energy independence, the province's coal industry supplies all of the coal needed for electricity production. Therefore, with weaker incentives to pursue renewable energy and stronger reasons to protect the local coal industry, Alberta politicians have not pursued strong policies to promote renewables.

On the second question, this thesis argues that Texas benefited from both a Renewable Portfolio Standard and a generous federal tax credit for renewables. The renewables mandate served to initiate interest in wind energy by forcing utilities to produce energy from renewables, while the tax credit made wind more attractive to investors by making it more competitive with other sources of energy. In the case of Alberta, a weaker federal financial incentive together with a lack of a provincial renewables mandate has kept the wind industry from experiencing comparable growth.

Preface

Primary research for this thesis was approved by the UBC Behavioural Research Ethics Board. The author conducted open-ended and unstructured interviews. The Ethics Certificate number is H10-02092.

Table of Contents

List of Tables

List of Figures

Acknowledgements

This thesis would not have been possible without the generous support of my supervisor, Dr. Kathryn Harrison. Thank you for your (dozens of) insightful comments, your patience, and your willingness to discuss new ideas. The shape and depth of this thesis is largely a product of your ability to steer my reasoning. I also want to thank my second reader, Dr. Peter Dauvergne, for taking the time to carefully engage with my work, and for creating such a positive atmosphere during my defense. Your encouraging comments truly enriched that final step of this project.

I am also grateful to my interview subjects, who shared their valuable time and knowledge. Your expertise proved invaluable to my research.

Lastly, I would like to thank my colleagues and friends who in one way or another enriched my life during this research process. Having your constant love and friendship made all the difference.

To my mother, Lorenza, for your unconditional support.
To my father, Jorge, for your never-ending generosity.
To my sister, Loren, for your immeasurable love.

Without you, I'm nothing.

1. Introduction

Despite strong international support for the Kyoto Protocol as an initial response to curb anthropogenic climate change, an international agreement with binding targets for greenhouse gas reductions remains elusive. As the effects of climate change become increasingly evident and a majority of climate scientists warn of an impending climate crisis, locally motivated solutions to the climate challenge become increasingly important as a substitute for inadequate national policies. In this light, the purpose of this thesis is to explore how two relatively large and energy-intensive sub-national jurisdictions have responded to the climate change crisis by adopting (or failing to adopt) renewable energy. Specifically, it will compare the policies that have led to the development of wind energy in the state of Texas and the province of Alberta.

The comparison between Texas and Alberta derives its coherence from a number of similarities that are relevant to their energy choices. First, both jurisdictions contain the largest fossil fuel extraction industries in their respective countries. This similarity in industrial makeup serves as a common denominator in terms of potential industry opposition to renewable energy policies. The economies of both Alberta and Texas are highly dependent on the oil industry, which is a sector that contributes greatly to the carbon emissions of both jurisdictions. This can imply a similar set of economic and political obstacles to emissions reductions policies that translate into a negative impact on the oil industry. Second, both jurisdictions produce a large portion of their electricity from locally extracted fossil fuels. Moreover, both jurisdictions rely on coal to produce a large portion of their electricity, and coal power plants contribute to a large portion of their GHG

emissions. Third, both jurisdictions strongly oppose the Kyoto Protocol and any federal attempts to impose legislation that would restrict their levels of greenhouse gas emissions. Therefore, their motivations to promote renewable energy have little to do with an adherence to national standards on carbon emissions.

Despite these seemingly important similarities, however, Texas and Alberta have taken starkly divergent paths towards promoting the development of wind energy capacity in the past two decades. Texas has enabled a dramatic expansion of its wind energy capacity via a combination of renewable energy mandates and fiscal incentives. The combination of carrot and stick approaches in Texas has been so effective that the state has surpassed every yearly renewable energy production target and is currently producing more than a third of total wind energy in the United States. In other words, the wind energy industry in Texas is thriving and all future projections indicate further (and steeper) growth in wind energy production in the near future. On the other hand, Alberta has shied away from restrictive measures, relying instead on a voluntary approach to renewables, combined with much smaller federal fiscal incentives. Although future projections indicate that the Alberta wind sector will experience substantial growth in the coming years, the growth of wind energy capacity in the province has so far been slower than in Texas.

Therefore, this study seeks to explain what caused this relative lag in wind energy development. To do so, this thesis addresses two questions: first why did two similar sub-national jurisdictions adopt very different policies for wind energy development? Second, did these policies result in asymmetric growth of wind power capacity between Texas and Alberta?

To answer the first question, I argue that none of the following can account for the observed divergence in policies: differences in the public's concern about the environment, governing parties' ideologies or positions on climate change, or differences in legislative institutions. Instead, I contend that a combination of decades-old policy decisions and natural resource endowments played a central role in prompting Texas legislators, but not their counterparts in Alberta, to adopt renewable energy mandates. The state of Texas had long pursued a policy of energy independence, which had the effect of isolating Texas from the national power grid. That independence was threatened, however, when a shortage of local coal emerged in the mid 1990s. Texas faced a choice between increasing reliance on "imported" coal from other states and investment in alternate *local* energy sources. The latter was not only popular with Texas voters, but also offered the promise of creation of jobs at home, rather than in neighbouring Wyoming. On the recommendation of state officials, Texas legislators adopted a Renewable Portfolio Standard to mandate development of alternate sources of electricity. Although Alberta also has long pursued a policy of energy independence, the province's coal industry has supplied and can continue to supply all of the coal needed for electricity production. Therefore, Alberta politicians not only lack equivalent incentives to pursue renewable energy, but also face a strong incentive to protect the local coal industry from national policies pursuant to Canada's ratification of the Kyoto Protocol.

On the second question, I argue that Texas benefited from both a Renewable Portfolio Standard and a generous federal tax credit for renewables. The renewables mandate served to initiate interest in wind energy by forcing utilities to produce energy from renewables, while the tax credit made wind more attractive to investors by making it

more competitive with other sources of energy. In the case of Alberta, I argue that a weaker federal financial incentive together with a lack of a provincial renewables mandate has kept the wind industry from experiencing comparable growth.

2. Methods

In order to fully comprehend why Texas and Alberta chose such different policies for renewable energy, this thesis explores a number of independent variables, or structural factors, that influenced these policy choices. The first things to analyze are the existing sources of electricity. This helps to determine whether any important differences in the power system could explain different barriers to wind energy development. A second and deeply related structural factor is natural resource endowments. A jurisdiction's endowment of fossil fuels (especially coal and natural gas) can play a significant role in its choice of power plants, which can affect the choice of non-fossil fuel sources of electricity. Moreover, having large tracts of land with favorable wind patterns is an obvious advantage for the viability of wind farms. Other relevant structural factors to discuss are the power-trading scheme with adjoining jurisdictions, and the availability of transmission lines that can enable the distribution of wind-generated electricity to the towns and cities that require it.

After exploring the structural factors that led to specific policies, this study presents and explains the renewable energy policies that were enacted in each jurisdiction. This elucidates the main differences between government actions aimed at promoting renewable energy. Then, the analysis traces the impact that each policy had on the growth of wind energy in Texas and Alberta.

The first section of this thesis presents relevant energy data. This serves to paint a general comparison of energy sources, wind energy capacity growth, energy production costs for competing sources of electricity, and per capita energy use. The second section

presents my hypotheses on why Texas and Alberta chose such different policies, and introduces the theoretical approaches that best explain these policy choices. The third and fourth sections contain the evidence to support my hypotheses, presenting the history of wind energy development in Texas and Alberta, together with the stories of how renewable energy policies were enacted. Then, a fifth section compares the policies enacted in each jurisdiction, and incorporates relevant literature to explain the different policy outcomes and evaluate policy performance. Lastly, the concluding section reviews the arguments and explains which hypotheses best answer the thesis questions.

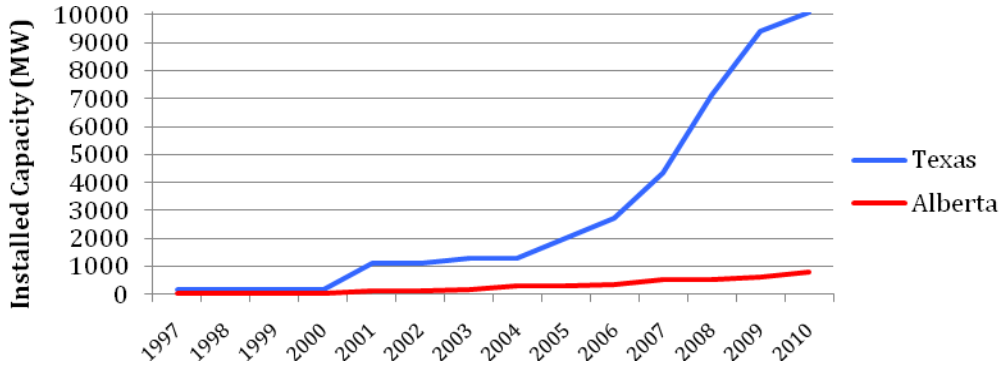
To investigate the hypotheses, this thesis also draws on primary and secondary documents, as well as telephone interviews with wind energy experts and government officials. Four interviewees were chosen for their professional connection to the wind energy industries in Texas and Alberta: Kenneth Starcher, Assistant Director of the Alternative Energy Institute (Texas); Terry Hadley, Communications Director of the Texas Public Utility Commission; Ronald Liepert, Alberta Minister of Energy; Tom Levy, Manager at the Canadian Wind Energy Association.

3. Data: electricity generation

3.1. The rise of wind energy

The rise of the wind energy sectors in Texas and Alberta can be traced to the late-1990s, when both jurisdictions began to experience considerable growth in wind energy capacity. However, the difference in wind capacity growth (in absolute terms) between Texas and Alberta is unequivocal. As the following graph illustrates, Texas wind capacity grew from 180 megawatts in 1997 to more than 10,000 megawatts in 2010. In the same period, Alberta's wind capacity grew from 20 to 806 megawatts.

Figure 1. Wind energy in TX and AB: 1997-2010[1]



However, given the vast population differences between Texas and Alberta, the wind capacity difference seems less pronounced when comparing wind capacity per capita data, or when analyzing the growth of wind capacity as percentage of total electricity capacity:

[1] U.S. Energy Information Administration, "State Energy Profiles: Texas," http://www.eia.gov/cfapps/state/state_energy_profiles.cfm?sid=TX (accessed January 23, 2011); Government of Alberta, "Electricity Statistics," http://www.energy.alberta.ca/Electricity/682.asp (accessed January 23, 2011).

