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Canada's constitutional separation of (wind) power

Scott Victor Valentine *

Lee Kuan Yew School of Public Policy, National University of Singapore, Singapore

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ABSTRACT

This paper investigates the impact that a federal government structure has on strategic selection of renewable energy policy instruments. The context for this study centers on wind power development in Canada. Canada is a nation that is blessed by all the attributes necessary to catalyze global leadership in installed wind power capacity. Unfortunately, the constitutional separation of powers that underpins Canada's federal system impedes the creation of a national wind power development strategy because Canada's provinces have constitutional authority over electricity governance. The insights gleaned from the case study are used to develop a conceptual framework for understanding the impact that federal structure has on policy instrument selection and efficacy under areas of federal, regional and concurrent policy jurisdiction. Finally, this framework is re-applied to identify specific approaches the Canadian federal government could take to resolve what currently amounts to be a fragmented, ineffective approach to wind power development planning.

1. Introduction

Should policymakers facilitate renewable energy capacity development through distributive policies (i.e. subsidies), regulatory policies (i.e. CO_2 emission caps), redistributive policies (i.e. carbon taxes) or constituent policies (i.e. green energy campaigns) (Lowi, 1972)? A preponderance of research has gone into addressing this question from various conceptual perspectives, which include popular themes such as comparing the efficacy of various policy instruments (cf. Blakeway and White, 2005; EWEA, 2005; Menza and Vachona, 2006; cf. Lipp, 2007), championing the efficacy of one specific instrument (cf. Sorrell and Sijm, 2003; cf. Mathews, 2008), assessing the impact that socio-economic dynamics have on the selection or design of policy instruments (cf. Maruyama et al., 2007; cf. Huang and Wu, 2009), investigating policy instrument selection in stakeholder networks (cf. Rowlands, 2007; cf. Mander, 2008), investigating hurdles to effective policy instruments implementation (cf. Alvarez-Farizo and Hanley, 2002), and examining challenges associated with evaluating policy instrument efficacy (cf. Mallon, 2006; cf. Vine, 2008).

Despite the proliferation of studies on policy instruments in the renewable energy policy field, there are no prominent examples of studies which investigate the impact that the federal form of government has on strategic selection of policy instruments. Federal government systems are characterized by power-sharing between the central authority and the regions comprising the federation. For federal policymakers, the manner in which power is divided can pose significant policy-making problems (Thorlakson, 2003). Specifically, federal attempts to apply coercive policy instruments in policy areas of regional or concurrent (shared) authority can generate political, legal or operational resistance by regional authorities. Even when developing policy for areas under federal jurisdiction, regional authorities have to avail their various "thrust and riposte" tactics to undermine the efficacy of disagreeable federal policies (Braun et al., 2002). Given that there are 24 nations with a federal government structure (including the major economies of the United States, Germany, Canada, Australia, Russia, India, Spain, Brazil and Mexico), a formal enquiry into the impact that federal structure has on renewable energy policy instrument development is merited.

This study seeks to contribute to such enquiry by investigating the hurdles that one federal nation – Canada – faces in trying to propel wind power development through federal policies and provincial cooperation. The study will demonstrate why the application of policy instruments that are popularly used for facilitating renewable energy development such as carbon taxes, CO_2 emission regulations, CO_2 emission cap and trade systems, and renewable portfolio standards is tenuous under Canada's federal structure. The insights gleaned from the case study will then be used to develop a conceptual framework for understanding the impact that federal structure has on policy instrument selection and efficacy. Finally, this framework will then be re-applied to identify specific approaches the Canadian federal government could take to resolve what currently amounts to be a fragmented, ineffective approach to wind power development planning in order to demonstrate how such knowledge can be applied in a contextual setting.

* Tel.: +65 6516 4844; fax: +65 6778 1020.
E-mail addresses: scott.valentine@nus.edu.sg, scott_valentine@yahoo.com.