Figure 2. Wind capacity as % of total capacity[2]

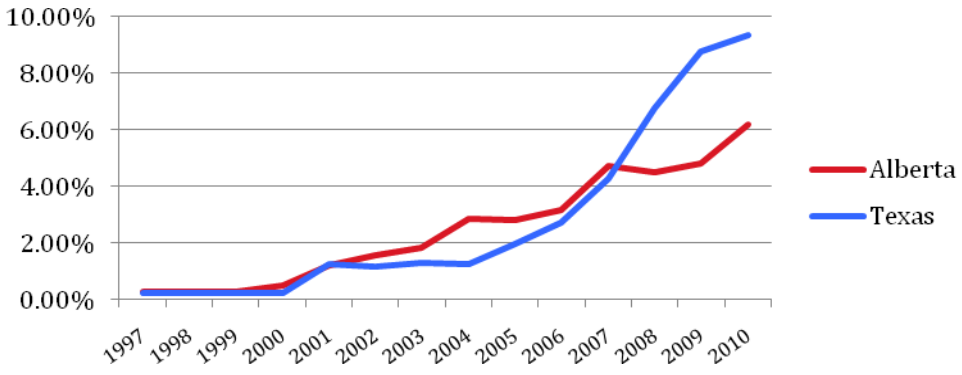
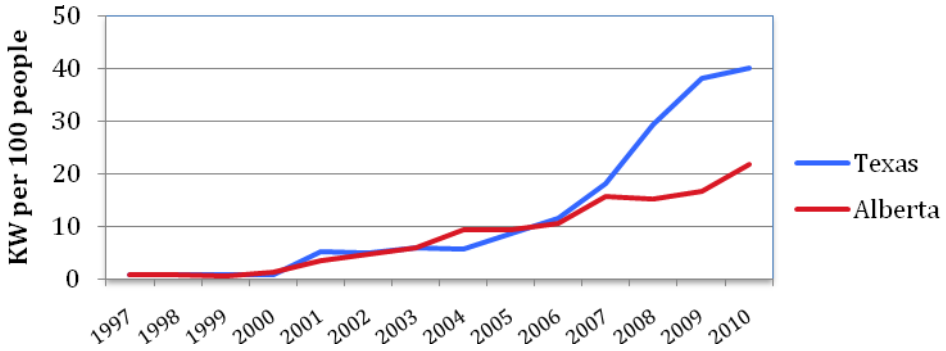


Figure 3. Wind energy capacity per capita[3]



As the last two figures indicate, the real differences in wind capacity per capita and wind as a percentage of total electricity capacity started after 2007, when Texas experienced a very steep growth in wind energy capacity. For the purposes of this thesis, this implies that if policy differences were responsible for a steeper growth in Texas's wind capacity, the effect of these policies (in terms of wind energy per capita) was not comparatively significant prior to 2007. In other words, the policies that allowed a fast growth of wind energy in Texas had their greatest effect between 2007 and 2010, when the

---

[2] U.S. Energy Information Administration, *State Energy Profiles: Texas* Government of Alberta, *Electricity Statistics*

[3] U.S. Energy Information Administration, *State Energy Profiles: Texas*; Government of Alberta, *Electricity Statistics*; Texas State Library and Archives Commission, "United States and Texas Populations: 1850-2010," http://www.tsl.state.tx.us/ref/abouttx/census.htm (accessed January 12, 2011); Statistics Canada, *Annual Demographic Estimates: Census Metropolitan Areas, Economic Regions and Census Divisions, Age and Sex: 2001 to 2006,* Statistics Canada, 2007.

Texas wind sector grew considerably faster than the Alberta wind sector. The reasons for this sudden growth after 2007 will be explained in the policy analysis section (VI).

3.2. Dirty power: fossil fuels and electricity

In order to draw a fuller comparison of the Texas and Alberta wind energy sectors, it is important to analyze the energy mix in both jurisdictions. The following graphs help illustrate recent trends in electricity generation:

Figure 4. Texas electricity capacity by source[4]

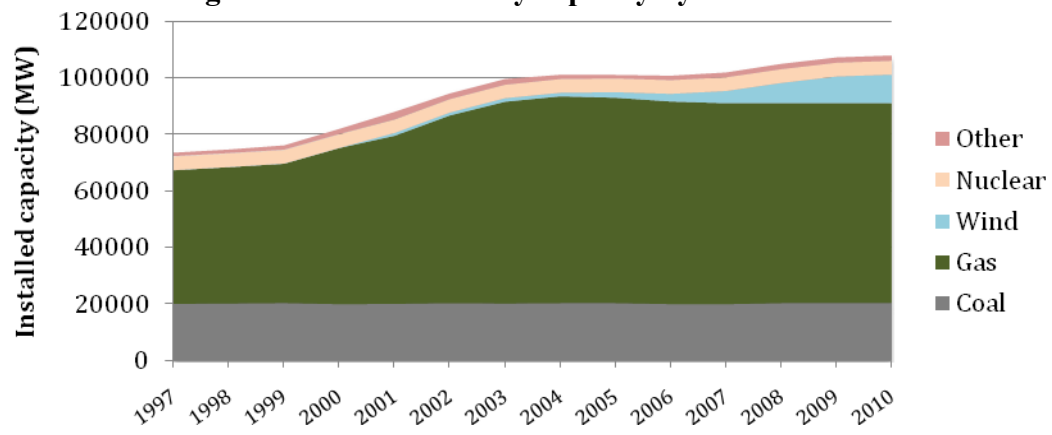
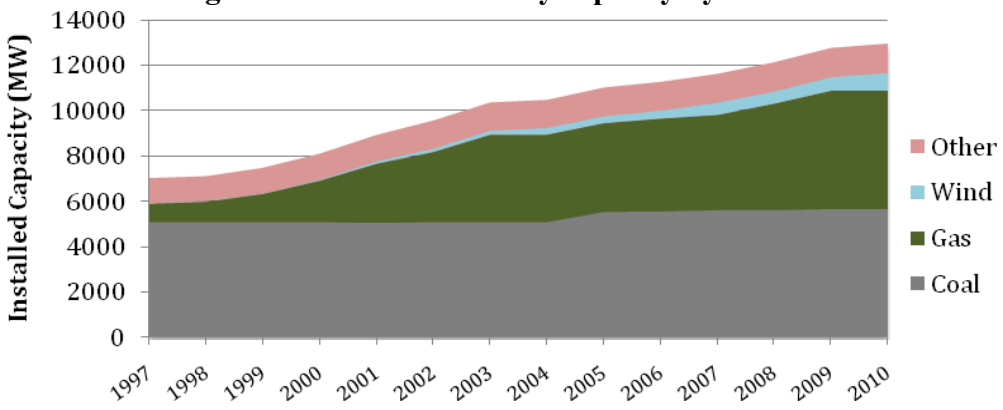


Figure 5. Alberta electricity capacity by source[5]



[4] U.S. Energy Information Administration, "Electricity Statistics," http://www.energy.alberta.ca/Electricity/682.asp (accessed January 23, 2011).
[5] Government of Alberta, *Electricity Statistics*

Figure 6. Texas share of generation capacity by source[6]

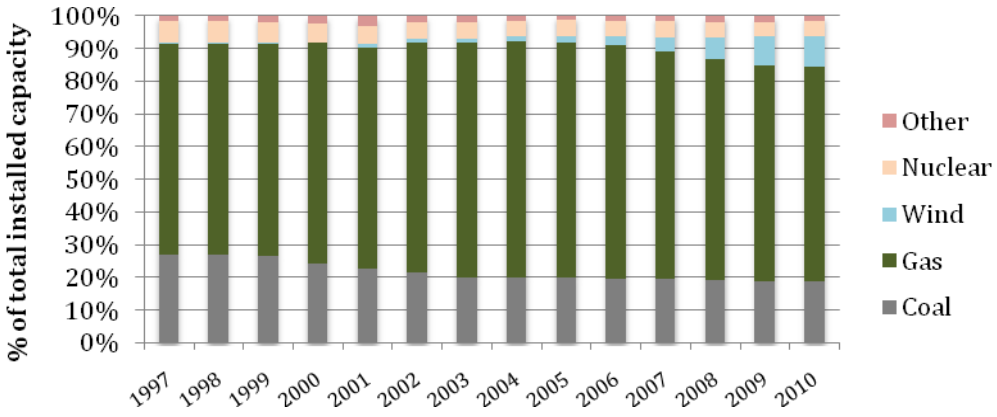
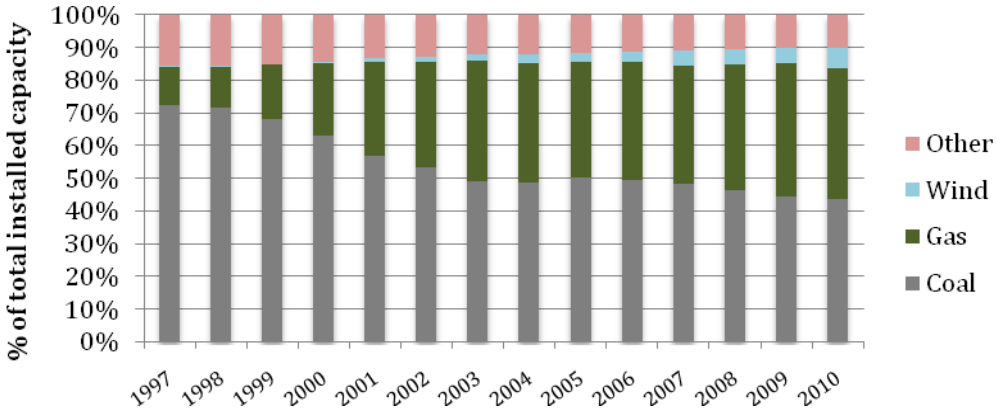


Figure 7. Alberta share of generation capacity by source[7]



As the previous figures show, the power sectors of Texas and Alberta share some important similarities. First, fossil fuels have been the main source of electricity in both jurisdictions for the period 1997 to 2010. In the case of Texas, coal energy has remained stable at around 20% of total generation capacity, while natural gas has remained at around 60%. In Alberta, coal power has decreased its share of total capacity from 73% in 1997 to 44% in 2010. In this same period, natural gas has increased from 10% to 40% of total generation capacity.

[6] U.S. Energy Information Administration, *State Energy Profiles: Texas*
[7] Government of Alberta, *Electricity Statistics*

Furthermore, the relative cost of generating electricity with different types of power plants is an important variable for this study. The difference in cost between fossil fuel power plants and wind farms may affect the choice of new sources of electricity. However, due partly to geographic and national variations of factors that affect a specific power system's generation costs, the literature on this does not present a consensus on the costs of electricity generation across sources. In other words, different studies present cost estimates for a very specific type of energy mix, in a specific location, and with specific transmission constraints, making it difficult to present precise comparisons on the costs of electricity from coal, natural gas, and wind. Also, the volatility of fossil fuel prices, especially the price of natural gas, may render cost estimates unreliable (see Figure 11 in the Appendix for a graph of fuel prices). For example, a 2003 study by Sims et al. presents the following cost estimates for electricity generation in developed countries,[9] showing large variations for each source:

Table 1. Cost of generating electricity: Annex I countries (2003)[10]

Energy Source	*Cost*
Coal (pulverized fuel)	4.9 cents per kWh
Coal (integrated gasification)	3.6 to 6.0 cents per kWh
Coal (carbon capture)	7.9 cents per kWh
Natural Gas (CCGT)	3.45 to 6.9 cents per kWh
Natural Gas (carbon capture)	4.95 to 8.4 cents per kWh
Wind	3.0 to 8 cents per kWh

However, the literature on the viability of wind power in North America does suggest that, in general terms, the cost of generating electricity using coal and natural gas power plants has so far been lower than the cost of wind-generated power. For instance,

[8] Ralph E. H. Sims, Hans-Holger Rogner and Ken Gregory, "Carbon Emission and Mitigation Cost Comparisons between Fossil Fuel, Nuclear and Renewable Energy Resources for Electricity Generation," *Energy Policy* 31 (2003), 1321.

[9] Annex I countries under the Kyoto Protocol

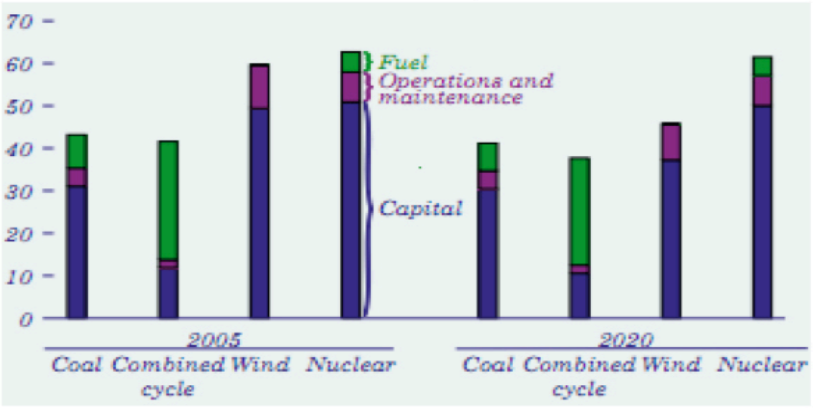
[10] Ralph E. H. Sims, Hans-Holger Rogner and Ken Gregory, "Carbon Emission and Mitigation Cost Comparisons between Fossil Fuel, Nuclear and Renewable Energy Resources for Electricity Generation," *Energy Policy* 31 (2003), 1321.

Christopher Riti explains that "after factoring in inflation-adjusted credits, wind-generated electricity can cost as little as 6 cents per kilowatt hour, as compared to the 3 to 5 cents for coal-fired electricity."[11] Considering that this comment appears in a discussion about a 1.8 cents per kilowatt hour credit, his estimate places the cost of wind-generated electricity at around 8 cents per kilowatt hour. In another study, Benitez et al. explain that the cost of wind energy is still higher than coal and natural gas power, but has decreased steadily over time and is becoming competitive with fossil fuel energy costs:

> With improvements in technology and growth in the market for wind power, the cost of electricity generated by modern wind farms has declined by some 80% since 1980 — from about 38 cents per kilowatt hour (kWh) to about 4 cents. Engineers claim that costs will continue to decline so that, with increasing oil prices, wind power will be competitive with fossil fuel energy.[12]

Also, the 2001 "Energy Outlook Report" by the U.S. Energy Information Administration presents cost estimates for new generation installed in 2005 and 2020 that place the cost of wind power above coal and natural gas power:[13]

Figure 8. Projected electricity generation costs, 2005 and 2020[14] **(1999 mills per kWh)**



[11] Christopher Riti, "Three Sheets to the Wind: An Intersection of the Renewable Energy Production Tax Credit, Congressional Political Posturing, and an Unsustainable Energy Policy," *Pace Environmental Law Review* 27, no. 3 (2010), 793.
[12] Lliliana E. Benitez, Pablo C. Benitez and G. Cornelis van Kooten, "The Economics of Wind Power with Energy Storage," *Energy Economics* 30 (2008), 1974.
[13] I chose the 2001 version of this report over the most recent one (2011) because the latter contains cost estimates for 2016, which are not useful for the period analyzed in this thesis.
[14] U.S. Energy Information Administration, "Annual Energy Outlook 2001," (2001), 75, http://www.eia.doe.gov.

Given the above data, it is safe to assume that throughout the period analyzed in this thesis, it was more expensive to generate electricity with wind turbines than with fossil fuel power plants in both Alberta and Texas.

Another relevant variable for this thesis is the degree of energy independence because a jurisdiction's degree of reliance on foreign sources of energy may affect its energy choices. Information on energy trade shows that Texas and Alberta generate the majority of the electricity they consume, and only import a small fraction of their power.[15] The following table presents data on net electricity imports:

Table 2. Texas electricity trade, million KWh[16]

Year	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
Net Interstate Trade	-2355	-3967	-4407	-8855	-9579	-8599	-7583	-5647
International Imports	0	0	0	6	526	738	204	2
Net trade	-2355	-3967	-4407	-8861	-10105	-9337	-7787	-5649
Total state electricity disposition	302044	311147	322043	337810	346425	364657	366732	383391
Imports as % of total disposition	-0.78%	-1.27%	-1.37%	-2.62%	-2.92%	-2.56%	-2.12%	-1.47%
Year	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*
Net Interstate Trade	-1555	5720	-712	7583	2195	7157	8589	-246
International Imports	4	80	80	79	78	80	160	961
Net trade	-1559	5640	-792	7504	2117	7077	8429	-1207
Total state electricity disposition	374139	379989	379991	382795	394552	393506	397064	405995
Imports as % of total disposition	-0.42%	1.48%	-0.21%	1.96%	0.54%	1.80%	2.12%	-0.30%

[15] Minor seasonal disruptions in electricity generation and delivery may prompt a jurisdiction to import small amounts of electricity from an adjoining jurisdiction (if inter-jursidiction transmission lines exist). Otherwise, rural communities that are far from the main transmission lines and close to a border may have an agreement to buy electricity from a neighboring municipality in another state/province. However, the amount of net imports in both cases is so insignificant, that I have chosen not to investigate specific details.

[16] U.S. Energy Information Administration, *State Energy Profiles: Texas*

Table 3. Alberta electricity trade, MWh[17]

	2004	*2005*	*2006*	*2007*
Exports	130888	85686	67414	154748
Imports	366611	451727	209326	222902
Net trade	-235723	-123640	-141912	-68154
Total electricity disposition	64683989	64544208	66377930	68073392
Imports as % of total disposition	-0.36%	-0.19%	-0.21%	-0.10%

The first thing to note is that the unavailability of similar data for the same years makes any comparison between Texas and Alberta difficult. However, the Texas data indicates that the state's electricity imports varied considerably over the 1993-2008 period. Texas electricity imports were on the rise during the 1990s until they peaked in 1997 (as percentage of total electricity disposition). Also notably, the state imported more than 1% of its electricity from 1994 to 2000, and then imports slowed down during the 2000s (during 5 out of 7 years, the trade balance was positive[18]), which is when the new renewable energy policies came into effect. In the case of Alberta, electricity imports accounted for less than half of a percentage of total power disposition from 2004 to 2007.

In sum, it can be said that both Texas and Alberta display strong energy independence since the vast majority of its power is generated locally (in both places, more than 97% of electricity was locally sourced for every year analyzed). However, Texas displays a greater need for energy imports. Also, Texas's electricity trade data shows a clear rise and decline of electricity imports during the period analyzed, coinciding with the implementation of restrictive policies, as will be explained later.

[17] Statistics Canada, *Electric Power Generation, Transmission and Distribution: 2007*, 2009, http://www.statcan.gc.ca/pub/57-202-x/57-202-x2007000-eng.pdf.
[18] There were more electricity exports than imports during 2002, 2004, 2005, 2006 and 2007.

3.3. Resource endowments

Another variable that may affect a jurisdiction's energy choices is resource endowments. The data on natural resource endowments indicates some similarities between Alberta and Texas. First, both jurisdictions benefit from a very large endowment of natural gas reserves. Moreover, all of the natural gas used for electricity generation in Texas and Alberta is locally extracted.[19] In both jurisdictions, natural gas occurs in public land as well as privately owned land, and gas is extracted and sold mainly by private corporations.

A second and important similarity is that both Texas and Alberta have a favorable endowment of wind. According to studies by the Alternative Energy Institute at Texas A&M University and data from the Texas Energy Conservation Office, Texas has excellent wind resource in the state's Panhandle region. These studies estimate a potential wind power capacity of 524,800 megawatts (MW), which translates into enough wind energy to power approximately 121 million homes.[20] On the Alberta side, according to the Pembina Institute, "Alberta's wind energy resource is one of the best and most accessible land-based wind resources in Canada"[21], with the best winds located in the south of the province. According to this institute's estimates, based on calculating the suitability of 2 MW turbines in Alberta's territory, the province has a potential wind power capacity of 64,000 MW.[22] Based on this data, there is no reason to conclude that any of the two jurisdictions has a wind resource advantage that would explain the difference in wind energy development.

---

[19] Government of Alberta, Electricity Statistics; Energy Information Administration, State Energy Profiles: Texas.

[20] Texas Comptroller of Public Accounts, "The Energy Report, 2008," http://www.window.state.tx.us/specialrpt/energy/renewable/wind.php (accessed October 4, 2010).

[21] The Pembina Institute, *Greening the Grid: Powering Alberta's Future with Renewable Energy* (Drayton Valley, Alberta: The Pembina Institute,[2009]).

[22] 2 MW turbines require specific wind conditions to operate efficiently. Therefore, this estimate is not comparable to the much higher potential wind power estimate for Texas.

In the case of coal, however, Texas and Alberta face a rather different scenario. Texas relies heavily on imported coal to meet its electricity demands. As the Energy Information Administration explains, "[a]lthough Texas produces a substantial amount of coal from its 11 surface mines, including five of the 50 largest in the United States, the State relies on rail deliveries of subbituminous coal from Wyoming for the majority of its supply."[23] To meet its energy demands, the state imports two-thirds of the coal it burns. According to a 2008 report by the Union of Concerned Scientists, these coal imports make Texas the most coal-dependent state as measured by net quantity of imported coal.[24] On the Alberta side, all of the coal used for power generation is extracted locally. As Environment Canada explains, "coal-fired sources predominate in Alberta and Saskatchewan, due in no small part to easy and reliable access to abundant coal resources."[25] In fact, four fifths of Alberta's coal extraction is used by the local energy generation industry, and most of the rest is exported to Japan and South Korea.[26]

3.4. Opposition to Kyoto

Attitudes towards greenhouse gas mitigation can also be expected to haven an effect on a jurisdiction's willingness to promote renewable energy. Given the size of the oil industry in Texas and Alberta, and considering their reliance on fossil fuels for electricity generation, the economies of both jurisdictions are intimately tied to industrial processes that generate vast amounts of GHG emissions. As a result, the economies of both Texas and

---

[23] U.S. Energy Information Administration, *State Energy Profiles: Texas*

[24] Jeff Deyette and Barbara Freese, *Burning Coal, Burning Cash: Ranking the States that Import the most Coal* (Cambridge, MA: Union of Concerned Scientists, [2010]).

[25] Environment Canada, *National Inventory Report 1990-2008: Greenhouse Gas Sources and Sinks in Canada*, 2010, http://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=1357A041-1 (accessed November 2, 2010).

[26] Government of Canada, "What is Coal?" http://www.energy.alberta.ca/coal/645.asp (accessed October 20, 2010).

Alberta are very sensitive to any federal climate change mitigation strategies. Not surprisingly, both jurisdictions strongly oppose compliance with Kyoto Protocol targets or any federal plans to reduce their GHG emissions. Moreover, both Texas and Alberta have repeatedly expressed that emissions reductions place a disproportionate burden on their economies.

On the Texas side, opposition to greenhouse gas reductions is expressed as a combination of economic protectionism, states' rights, and climate skepticism. As Barry Rabe explains, "Texas members of the U.S. House and Senate have remained outspoken in their opposition to international greenhouse gas agreements, such as the Kyoto Protocol, […] on the basis of anticipated economic repercussions for the state."[27] Moreover, Texas is currently attacking President Obama's environmental plan, by suing the Environmental Protection Agency over its new plan to reduce greenhouse gases by declaring CO_2 a threat to human health.[28] The current Governor of Texas, Rick Perry, together with the state's Attorney General Greg Abbot have expressed their concern that the EPA's plan is based on uncertain climate science and could put thousands of jobs at risk.[29] Moreover, Rick Perry argues that unelected federal bureaucrats should not be allowed to regulate a state's internal energy affairs, and promises to "fight back against this latest encroachment into states' authority, which would effectively strip states of the right to regulate oil and gas

[27] Barry Rabe, *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy* (Washington, D.C.: Brookings Institution Press, 2004), 50.
[28] U.S. Environmental Protection Agency, "Endangerment and Cause Or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act," http://epa.gov/climatechange/endangerment.html (accessed April 15, 2010).
[29] Katherine Goldstein, "Gov. Rick Perry Sues EPA Over Greenhouse Gas Regulation," *The Huffington Post:* Feb. 10, 2010, http://www.huffingtonpost.com/2010/02/18/gov-rick-perry-sues-the-e_n_467576.html (accessed April 20, 2010).

exploration and production within their own borders."[30] In other words, it is difficult to argue that the Texas approach to renewable energy, however successful in developing wind farms, is fueled by a commitment to greenhouse gas mitigation.