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The layout of this paper is as follows. Section 2 presents Canada's electricity profile and enumerates the importance of wind power development in Canada. Section 3 provides data on installed wind power capacity in Canada and presents an argument that Canada is uniquely endowed with the assets necessary to achieve global leadership in wind power development, while Section 4 explains why such a goal would be desirable. Section 5 addresses some of the prominent but resolvable challenges to wind power development in Canada. Section 6 examines Canada's federal political structure and related obstacles in developing a national wind power development strategy. Section 7 draws the insights gleaned from Section 6 into a framework for conceptualizing the efficacy of different types of renewable energy policy instruments under the various jurisdictions of authority commonly found in a federal system (federal, regional and concurrent) and applies these insights to the search for a solution to facilitating a collaborative approach to optimize wind power development in Canada. Section 8 provides some concluding thoughts on the contribution this paper makes to better understanding the nexus between federal political structure and policy instrument design and implementation.

2. Canada's electricity sector

With the world's 14th largest economy (CIA, 2009) and severe winter conditions in much of the country, it should come as no surprise that overall electricity consumption in Canada consistently ranks amongst the highest in the world. On a per capita basis, Canada's highly affluent population (US$39,300 in per capita GNP (PPP) in 2008) of 33 million people consumed on average 1910 watts of electricity per hour (W/h), ranking fourth highest in the world behind only Iceland (3152 W/h), Norway (2812 W/h) and Finland (1918 W/h) (CIA, 2009).

Canada's electricity grid is the sixth largest in the world, supported by 124,240 MW of total installed generation capacity, incorporating six generation technologies (Statistics Canada, 2009). As Table 1 indicates, Canada abounds in hydropower resources. In 2008, only China consumed more hydropower than Canada (BP, 2009).

Despite an abundance of hydropower, Canada's electricity carbon footprint is sizable due in large part to heavy reliance on fossil fuels for steam and combustion turbine electricity systems. Canada has a legal obligation under the Kyoto Protocol to reduce aggregate greenhouse gas (GHG) emissions to 6% below 1990 levels. Yet, between 1990 and 2006, Canada's GHG emissions increased by 54.8% and CO_2 emissions increased by 68.3% (including land use, land change and forestry) (UNFCCC, 2008). Since CO_2 emissions represent a little over 70% of Canada's GHG emissions (UNFCCC, 2008) and electricity generation represents the largest source of CO_2 emissions in Canada, reducing CO_2 emissions in the electricity sector is an imperative element of Canada's climate change mitigation strategy.

Table 1
2007 Installed electrical generation capacity by source in Canadian utilities and industries.
Data source: Statistics Canada, 2009.

	2007	% of total
Hydro	73,435,687	59
Wind and tidal	1,600,399	1
Steam (mainly coal)	27,211,548	22
Nuclear	13,345,000	11
Internal combustion	593,480	0
Combustion turbine	8,054,193	6
Total (capacity in kilowatts)	**124,242,314**	**100**

Table 2
Electricity consumption projections in Canada by fuel, 2005–2030.
Source: Energy Information Administration, 2008.

Data in Quadrillion Btu	Projections					Avg. annual % change
Fuel source	2005	2010	2015	2020	2025	2030	
Liquids	0.2	0.1	0.1	0.1	0.1	0.1	−2.8
Natural gas	0.6	0.6	0.7	0.7	0.7	0.8	1.5
Coal	1.2	1.2	1.2	1.2	1.2	1.2	0
Nuclear	1.0	1.2	1.3	1.4	1.4	1.5	1.7
Renewables	3.7	4.1	4.5	4.9	5.2	5.5	1.6
Total	6.6	7.3	7.8	8.2	8.7	9.1	1.3

Ominously, as Table 2 portends, Canada's CO_2 emissions from electricity generation is not expected to improve much in the next 20–30 years. Although electricity generated from renewable sources (which includes hydropower) is expected to increase significantly, so is the amount of electricity generated by natural gas. Meanwhile, the amount of coal-fired electricity will remain virtually unchanged (EIA, 2008). If these projections are accurate, CO_2 emissions associated with electricity generation will inevitably increase.