In the case of Alberta, the province has consistently opposed federal climate change regulations, displaying a mixture of climate skepticism, concerns about the Alberta oil industry and the local economy, and defensiveness concerning provincial jurisdiction. The province has expressed concerns about the effect of climate change mitigation strategies on provincial energy resource revenues, especially now that oil sands production (which are highly carbon intensive) exceeds production of conventional oil.[31] For instance, prior to Canada's ratification of the Kyoto Protocol in 2002, Alberta Premier Ralph Klein became a prominent spokesperson against Kyoto, recruiting former Premier Peter Lougheed to jointly launch a campaign against the treaty. As Barry Rabe explains, "they regularly gave speeches denouncing ratification as a huge economic threat to Canada and an encroachment upon Constitutional powers over natural resources that belonged to provinces."[32] Moreover, they used provincial funds to launch a 1.5 million dollar advertising campaign to publicize "Alberta's" opposition to the Kyoto Protocol.[33] The advertisements explained that Kyoto would cost jobs, raise taxes, and cause a doubling of

---

[30] The Gov Monitor, "Governor Rick Perry on EPA Denial of Texas Clean Air Petition," *The Gov Monitor:* August 2, 2010, http://www.thegovmonitor.com/world_news/united_states/governor-rick-perry-on-epa-denial-of-texas-clean-air-petition-36365.html (accessed October 30, 2010).

[31] Alastair Lucas, "The Alberta Energy Sector's Voluntary Approach to Climate Change: Context, Prospects, and Limits," in *Canadian Energy Policy and the Struggle for Sustainable Development* (Toronto: University of Toronto Press, 2005), 293-308.

[32] Barry Rabe, "Beyond Kyoto: Climate Change Policy in Multilevel Governance Systems," *Governance: An International Journal of Policy, Administration, and Institutions* 20, no. 3 (2007), 438.

[33] CBC News, "Alberta Launches Campaign Against Kyoto," *CBC News:* September 18, 2002, http://www.cbc.ca/canada/story/2002/09/18/alberta_kyoto020918.html (accessed April 12, 2010).

electricity prices. These actions by the provincial government provide clear evidence of Alberta's official opposition to policies designed to mitigate climate change.

This section has explained some of the main variables that could be expected to affect Texas and Alberta's choice of electricity sources. Due to similarities between the jurisdictions, we can rule out some of them: wind resources, natural gas endowments, attitudes towards climate change and federal legislation to curb greenhouse gas emissions, the existing energy mix, and the cost of generating electricity across different sources. The remaining variables may explain the policy divergence between Texas and Alberta: coal endowments, and electricity trade (or degree of energy independence).

4. Theoretical approaches

A number of theoretical approaches are proposed to solve the first of the thesis questions: why did Texas and Alberta choose different policies for wind power development?

4.1. Initial hypotheses

Before discussing the most plausible hypotheses, a number of explanations can be ruled out. First, differences in wind potential between Texas and Alberta do not explain the divergence in wind energy growth. As mentioned earlier, both jurisdictions have a favorable endowment of wind, deemed by experts as an adequate resource for a thriving wind energy industry.

Second, voter's concerns about climate change do not explain Texas's embrace of restrictive policies towards the development of renewables. In both jurisdictions opinion polls have consistently shown that the local population is skeptical of climate change and climate science. In the case of Texas, a recent poll suggests that only 49% of the Houston population believes that climate change is caused by human activities.[34] In the case of Alberta, less than 40% of the population believes that climate change is caused by human activity.[35] In other words, the support for wind energy policies in Texas does not mean that Texans are more concerned with the environment or with climate change than Albertans. Both jurisdictions remain highly skeptical of climate change and are strongly against compliance with the Kyoto Protocol. Therefore, there is little evidence that the policies

[34] Bill Dawson, "Texans' Views on Climate Change Aren't so Different, Polls show," *Texas Climate News*August 6, 2009, http://www.texasclimatenews.org/FeatureStories/8609Texansarentsodifferentonclimate/tabid/1124/Default.aspx (accessed April 12, 2010).

[35] Christina Spencer, "Planet in Peril: Poll," *TorontoSun.Com:* January 4, 2010, http://www.torontosun.com/news/canada/2010/01/04/12337176-sun.html (accessed April 12, 2010).

enacted by Texas are a result of politicians acting to please voters' concerns about greenhouse gas mitigation.

Third, governing parties' concerns about climate change also do not explain Texas's policies on renewables. The evidence presented earlier shows a strong aversion by leaders in both jurisdictions towards climate change mitigation measures. The leaders in both jurisdictions openly opposed federally mandated plans to comply with the Kyoto Protocol, and both local governments have taken actions to oppose federal regulations aimed at reducing their emissions. For the purposes of this thesis, this implies similar constraints on the adoption of renewable energy. In other words, there is no indication that one jurisdiction's position towards greenhouse gas mitigation measures could be an advantage to its promotion of renewable energy.

Fourth, differences in legislative institutions do not explain this policy divergence. George Tsebelis argues that the number of veto players in different political systems has an effect on policymaking: systems with more veto players are less likely to pass controversial legislation than systems with fewer veto players.[36] In this sense, one could argue that Texas and Alberta have a different number of veto players, giving one jurisdiction an advantage over the other with respect to their capacity to produce policy change. Given the separation of powers in a presidential system, one could hypothesize that new renewable energy policies would face more veto players in Texas than in a parliamentary system such as Alberta's, where the Premier is appointed by the Legislative Assembly and is a member of the legislature. In theory, this would make it easier for Alberta to adopt new policies. This hypothesis, however, is irrelevant because the opposite scenario occurred: the decision to

[36] George Tsebelis, "Decision Making in Political Systems: Veto Players in Presidentialism, Parliamentarism, Multicameralism and Multipartyism," *British Journal of Political Science* 25, no. 3 (1995), 289-235.

adopt renewable energy policies was unanimous in Texas, supported by both the governor and the majority of the state legislature; in Alberta, key actors agreed not to pursue restrictive policies to promote renewable energy. In other words, the question is not why there was less opposition in Texas, but rather, why did Texas leaders want policy change in the first place.

4.2. Policy legacies and path dependence

Policy legacies serve as a central explanation for why Texas leaders chose to suddenly support the development of renewable energy. Specifically, two policy legacies are most important: policies to promote energy independence, and reliance on local fossil fuels.

As the data section showed, both jurisdictions display strong energy independence: they generate most of their electricity in local power plants, and thus electricity imports represent only a tiny fraction of the their power needs. However, there is an important difference: in the case of Alberta, all of the fossil fuel sources used for electricity are locally extracted. On the other hand, Texas currently imports two thirds of the coal it uses to generate power, and coal energy represents a large portion of the state's electricity mix: 36.5% of electricity generated in 2010.[37] In other words, about 25% of Texas's electricity is produced using imported coal. Therefore, Texas was not nearly as energy independent as Alberta during the period analyzed.

This lack of energy independence was particularly important to Texas leaders during the mid 1990s for one reason: the Texas electricity grid was developed separate from the rest of the country's grid, following a long-held desire for energy independence

[37] U.S. Energy Information Administration, *State Energy Profiles: Texas*

and self-reliance. As will be explained later, this historical energy isolation of Texas was a key element for a paradigm shift that occurred in 1992 when the state became a net importer of electricity. In other words, the lack of important electricity interconnections and the state's historical energy self-sufficiency prompted a sense of urgency in developing alternative sources of energy when it became evident that energy imports were on the rise. My prediction is that this policy legacy of energy isolationism, together with limited local coal capacity, facilitated the Texas authorities' decision to opt for restrictive measures to promote renewables in the state. When officials in Texas realized that coal imports were rising and threatening the state's energy self-reliance, integrating renewable sources became an important policy alternative. Thus, the incorporation of renewables was a way to reinstate the state's energy self-reliance.

In this sense, the rise in energy demand in Texas, which suddenly made the state more dependent on imported coal, was a critical juncture that caused a mental shift away from the established energy path. Coupled with diminishing reserves of natural gas, and an increasing preoccupation with energy security, the state's leaders began to consider other paths for their energy development. Developing a renewable energy industry also held the promise of creating thousands of new jobs in the state, whereas continuing to import coal was a drain to the local economy. This became a powerful reason to pursue a higher degree of energy independence. Therefore, the Texas Public Utility Commission, together with state legislators and the governor, opted to protect the state's energy independence and enhance the local economy by adopting policies that promoted a more diversified energy mix, prompting the rise of wind energy in the state.

4.3. Issue framing and strategic linkage

Issue framing is at the centre of the Texas success story with wind energy. When developing the set of restrictive policies to promote renewables, officials at the Public Utility Commission (PUC) were very careful not to speak of climate change or greenhouse gas emissions reductions because they understood the climate of denial that existed in the state. Instead, Texas officials presented their case for a Renewables Portfolio Standard[38] (RPS) to the Governor as an opportunity for diversification of the energy supply. In turn, the Governor promoted the idea to the legislature as an opportunity for economic development and for ensuring the reliability, stability, and self-sufficiency of the state's energy sector. As an official at the PUC explained, "If we had characterized this as something to do with greenhouse gases, it would have hurt the bill's chances. So we didn't. The fact that no one used the term [climate change] to argue for the bill shows it would not have sold."[39] In this sense, a measure that has a large potential to reduce greenhouse gas emissions in the state by developing a large renewable energy capacity was negotiated without ever mentioning climate change.

Another closely related hypothesis is strategic linkage. When the Public Utility Commission of Texas decided to promote the idea of a Renewables Portfolio Standard in the late 1990s, they did not present it as a stand-alone policy. Instead, the RPS was introduced as one part of the electricity restructuring plan that the state began to discuss in 1995. In other words, the RPS was linked to wider legislation that sought to change the electricity landscape in Texas by allowing competition in retail electricity markets and

[38] A Renewables Portfolio Standard (RPS) is a regulation that promotes renewable energy by obligating electricity supply companies to generate a certain percentage of their electricity from renewable sources. Details of the Texas RPS will be explained in a later section.

[39] Rabe, *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy*, 60.

increased consumer choices. I argue that linking the RPS to wider issues of market competition helped to appease the diverse sectors and interest groups that would have opposed a stand-alone mandate on renewable energy that would have affected their interests.

On the Alberta side, there is no indication that the issue of renewables has been framed as an opportunity for economic development. There is also no evidence that officials or policy advocates have tried to push for the development of restrictive emissions measures by framing it as separated from climate change. Moreover, due to Canada's ratification of the Kyoto Protocol and Ottawa's initial intention to comply, attempts to promote and develop renewables in the country are seen as tied to greenhouse gas reductions. In other words, the ratification of the Kyoto Protocol may have been an important window-shutting event for renewable energy in Alberta. Given that the province strongly opposed Kyoto and any measures that would hurt the local energy economy, renewable energy polices that were perceived as tied to compliance with Kyoto would have faced enormous opposition in the provincial legislature. Therefore, policy framing did not help Alberta to adopt any measure to promote renewable energy. I argue that these differences in the way Texas and Alberta approached the development of renewables gave Texas authorities a political advantage that facilitated the implementation of restrictive policies.

4.4. Interest groups

Lastly, I also hypothesize that interest group politics plays a significant role in explaining why Texas was able to implement strong renewable energy policies and Alberta was not. As shown by the data, Texas imports a large portion of its coal from Wyoming,

while Alberta's coal is all locally mined. Therefore, a policy that increases renewables (and thus displaces existing coal energy or slows the expansion of new coal energy) affects the local coal industry less in Texas than in Alberta, which translates into weaker opposition to renewables by the coal industry. Adding to this, a Texas politician facing a decision of whether to promote the creation of new local jobs (via renewables) or protect imports from another state is likely to choose the direct political benefits of creating local jobs. Moreover, a politician promoting wind energy can promise not only local jobs, but also other positive externalities, like better air quality. Thus, I propose that the issue of imported coal in Texas facilitated legislators' choice to support the new Texas renewable energy policies.

In the case of Alberta, the economic growth of the province is largely based on its strong fossil fuel extraction industry. All of the coal and natural gas used for electricity comes from underneath the province's soil, and most electricity comes coal and natural gas power plants. Therefore, this strong industry sector provides economic wealth for the province, and thus the province has a strong reason to protect it. I argue that Alberta legislators face no political incentives to enact restrictive measures that would pose a threat to these industries.

5. Evidence: the story of wind energy in Texas

This section focuses on the historical processes that enabled the adoption of policies to promote wind energy in Texas. It introduces the relevant political actors, key moments, and the resulting policies that support the previously explained hypotheses.

5.1. The Texas "wind rush": historical background

Historically, the state of Texas has embraced energy independence by developing its own energy sources and avoiding reliance on other states or the federal government for its energy needs. Before the creation of the Texas Public Utility Commission (PUC) in 1975, unregulated state electricity generators made a series of informal agreements to maintain energy independence from other states, and produce electricity only for Texas.[40] Through this lack of government regulation "the state actively encouraged aggressive energy development alongside a semiformal separation from the remainder of the North American network for electricity distribution."[41]

This resulted in a very particular geographical separation of power for Texas: the North American electric power grid is divided into various multi-state zones (in which electricity interconnections happen between states within each zone), whereas the zone that operates the electricity grid for Texas adheres mostly to the Texas state boundaries. In other words, most of Texas's electricity is generated by utilities that sell electricity primarily within Texas and remain disconnected from other parts of the US power grid.[42]

[40] Ibid., 54
[41] Ibid., 54
[42] Ibid., 54

This self-imposed energy isolation, although fundamental to sustain Texas's objective of energy independence, became a concern in the late 1980s as growth of cities caused an enormous rise in energy demand. Furthermore, by 1992 Texas became a net importer of energy (mainly coal from Wyoming), consuming twelve percent more energy than it was able to produce with domestic fuels.[43] At this point, the Texas energy establishment realized that exclusive reliance on fossil fuels for power generation was no longer a viable policy to sustain the state's future electricity needs.

5.2. Texas considers renewable energy

The year 1992 proved pivotal for a second reason: as a result of President George H. W. Bush's National Energy Strategy, the US Congress enacted the Energy Policy Act of 1992, calling for a nationwide restructuring of state systems in charge of electricity generation and delivery. This opened up the possibility of new competition in the electricity sector. Specifically, the Energy Policy Act of 1992 was significant as a promoter of renewable energy because it gave states the ability to redesign their local energy markets, allowing them to integrate and promote investments in renewable alternatives to fossil fuels.

More importantly, the 1992 Act instituted a generous inflation-adjusted Production Tax Credit (PTC) of $0.017 per kilowatt-hour to generators of new sources of renewable energy.[44] It was created for projects initiated between 1994 and 1999, which would have their costs subsidized for ten years after startup. In other words, it was a tax credit to encourage private investment in renewable energy generation. As the data section showed,

[43] Ibid., 56
[44] Ibid., 9

the amount of the credit made the cost of wind projects more competitive with that of other electricity sources.[45]

The enactment of this Act coincided with the first year in which Texas became a net importer of energy. This revelation shook the Texas energy establishment: it served as a critical juncture in the state's established energy path by challenging the traditional assumption that Texas had enough energy sources on its soil to remain self-sufficient. In other words, the policy legacy of energy isolationism suddenly became a liability. As a result, the Texas Public Utility Commissioners took action and in 1995 announced a formal review of the Texas electricity sector, requesting public involvement in the process and launching a program of deliberative polling[46] to gauge public opinion on different energy policies.

This process of deliberative polling proved fundamental to the result of the Commission's restructuring of Texas energy policy. Texas utility representatives as well as PUC Commissioners were expecting that citizens valued low prices for electricity above all other considerations. However, the results of the deliberative polling indicated that citizens were more interested in reliability and stability of power supply. More importantly, citizens showed strong support for avoiding environmental damage during electricity generation, and were highly responsive to proposals for renewable energy.[47] Also, the

---

[45] Riti, *Three Sheets to the Wind: An Intersection of the Renewable Energy Production Tax Credit, Congressional Political Posturing, and an Unsustainable Energy Policy*, 793.

[46] Contrary to traditional polling, where citizens are asked questions about a topic assuming they understand what is at stake, deliberative polling consists in gathering a diverse group of citizens for a number of days and educating them about a topic. After spending considerable time pondering about the issue and interacting with other participants, the subjects are asked to respond poll questions.

[47] R. L. Lehr, W. Guild and D. L. Thomas, *Listening to Customers: How Deliberative Helped Build 1,000 MW of New Renewable Energy Projects in Texas* (Golden, Colorado: National Renewable Energy Laboratory,[2003]).

results showed that citizens were willing to pay slightly higher rates for renewable energy.[48]

5.3. Renewable Portfolio Standard: a mandatory approach to renewables

With the results of the deliberative polling in mind, key officials in the Texas PUC began a series of negotiations with various interests (utility companies, citizen groups, and environmental organizations) to develop a viable renewable energy strategy. After months of deliberations, the negotiators decided to push for a Renewables Portfolio Standards (RPS)[49], strategically linking it to the state's wider push towards electricity market restructuring. The Texas legislature embraced the idea of the RPS in part because of the political incentives given by the deliberative polling results. As Hurlbut explains, "the state's political leadership recognized the relationship between renewable power and a customer's right to choose, to the point that making the RPS part of restructuring was never really in doubt."[50] Interestingly, utility companies also felt compelled to satisfy their customers' desires for a larger mix of renewable energy options. In the words of an energy attorney, "companies began to integrate customer values about [renewable] energy choices"[51] into their strategies, and this influenced the position of utility companies in the legislative debates over Texas energy restructuring.

Also, the supporters of the RPS carefully framed it not as an environmental policy, but as an opportunity to increase market competition and consumer choices. As David

---

[48] David Hurlbut, "A Look Behind the Texas Renewable Portfolio Standard: A Case Study," *Natural Resources Journal* 48 (2008), 134.

[49] As previously noted, an RPS is a mandate that obliges electric utilities to produce a certain portion of their electricity from renewable energy sources.

[50] Ibid., 142

[51] Lehr, Guild and Thomas, *Listening to Customers: How Deliberative Polling Helped Build 1,000 MW of New Renewable Energy Projects in Texas*, 9.

Hurlbut explains, "the [Public Utility Commission of Texas] implemented the RPS with the intent of making competition the engine of a market transformation process in which clean technologies could grow economically."[52] Therefore, by couching the goals of the RPS in the rhetoric of this new paradigm of electricity restructuring, the proponents of the policy were able to gain legislative momentum.

However, this policy linkage also led to considerable opposition: consumer groups were opposed to the price increases that come with restructuring, while municipally owned utilities and rural electric cooperatives opposed a mandatory renewables requirement. To solve any problems arising from this opposition, the legislators had to make a political compromise: they excluded the municipally owned utilities and the rural cooperatives from the restructuring bill, exempting them from the obligation to comply with the RPS mandate.

On the other hand, a mixture of strong public support for renewables plus a convergence of opinions from various advocacy groups helped to overcome any pressures against the RPS from other interest groups. As Langniss and Wiser explain, "helping to overcome this resistance was the fact that the RPS was only a small part of the overall restructuring legislation […], that public surveys showed overwhelming support for renewable energy"[53] and that the renewable and environmental communities argued strongly and in unison for the RPS. Moreover, Texas lawmakers at this point agreed that energy source diversification was an important component of electricity restructuring. As Terry Hadley, Communications Director for the Texas Public Utility Commission, explains,

---

[52] Hurlbut, *A Look Behind the Texas Renewable Portfolio Standard: A Case Study*, 129.
[53] Ole Langniss and Ryan Wiser, "The Renewables Portfolio Standard in Texas: An Early Assessment," *Energy Policy* 31 (2003), 528.

> When the electric industry was restructured in Texas in the late 90s there was a realization by lawmakers [...] that the state would best be served by having a wide variety of fuels to generate electricity, so as not to be dependent on any one fuel source, both for reasons of reliability and potential price spikes. So as part of the overall legislation to restructure the retail electric industry and open it up to competition, a significant component was a RPS.[54]

Moreover, Texas Governor George W. Bush was persuaded to move away from his preference for a voluntary renewables program and instead embraced this idea of binding legislation because a renewable portfolio standard (RPS) would be best to boost both his environmental and economic credentials.[55] For the Governor it was a win-win situation because the RPS could be promoted as a way to ensure long-term electricity stability, while responding to the public's demonstrated interest in cleaner sources of energy. When asked about this, Kenneth Starcher, Manager at the Texas Alternative Energy Institute, said:

> [Bush] was unopposed to it and he realized that it was good potential benefit for the rural communities. We never expected windmills to grow in Dallas, or the major cities, they were always going to grow in rural areas. [...] And this was a way to throw benefit to these communities. It was a good political decision made for the right reasons. [56]

On this point, Terry Hadley comments:

> His support was crucial. Perhaps even more significant, [...] when the legislation passed in 1999, it was a near unanimous approval from the legislature. That crossed not only party lines, but geographic lines, really statewide. By the time the final legislation had been fashioned, there was very little opposition to the overall legislation, and part of that was the RPS.[57]

Thus, in 1999 the Texas Legislature enacted Senate Bill 7 (Restructuring of Electric Utility Industry Act), which forever changed the electricity landscape of Texas. The bill included two landmark provisions to promote the development of a competitive market for renewable energy in Texas. First, the bill established the RPS: utilities were required to generate a certain percentage of their electricity from renewables, aiming for a 2000 MW

[54] Telephone interview
[55] Rabe, *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Policy*, 59.
[56] Telephone interview
[57] Telephone interview

target by 2009 (which translates into about 3% of Texas electricity capacity).[58] Second, the act established a Renewable Energy Certificates Trading Program (REC), which established a market mechanism that gave utilities great flexibility in complying with the 3% standard by allowing them to buy renewable energy credits from other electricity generators. These measures helped to lower the compliance costs of the RPS, rendering it a cost-effective policy.