As Table 2 indicates, expansion of renewable and nuclear energy capacities by approximately 50% is expected by 2030. Although the growth estimate for renewable energy represents the progression of a growth trend that will likely continue for decades, expansion prospects for nuclear power in Canada face diminishing potential due to public opposition. A public opinion survey conducted in 2006 found that 3 of 4 Canadians were opposed to nuclear power (Saint Consulting, 2007). Although Canada is a major supplier of uranium and Canada's CANDU nuclear reactor technology is marketed around the world, only three Canadian provinces – Ontario, New Brunswick and Québec (to a lesser extent) – have managed to sufficiently dispel public opposition to facilitate nuclear power plant development. Consequently, if Canada is to significantly reduce CO_2 emissions associated with electricity generation, it will need to do so primarily by: (1) improving both supply and demand side electricity efficiency, (2) facilitating the transition from "dirty" fossil fuels (i.e. coal) to "cleaner" fossil fuels (i.e. natural gas, carbon capture and sequestration, etc.), and (3) fostering expansion of non-fossil fuel electricity generation capacity.

This paper addresses the third policy challenge of fostering expansion of alternative energy capacity. Specifically, this paper focuses on the challenge of enhancing wind power development in Canada due to the emergent commercial viability of wind power. Given the high cost of competing renewable energy technologies (such as solar PV, utility-scale solar thermal, and tidal energy), widespread opposition to nuclear power (Saint Consulting, 2007) and the increasing difficulty of establishing large-scale hydropower projects due to opposition based on environmental concerns (IEA, 2004; Islam et al., 2004), wind power exhibits the highest potential of all renewable energy sources to abate CO_2 emissions associated with electricity generation over the short to medium terms.

3. Wind power in Canada

As Table 3 conveys, the last 5 years have been a banner period in Canada for wind power developers. Since 2004, installed wind power capacity has increased nearly seven-fold. As of the end of

Table 3
Canada's installed wind power capacity.
Data source: Canada Wind Energy Association (www.canwea.ca).

Year	Capacity (MW)	Annual growth (%)
2000	137	
2001	198	45
2002	236	19
2003	322	36
2004	444	38
2005	684	54
2006	1460	113
2007	1770	21
2008	2369	34
2009	3022	28

2008, Canada occupies 11th position in the world in total installed wind power capacity (WWEA, 2009).

With only 10 other nations possessing higher installed wind power capacity than Canada, wind power development in Canada appears from a statistical perspective to be comparatively successful. However, comparing Canada's wind power potential to most other nations in the world is like comparing a Ferrari to a herd of horses in a street race. Canada is blessed by four unique attributes that position the nation to become the undisputed world leader in wind power capacity.

First, Canada's huge tracts of undeveloped land could easily accommodate tens of thousands of wind turbines. It has been estimated that harnessing the wind potential of 0.25% of Canada's landmass would generate enough electricity to meet Canada's total electrical demand (CanWEA, 2008b). As an illustration of its unbridled potential, Canada is 28 times larger than Germany, yet in 2008, Germany currently had 10 times more installed wind capacity than Canada (Pembina Institute, 2008).

Second, from east to west Canada stretches nearly 6000 kms. This allows wind farms to be geographically dispersed to mitigate the threats posed by wind *intermittency* (Gil et al., 2006). *Intermittency* refers to the disruptive influence that sporadic lulls and gusts of wind have on the consistent generation of electricity (Ackerman, 2005). Geographic dispersal smoothes the aggregate power fluctuations from wind turbines because when wind is not blowing in one province, it is blowing in another (Wizelius, 2007).

Third, as outlined earlier, 59% of all electricity generated in Canada comes from hydropower. Hydropower is an ideal complement to wind power because it can expediently compensate for power fluctuations arising from the intermittency of wind (Boyle et al., 2004; Gil et al., 2006).

Fourth, Canada's only land-connected neighbor, the United States, is also the world's largest consumer of electricity, with demand for electricity expected to increase by 39% between 2005 and 2030 (IEA, 2008). Canada is already the United States' foremost supplier of electricity. In 2007, exports of electricity to the United States via established cross-border transmission conduits amounted to 25,310 GW worth over C$3.2 billion (Statistics Canada, 2009). Given that the US faces enormous costs just to upgrade existing transmission and distribution networks and replace aging generation facilities (Sovacool, 2008), the likelihood that the US will seek increased imports of Canadian electricity in the future is high. For Canadian wind power generators, the US electricity market provides nearly exclusive access to an expanding market opportunity.