The RPS started in January 2002 and will end in January 2020. Interestingly, it attracted so much interest after its launch in 1999, that by 2001 it had already spurred the installation of 915 MW of new wind energy.[59] In other words, a year before the requirement started, Texas wind generators had already met half the 2009 requirement (new wind projects met the 2005 requirement 4 years early). According to Fredric Menz, this was possible thanks to excellent wind resources in West Texas, as well as "key provisions in the RPS, including requirements sufficiently high to trigger market growth; requirements applicable to all electricity providers; flexibility mechanisms [REC trading], and substantial penalties for non-compliance."[60]

Due to this unanticipated growth, the Texas legislature passed Senate Bill 20 in 2005, expanding the RPS to 5,880 MW by 2015 and 10,000 MW by 2025. Today, the RPS is once again well ahead of schedule, with most new renewable energy coming from wind generators. Future projections indicate that the RPS requirements for 2025 will be achieved next year, and tripled by 2020. This overshoot indicates that wind energy grew in

[58] Langniss and Wiser, *The Renewables Portfolio Standard in Texas: An Early Assessment*, 528.
[59] Ibid., 529
[60] Fredric C. Menz and Stephan Vachon, "The Effectiveness of Different Policy Regimes for Promoting Wind Power: Experiences from the States," *Energy Policy* 34 (2006), 2406.

Texas not only to comply with a mandate, but also because economic incentives made wind an attractive investment. Section VI explains this further.

6. Evidence: Alberta's road to wind energy

6.1. Brief history of electricity in Alberta

Historically, the electricity system in Alberta developed in a very different way from other Canadian provinces. Instead of relying on a single Crown corporation with a monopoly on power generation, Alberta electricity developed under a model of three vertically integrated private utilities (TransAlta Utilities, ATCO Electric, and EPCOR) that had a government regulated franchise to generate, distribute, and sell electricity in their assigned region. Similar to the case of Texas, the abundance of coal and natural gas resources allowed this system of electricity to develop in a way that ensured self-reliance for Alberta.

In the early 1990s, provincial authorities began discussing the possibility of allowing more competition in the electricity sector. The first move towards restructuring the electricity system was the Electricity Utilities Act of 1995 and its amendments in 1998, which effectively changed the way that the power sector in Alberta works. This legislation developed a competitive market for electricity in the province by creating a Power Pool system, which functions as a spot market where all electricity that is bought and sold in Alberta is exchanged. In order to participate in this market as "pool participants", electricity generators were required to acquire long-term contracts called Power Purchase Agreements (PPAs), (which were auctioned in 2000 and 2001) and then submit bids to the Power Pool to supply energy.[61] In other words, the Electric Utilities Act opened the

[61] Government of Alberta, "Power Pool of Alberta," http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/eng4394 (accessed November 12, 2010)

possibility for new electricity generators (and possibly new types of electricity) to enter the Alberta market.

6.2. A rocky road to renewables

Despite the potential opportunity to promote new sources of energy during the restructuring of Alberta's electricity sector, neither the Electric Utilities Act of 1995 nor its 1998 amendments contained special provisions for the promotion of renewable energy. In sharp contrast to the Texas Senate Bill 7 of 1999, the Alberta legislation did not establish a restrictive measure like an RPS, nor did it create a market for renewable energy credits. Even though the Power Pool system was intended to increase competition in the power generation sector, and allow smaller, independent power producers to enter a market dominated by three very powerful electric companies, these reforms did not establish a provincial mandate for renewable energy.

According to the Pembina Institute, Alberta does not have a renewables mandate because the provincial government has not committed to promoting renewable energy. Although Alberta relies on market forces to determine what generating assets are built and when, provincial policy and government decisions can still influence investment decisions (and tacitly preclude renewable energy generation). As Pembina explains,

> Ministry decisions can also affect the choice of technology directly. Examples of actions previously taken by Alberta Energy or Alberta Environment include mandating a cap on wind power development (subsequently rescinded), allocating $2 billion of public funds toward CCS [carbon capture and storage] (effectively a subsidy to fossil fuels such as coal) and assembling an expert panel to look at nuclear power.[62]

In other words, instead of promoting renewables, Alberta has singled out coal as its preferred technology for the expansion of the province's electricity generating capacity, making it difficult for wind energy to penetrate the electricity market.

---

[62] The Pembina Institute, *Greening the Grid: Powering Alberta's Future with Renewable Energy*, 14.

The support for carbon capture and storage technologies (CCS) is particularly revealing. In 2008, Alberta announced a $2 billion CCS fund as part of the provincial strategy to reduce greenhouse gas emissions. The motivations for this program are very straightforward:

> Alberta has coal reserves with twice the energy content of even its vast oil sands reserves. Sustainable, coal-fired electricity generation is important to Alberta's continued competitiveness in an integrated North American energy market – but without CCS, the acceptability of power from coal will be far from assured. CCS offers the potential to address coal's carbon footprint, thus enabling its use in a carbon-constrained future.[63]

Moreover, the province estimates that the storing of CO_2 will have the additional effect of increasing oil production by 1.4 billion barrels from conventional reservoirs, effectively doubling Alberta's conventional oil recovery.

In other words, Alberta is comfortable about its energy policy legacies and recognizes its attachment to fossil fuels. The province is set on continuing along its path dependence of pursuing an economy based largely on exploiting its vast fossil fuel reserves. Furthermore, the province has not experience a critical juncture that puts into question these policy legacies and this chosen path for economic development and electricity generation.

6.3. Made in Alberta: a voluntary approach to renewables

Alberta has yet to enact restrictive legislation promoting the development of renewables. Nevertheless, the province has enacted a number of policy measures specifically designed to promote renewable energy, particularly wind. The following paragraphs explain the context of these measures.

---

[63] Alberta Carbon Capture and Storage Development Council, *Accelerating Carbon Capture and Storage Implementation in Alberta, Final Report*, 2009, http://www.energy.alberta.ca/Initiatives/1690.asp (accessed November 3, 2010).

The current Alberta energy strategy is based on Bill 37, the Climate Change and Emissions Management Act of 2003, which entails two main parts. First, the bill establishes an emissions intensity objective for GHG reductions, instead of an absolute reductions objective.[64] Second, the Alberta strategy establishes a framework for voluntary emissions reductions measures, which includes negotiations with various industry sectors where the different industries can choose to voluntarily reduce GHG emissions. This voluntary program has been highly criticized by environmentalists for its lack of accountability and failure to solve the free-rider problem.[65] Moreover, in 2007 Alberta implemented the first cap and trade regulation in Canada with its "Specified Gas Emitters Regulation," meant to reduce the carbon intensity of large polluters, such as electric utilities. However, the methods proposed for emissions reductions include better combustion efficiency, usage of cleaner fossil fuels, and technological advances, but do not include an elaborate plan to switch to renewable energy. In other words, although Alberta has a plan to reduce the intensity for greenhouse gases, the focus of this plan is on adapting existing polluters, not promoting new renewable power sources.[66]

In this sense, Alberta's approach to renewables is best summarized by the Provincial Energy Strategy statement currently on the government's website:

> Should Alberta be looking at alternative energy sources? Yes. Should we promote renewables? Again, yes. But the key question for Alberta, in a world that is going to be counting on energy from all sources, is how we can begin to produce and consume fossil fuels in a far cleaner way."[67]

---

[64] This is a fundamental difference, because an emissions intensity objective does not necessarily translate into absolute reductions. For instance, if the GDP grows enormously, emissions can continue to grow substantially while still meeting the target.

[65] Lucas, *The Alberta Energy Sector's Voluntary Approach to Climate Change: Context, Prospects, and Limits*, 300.

[66] Government of Alberta, "Greenhouse Gas Reduction Program," http://environment.alberta.ca/01838.html (accessed February 14, 2011).

[67] Government of Alberta, "Launching Alberta's Energy Future, Provincial Energy Strategy," http://www.energy.alberta.ca/Initiatives/1509.asp#production (accessed January 10, 2011).

This revealing statement confirms the Pembina Institute's opinion and helps to reaffirm why the province has not developed any mandatory mechanisms for the development of renewable energy: far from trying to implement restrictive legislation to reduce GHG emissions via alternative sources of energy, Alberta prefers a strategy of "cleaning" fossil fuels, instead of replacing them gradually with wind, solar, hydroelectric, or biomass energy. According to Alastair Lucas, a main reason that Alberta adopted this voluntary approach to renewables is that "it fits comfortably into the historic Alberta partnership model of energy sector regulation,"[68] where the interests of the fossil fuel extraction industries have dictated policy in the province.

Moreover, when asked about the desirability of promoting wind energy via a provincial tax incentive or a subsidy, Ronald Liepert, Alberta Minister of Energy, responded:

> We have in Alberta, whether it's in electricity generation or whether it's taxes, we have a very entrepreneurial, private sector way of approaching things. We don't have crown corporations like other provinces do, we don't have subsidies or feed in tariffs to the same extent that other provinces have. We believe that industry has to stand on its own. So we have not gone the route of putting in things like a feed in tariff or subsidy programs. Ontario is the best example of that right now and it is a mess. So that's just not the way we operate in Alberta.[69]

Thus, the Alberta government displays a strong aversion to measures that interfere with the functioning of the free market. Unless of course, those measures help to bolster new technologies that benefit the fossil fuel sector, like the province's enormous financial support for innovation on carbon capture and storage.

More importantly, although government support through financial incentives is identified in the literature as a crucial factor in the growth of wind energy in Texas (and in

[68] Lucas, *The Alberta Energy Sector's Voluntary Approach to Climate Change: Context, Prospects, and Limits*, 306.
[69] Telephone interview

wind industries worldwide), the Alberta Minister of Energy states that subsidies are not important. As explained above, he considers federal tax incentives an ineffective policy. Moreover, when asked whether a renewables portfolio standard would be a positive policy to promote wind in Alberta, he simply answered: "No, I just haven't seen where it's [an RPS] worked anywhere, to be honest with you."[70] Given the vast amount of literature citing the positive effects of an RPS for wind energy development, this answer seems more like a convenient excuse to mask the Province's active support for its strong fossil fuel industries.

[70] Telephone interview

7. Evidence: performance of policy instruments

This section addresses the second research question: did the Texas policies result in a larger growth in wind energy capacity?

7.1. Federal policies

The most notable federal policy influencing wind energy development in Texas was the Production Tax Credit (PTC) established in 1992. The initial validity period for the credits was from 1994 to 1999. Due to the program's nationwide effectiveness, the PTC has been extended a number of times until present day. However, these have been short-term extensions, lasting either one or two years, creating a climate of uncertainty amongst wind investors.[71] Moreover, on three occasions, the extension came after the credit had expired, causing a lapse period where the credits were unavailable. These lapse periods happened in 2000, 2002, and 2004. (See Table 3 in Appendix for a legislative history of the PTC)

Perhaps the best way to assess the effectiveness of the Production Tax Credit is by comparing the growth of wind energy in the years when the PTC was active to the years in which it lapsed. As Bird et al. explain,

> The impact of the tax credit on the [US] wind energy industry is evident in the boom-bust cycle of development in recent years. Wind energy installations have peaked in years when the credit was scheduled to expire (i.e., 1999, 2001, and 2003) as developers rushed to complete projects in time to take advantage of the credit. In the off years, development has lagged because of the uncertainty surrounding the Production Tax Credit extension and the lead-time necessary to plan and complete projects.[72]

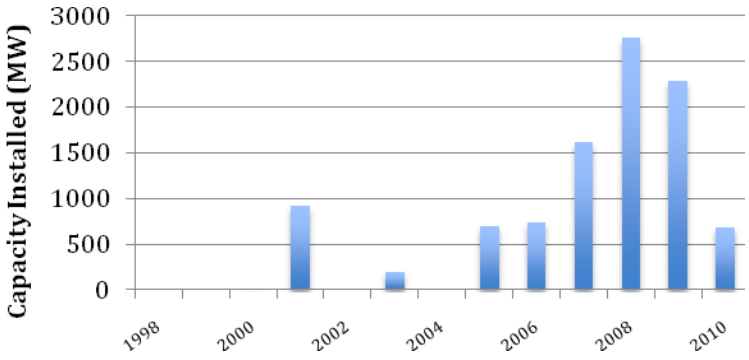
The following figure illustrates this boom and bust cycle of wind energy development in Texas, caused by the three lapse periods of the PTC:

---

[71] Ryan Wiser, Mark Bolinger and Galen Barbose, "Using the Federal Production Tax Credit to Build a Durable Market for Wind Power in the United States," *The Electricity Journal* 20, no. 9 (2007), 80.

[72] Lori Bird and others, "Policies and Market Factors Driving Wind Power Development in the United States," *Energy Policy* 33 (2005), 1398.

Figure 9. Wind capacity additions: Texas[73]



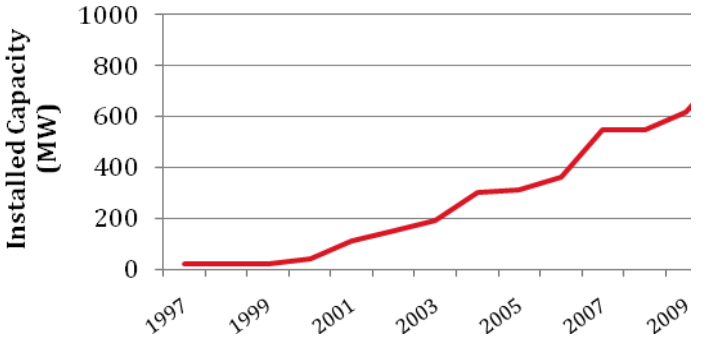
Consistent with the above quote, the previous figure shows no growth in wind capacity on the years that the PTC expired: 2000, 2002, and 2004. After this, the Energy Policy Act of 2005 extended the PTC for two years, which caused a steady growth in 2005-2006. Then, in mid 2006, the PTC was extended until the end of 2008, which caused the enormous growth of wind capacity in 2007 and 2008. This is consistent with Bird's explanation that developers rushed to complete wind projects before the credits expire. Or as Wiser et al. explain, "due to the series of one- to two- year PTC extensions, growing demand for wind power has been compressed into tight and frenzied windows of development."[74]

In the case of Canada, the most important federal policy has been the Wind Power Production Initiative (WPPI) of 2002. This production tax credit offers a financial incentive of 1 cent per kWh to certain types of wind turbines, for the first ten years of operation. The first phase of the WPPI was intended for wind projects started between 2002 and 2007, but it was suspended in 2006 when the Harper administration came into power. Then, the program was renewed in April of 2007 as the ecoEnergy Renewable Power Program, with

[73] U.S. Energy Information Administration, *State Energy Profiles: Texas*
[74] Wiser, Bolinger and Barbose, *Using the Federal Production Tax Credit to Build a Durable Market for Wind Power in the United States*, 80.

an identical tax credit of 1 cent per kWh. This amounts to half the size of the incentive offered by the American PTC which, adjusted for inflation, was 2 cents per kWh in 2007. Despite this difference, however, Alberta's wind energy capacity grew the most during the period that the WPPI was active:

Figure 10. Wind energy in Alberta: 1997-2010[75]



As the graph shows, wind capacity growth took off in 2001 and halted abruptly in 2007 when the WPPI was cut. However, growth resumed after 2007, when the Harper administration renewed the program. Judging by this data, it seems that the growth in wind energy in Alberta coincides with the period in which this incentive was active. When asked whether this incentive helped to promote wind energy development in Alberta, Tom Levy of the Canadian Wind Energy Association replied:

> Yes, most definitely. Eco Energy was one of the most successful incentive programs the federal government has ever put out for wind energy [...] I would expect with the absence of a federal policy in incentives that there will be some regions in Canada that might have reduced wind build-out as a result of a lack of incentives.[76]

Therefore, the evidence suggests that the WPPI was at least partially responsible for growth in wind energy in Alberta.

[75] Government of Alberta, *Electricity Statistics*
[76] Telephone interview.

7.2. State/Provincial policies

Given the previous evidence of the success of federal policies in spurring wind energy growth, was the role of state policies still important? In other words, the carrot seems to have worked, so was there really a need for a stick (RPS) in Texas?

The first thing to note is that there was no growth in wind energy in Texas during the initial period for the PTC, from 1994 to 1999. Wind energy growth in Texas began in 2001, a year before the RPS requirements came into place. In other words, in the absence of the RPS, the federal credits did not cause wind energy investments in Texas for nearly seven years. It was only after the RPS was implemented and the mandate on renewables became a pressing reality that investors took advantage of the federal credits. Once the RPS began obliging utilities to build renewable energy capacity, wind energy began to grow in Texas, only interrupted by the lapse periods of the federal credits. However, once the growth of wind energy got under way, the industry surpassed every RPS target. Therefore, investors' interest in wind farms goes beyond the amounts set by the renewable energy mandates. This means that, although the RPS enabled the initial growth of wind energy, the fiscal incentives provided by the PTC appear to be driving this growth. The following section elaborates on this dual responsibility.

In the case of Alberta, the province has not developed a provincial strategy for wind energy that includes restrictive measures or renewable energy mandates. Therefore, the growth in wind energy explained earlier cannot be attributed to provincial policies.

7.3. Discussion and comparison

As explained above, the growth of wind energy in Texas happened as a result of both the Renewables Portfolio Standard and the federal Production Tax. A combination of the stick

provided by the RPS and the carrot provided by the PTC has driven the "wind rush". This is consistent with the literature on the Texas wind story. According to Langniss and Wiser,

> This wind power boom is not solely an outgrowth of an effective RPS policy. A developing customer-driven market for green power and the wind power plans of electricity utilities not subject to RPS requirements have also driven some of the development. The federal PTC for wind, favorable transmission rules, and an outstanding wind resource have additionally played important roles.[77]

Moreover, they argue that size of the RPS enables economies of scale for wind projects, which results in deep cost reductions. Then, the PTC allows wind projects in Texas to deliver power for less than 3 cents (US) per kWh, making them competitive with new natural gas power plants.

Similarly, Kenneth Starcher argues that although the RPS is important to initiate the interest in wind energy, real growth in wind energy only happens with the PTC. He uses a winter Olympics analogy to explain,

> The RPS in Texas was a definite bobsled push, but without the smooth support of the complete track laid out by the federal support to wind energy, the PTC, when they turn that switch off, the industry dies. And that is why no growth 2000, no growth 2002, little growth 03. For five years we've had continuous growth, no switch-off (of the PTC). Without federal support, nothing happens at the state level [...] Every other federal mandate that gives you an exact target to reach, how often has it been that you have to drag industry, or drag a corporation into compliance? 'Meet this target or I'll charge you more penalties´. And this one, we're 3 times bigger than what we need to be, 10 years ahead of schedule. I didn't do that with a stick. It was the carrot. Again, the bobsled: a little push [RPS], and then everything else took its course [PTC].[78]

In a similar way, Langniss and Wiser explain that the PTC was effective for Texas wind development because it significantly reduced compliance costs with the RPS.[79] Thus, the RPS provided the initial reason to invest in wind, and then the PTC facilitated the flood of investments. In turn, this flood of investments helps to explain why the RPS targets have been surpassed every time.

---

[77] Langniss and Wiser, *The Renewables Portfolio Standard in Texas: An Early Assessment*, 534.
[78] Telephone interview
[79] Ibid., 533

On the other hand, Alberta did not employ a stick to drive the expansion of its wind energy capacity. Instead, the province has experienced a moderate yet steady growth that coincides with the implementation of a carrot mechanism, the WPPI. This moderate growth, however, does not compare with the steep growth displayed by the Texas wind energy industry, especially after 2007 (figure 1). Prior to this year, the per capita data shows that Alberta's wind energy grew parallel to Texas's until 2007 (figure 3), and for the period 2000-2006, Alberta's wind capacity as a percentage of total capacity was larger than that of Texas (figure 2). In other words, it is only after Texas's giant leaps during 2007 and 2008 that the difference in wind energy capacity between these jurisdictions is truly significant. Therefore, if we consider the steep growth of 2007-2008 the crown achievement of a successful combination of policies in Texas, then it is clear that employing a renewable mandate together with a strong fiscal incentive was more effective than Alberta's relatively weak fiscal incentive and no mandates.

8. Conclusion

This thesis explored the development of wind energy in Texas and Alberta. It asked the question of why two similar jurisdictions chose very different policies to promote the expansion of their wind energy capacity. It also asked whether those policy choices led to a divergence in wind energy growth.

On the first question, this study found that policy legacies played a major role in Texas's decision to implement a renewable energy mandate. Texas had a longstanding policy commitment to energy independence, reflected in the state's historical choice to develop a separate electricity grid. However, the state's energy self-sufficiency came under threat in the mid 1990s: a growing dependence on imported coal in response to a rise in energy consumption created a critical juncture in Texas. Then, the choice between continuing to spend vast resources on imported coal versus creating local jobs from a new renewable energy sector prompted officials to propose a Renewables Portfolio Standard (RPS) as a policy option. If the state had not experienced this threat to its energy independence, it is hard to imagine that officials would have found any motivation to begin thinking of ways to stray away from the state's historical path of generating power from fossil fuels. Alberta also displays a legacy of energy independence, but the province did not experience any similar critical juncture. In other words, both jurisdictions have historically pursued development based on energy independence, but only Texas ran out of cheap local coal. Thus, this interaction between the jurisdictions' resource endowments and their legacy of energy independence is the most compelling explanation for the difference in renewable energy policies between Texas and Alberta.

Moreover, interest groups are intimately related to this policy legacy and resource endowment dynamic. If Texas did not have to import two thirds of the coal it uses for electricity, not only would policymakers not feel the urgency to develop alternative sources of electricity, but they would also be protective of the local jobs in the coal industry. However, faced with growing coal imports, politicians in Texas had the option of pursuing energy independence by promoting a wind energy sector, while creating thousands of local jobs in this new industry. In Alberta, the province could continue to promote its energy independence by supporting present local jobs in the fossil fuel extraction industry. In light of a booming oil industry and sufficient coal reserves, politicians in Alberta faced no urgency in adopting renewable energy policies, and faced the easier choice of simply protecting the interests of the local coal and natural gas industries.

Once Texas officials decided on a renewable energy mandate, issue framing and strategic linkage played a role in gaining near unanimous support in the state legislature. By avoiding any connection with climate change, and framing the issue as an opportunity for economic development and more consumer choices, officials were able to garner the support of diverse sectors. Then, by linking the RPS to the state's plan for electricity restructuring, they were able to avoid serious opposition from interest groups. As the literature suggests, if the proponents of the RPS had linked it to climate change, or if they had proposed it as a stand-alone policy, the mandate's chances of political survival would have been very slim. In contrast, Alberta could not avoid the "climate change" frame given Canada's ratification of the Kyoto Protocol and the prominence of the issue. Knowing that the Province was openly opposed to Kyoto, the ratification made it even harder for Alberta

officials to even think of proposing renewable energy policies that would be seen as tied to the rhetoric of reducing the province's greenhouse gas emissions.

Nevertheless, the framing issue in Texas would not have mattered if the policy legacies of fossil fueled power and energy independence had not caused the initial stir. In other words, issue framing only mattered after it became clear to policymakers in Texas that the legacy of energy independence was threatened by the rise in coal imports (and the resulting budget drain from importing out-of-state coal). It seems doubtful that framing wind energy as an opportunity for energy independence or diversification of the power grid would have prompted officials to adopt restrictive policies in the absence of the rise in coal imports and the threat to energy independence. In this sense, framing was a tool that facilitated the adoption of a new policy, but only after the critical juncture caused a mental shift in the Texas policymakers. In a similar way, even if Canada had not ratified the Kyoto Protocol, it is hard to imagine that the framing of renewables as a source of economic development would have been successful in Alberta given the economic protectionism around the province's fossil fuel extraction industries. Therefore, issue framing is the least convincing explanation as to why these jurisdictions developed different policies on wind energy.

On the second question, this study found that the federal Production Tax Credit in the U.S. has been very effective in promoting wind energy growth in Texas: new capacity installations coincide with the periods when the PTC was in place or about to expire. However, there was no growth in wind capacity in Texas during the first 6 years of the PTC, before the RPS was implemented. Once the RPS was in place, Texas wind began its steep rise. Therefore, the Texas "wind rush" began with the stick provided by the RPS, and has

continued thanks to the carrot provided by the PTC. In other words, these instruments worked in tandem and there is no evidence to support the idea that wind energy in Texas would have experienced substantial growth with just one of the policy instruments. In Alberta, wind capacity has grown steadily in recent years, but the lack of a renewables mandate, the province's focus on "clean" fossil fuel energy, and the smaller size of the fiscal incentive have prevented a larger growth of the wind energy sector.

As the reduction of global greenhouse gas emissions becomes a more serious concern, substituting fossil fuel power for renewable energy sources may be humanity's best chance at mitigating the effects of anthropogenic climate change. Given the current international stalemate on enforceable greenhouse gas reduction mandates for polluting nations, sub-national solutions are an important alternative for achieving substantial greenhouse gas emissions reductions. Hopefully, the analysis presented here can serve as a case study on how an oil-intensive, climate-denying jurisdiction like Texas can successfully develop a strong renewable energy sector and begin to reduce its carbon intensity.

References

Alberta Carbon Capture and Storage Development Council. *Accelerating Carbon Capture and Storage Implementation in Alberta, Final Report*, 2009, http://www.energy.alberta.ca/Initiatives/1690.asp (accessed November 3, 2010).

Benitez, Llliana E., Pablo C. Benitez, and G. Cornelis van Kooten. "The Economics of Wind Power with Energy Storage." *Energy Economic*s 30, (2008): 1973-1989.

Bird, Lori, Mark Bolinger, Troy Gagliano, Ryan Wiser, Matthew Brown, and Brian Parsons. "Policies and Market Factors Driving Wind Power Development in the United States." *Energy Policy* 33, (2005): 1397-1407.

CBC News. "Alberta Launches Campaign Against Kyoto." *CBC News*, September 18, 2002, http://www.cbc.ca/canada/story/2002/09/18/alberta_kyoto020918.html (accessed April 12, 2010).

Dawson, Bill. "Texans' Views on Climate Change Aren't so Different, Polls show." *Texas Climate News*, August 6, 2009.

Deyette, Jeff and Barbara Freese. *Burning Coal, Burning Cash: Ranking the States that Import the most Coa*l. Cambridge, MA: Union of Concerned Scientists, 2010.

Environment Canada. *National Inventory Report 1990-2008: Greenhouse Gas Sources and Sinks in Canad*a, 2010, http://www.ec.gc.ca/gesghg/default.asp?lang=En&n=1357A041-1 (accessed November 2, 2010).

Goldstein, Katherine. "Gov. Rick Perry Sues EPA Over Greenhouse Gas Regulation." *The Huffington Post*, Feb. 10, 2010, http://www.huffingtonpost.com/2010/02/18/gov-rick-perry-sues-the-e_n_467576.html (accessed April 20, 2010).

Government of Alberta. "Greenhouse Gas Reduction Program," http://environment.alberta.ca/01838.html (accessed February 14, 2011).

———. "Launching Alberta's Energy Future, Provincial Energy Strategy." http://www.energy.alberta.ca/Initiatives/1509.asp#production (accessed January 10, 2011).

———. "Electricity Statistics." http://www.energy.alberta.ca/Electricity/682.asp (accessed January 23, 2011).

———. "Power Pool of Alberta." http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/eng4394 (accessed November 12, 2010.

———. "What is Coal?" http://www.energy.alberta.ca/coal/645.asp (accessed October 20, 2010).

Hurlbut, David. "A Look Behind the Texas Renewable Portfolio Standard: A Case Study." *Natural Resources Journa*l 48, (2008): 129-162.

Langniss, Ole and Ryan Wiser. "The Renewables Portfolio Standard in Texas: An Early Assessment." *Energy Polic*y 31, (2003): 527-535.

Lehr, R. L., W. Guild, and D. L. Thoma*s. Listening to Customers: How Deliberative Helped Build 1,000 MW of New Renewable Energy Projects in Texa*s. Golden, Colorado: National Renewable Energy Laboratory, 2003.

Lucas, Alastair. "The Alberta Energy Sector's Voluntary Approach to Climate Change: Context, Prospects, and Limits." Chap. Chapter 12, In *Canadian Energy Policy and the Struggle for Sustainable Developmen*t, 293-308. Toronto: University of Toronto Press, 2005.

Menz, Fredric C. and Stephan Vachon. "The Effectiveness of Different Policy Regimes for Promoting Wind Power: Experiences from the States." *Energy Polic*y 34, (2006): 1786-1796.

Pierson, Paul. "Increasing Returns, Path Dependence, and the Study of Politics." *The American Political Science Revie*w 94, no. 2 (2000): 251-267.

Rabe, Barry. "Beyond Kyoto: Climate Change Policy in Multilevel Governance Systems." *Governance: An International Journal of Policy, Administration, and Institution*s 20, no. 3 (2007): 423-444.

———. *Statehouse and Greenhouse: The Emerging Politics of American Climate Change Polic*y. Washington, D.C.: Brookings Institution Press, 2004.

Riti, Christopher. "Three Sheets to the Wind: An Intersection of the Renewable Energy Production Tax Credit, Congressional Political Posturing, and an Unsustainable Energy Policy." *Pace Environmental Law Revie*w 27, no. 3 (2010): 783-821.

Sims, Ralph E. H., Hans-Holger Rogner, and Ken Gregory. "Carbon Emission and Mitigation Cost Comparisons between Fossil Fuel, Nuclear and Renewable Energy Resources for Electricity Generation." *Energy Polic*y 31, (2003): 1315-1326.

Spencer, Christina. "Planet in Peril: Poll." *TorontoSun.Com*, January 4, 2010, , http://www.torontosun.com/news/canada/2010/01/04/12337176-sun.html (accessed April 12, 2010).

Statistics Canada. *Annual Demographic Estimates: Census Metropolitan Areas, Economic Regions and Census Divisions, Age and Sex: 2001 to 2006*: Statistics Canada, 2007.

———. *Electric Power Generation, Transmission and Distribution: 2007*, 2009.

Texas Comptroller of Public Accounts. "The Energy Report, 2008." http://www.window.state.tx.us/specialrpt/energy/renewable/wind.php (accessed October 4, 2010).

Texas State Library and Archives Commission. "United States and Texas Populations: 1850-2010." http://www.tsl.state.tx.us/ref/abouttx/census.htm (accessed January 12, 2011).

The Gov Monitor. "Governor Rick Perry on EPA Denial of Texas Clean Air Petition." *The Gov Monitor*, August 2, 2010, http://www.thegovmonitor.com/world_news/united_states/governor-rick-perry-on-epa-denial-of-texas-clean-air-petition-36365.html (accessed October 30, 2010).

The Pembina Institute. *Greening the Grid: Powering Alberta's Future with Renewable Energy*. Drayton Valley, Alberta: The Pembina Institute, 2009.

Tsebelis, George. "Decision Making in Political Systems: Veto Players in Presidentialism, Parliamentarism, Multicameralism and Multipartyism." *British Journal of Political Science* 25, no. 3 (1995): 289-235.

U.S. Energy Information Administration. "Annual Energy Outlook 2001." (2001).

———. "Electricity Statistics." http://www.energy.alberta.ca/Electricity/682.asp (accessed January 23, 2011).

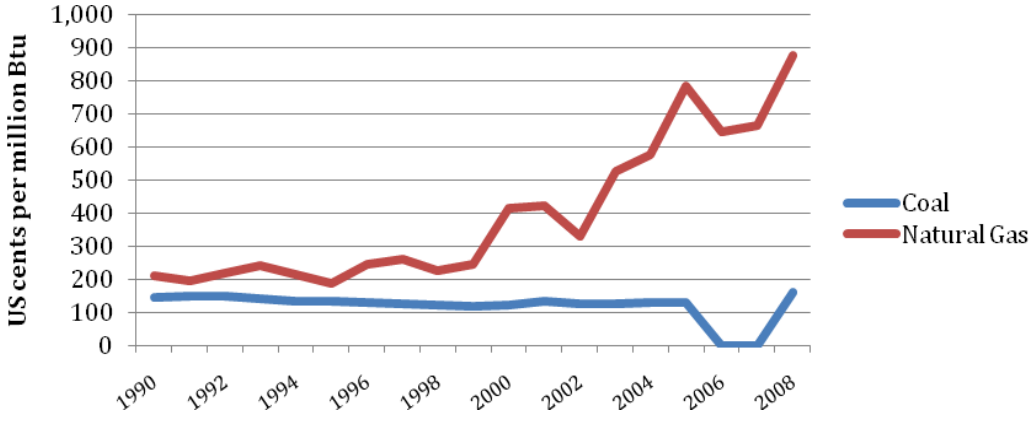
———. "State Energy Profiles: Texas." http://www.eia.gov/cfapps/state/state_energy_profiles.cfm?sid=TX (accessed January 23, 2011).

U.S. Environmental Protection Agency. "Endangerment and Cause Or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act." http://epa.gov/climatechange/endangerment.html (accessed April 15, 2010).

Wiser, Ryan, Mark Bolinger, and Galen Barbose. "Using the Federal Production Tax Credit to Build a Durable Market for Wind Power in the United States." *The Electricity Journal* 20, no. 9 (2007): 77-88.

Appendix: complementary data

Figure 11. Price of fuel delivered to electricity producers: TX[80]



This graph is meant to illustrate the volatility of fuel prices as something that increases the uncertainty of cost estimates for electricity production across sources. The data for Alberta was unavailable, but since coal and natural gas are commodities, it can be assumed that the price of these fuels delivered to electricity producers in Alberta is similar to these prices for Texas.

Table 4. Legislative history of the U.S. Production Tax Credit[81]

Legislation	Date Enacted	PTC Eligibility Window (for wind)	PTC Lapse Duration	Effective Duration of PTC Window (considering lapses)
Section 1914, Energy Policy Act of 1992 (P.L. 102-486)	10/24/92	1994-June 1999	n/a	80 months
Section 507, Ticket to Work and Work Incentives Improvement Act of 1999 (P.L. 106-170)	12/19/99	July 1999-2001	6 months	24 months
Section 603, Job Creation and Worker Assistance Act (P.L. 107-147)	03/09/02	2002-2003	2 months	22 months
Section 313, The Working Families Tax Relief Act, (P.L. 108-311)	10/04/04	2004-2005	9 months	15 months
Section 1301, Energy Policy Act of 2005 (P.L. 109-58)	08/08/05	2006-2007	None	24 months
Section 201, Tax Relief and Health Care Act of 2006 (P.L. 109-432)	12/20/06	2008	None	12 months

[80] U.S. Energy Information Administration, *State Energy Profiles: Texas*

[81] Wiser, Bolinger and Barbose, *Using the Federal Production Tax Credit to Build a Durable Market for Wind Power in the United States*, 79.