The combination of these four factors gives Canada an incomparable national competitive advantage in harnessing wind power. In fact, it is conceivable that if the Canadian authorities were to adopt an aggressive approach to developing wind power, as much as 40% of Canada's electricity needs could be provided by wind power. Denmark, which has considerably less hydropower capacity than Canada, has already proven that wind penetration levels of up to 40% of total system demand can be cost-effectively managed (Gil et al., 2006) and is aiming for 50% wind power penetration by 2030 (Ackermann and Soder, 2002). The implication of targeting a 40% contribution from wind power is that in conjunction with Canada's high capacity in hydropower (currently 59% of total generation capacity) and initiatives intended to improve electricity utilization efficiency, Canada could conceivably eliminate virtually all CO_2 emissions from the electricity generation process.

To meet a 40% target by 2040, approximately 130,000 MW of installed wind power capacity would be required.[1] This represents a many fold increase over the current installed capacity of 2775 MW. Assuming that the rated capacity of the average installed wind turbine were 2 MW, meeting the 40% target would require the installation of approximately 65,000 turbines.

Although 65,000 turbines seems a vast amount, it is useful to recall that at the turn of the 20th century, it is purported that at least 600,000 were used for farm irrigation across North America (Ackermann and Soder, 2002; CanWEA, 2008a). Obviously a modern-day utility-scale wind turbine is significantly more complicated and more aesthetically invasive than the windmills that were built in the 1900s. However, the amount of land required to accommodate a modern turbine is not significantly greater than that required for 20th century windmills. The challenge would be daunting but it would not be unprecedented.

4. Why strive for international leadership in wind power capacity?

For every reason why Canada could attain global leadership in wind power development, there is an equally salient incentive to do so. First, in response to the increasing certitude of missing its original Kyoto Protocol emission reduction target, the Canadian government has recently announced revised targets. It now aims to reduce greenhouse gas emissions to 20% below 2006 levels by 2020 (which equates to 24% above 1990 levels) and 60–70% below 2006 levels by 2050 (which equates to 39–54% below 1990 levels) (Government of Canada, 2009). Without significantly reducing CO_2 emissions associated with the electricity sector, achieving even these more lenient targets will be very unlikely, especially since trends indicate that the demand for electricity will increase by over 40% between now and 2040.

Second, employment and economic opportunities in the wind power sector eclipse similar opportunities attributed to the traditional power sector. Currently, a little over 75,000 people are employed by Canada's electricity utilities (Statistics Canada, 2009). This represents 0.60 jobs per MW of installed capacity. Conversely, extrapolating from estimates based on global wind power industry employment statistics, if 20% of Canada's electricity were produced by wind power, at least 52,000 new jobs would be created (CanWEA, 2008b). This equates with 2.09 jobs per MW of installed capacity; over twice the rate of

[1] This estimate is based on the following calculation: The Energy Information Administration in the US estimates that Canadian electricity demand will increase by 40% by 2040, given current trends EIA, 2008: International Energy Outlook 2008: Energy Information Administration, U.S. Department of Energy, 1–260. Therefore, total electricity demand will be 617,469 GWh (2007 electricity production according to Statistics Canada) × 1.4=864,457 GWh. A 40% contribution from wind power amounts to 864,457 × 0.4=345,782 GWh. To find the amount of installed wind power capacity required given a 30% capacity load factor the calculation is: (((yearly demand/days in a year)/hours in a day)/capacity load factor)=(((345,782 GWh/365)/24)/0.3)=131,576 MW of installed wind power capacity required.

employment in the traditional power sector. In terms of economic opportunities, evidence from countries such as Germany, Denmark and Spain indicate that large-scale development of wind power catalyze business opportunities in the manufacture of turbines, turbine towers, rotor blades, castings, forgings, nacelle assemblies and nacelle covers (CanWEA, 2008b).

Third, the North America power grid represents an underutilized market opportunity. The combination of blossoming demand in the US for clean energy, a dearth of alternative energy capacity in the US (Sovacool, 2008), a favorable trade agreement (NAFTA) and a shared border that extends 6416 km (CIA, 2009), positions Canada to establish a whole new service industry of generating and distributing "clean" energy to the US. Economic benefits alluded to in the previous paragraph could be significantly accentuated by exploiting this market opportunity.

Fourth, although Canada is rich in fossil fuel and uranium energy resources, these resources are finite and have the potential to contribute significantly to global warming. Canada's proven oil reserves are estimated to be 179 billion barrels (including 173 billion barrels of oil sands), which places Canada second only to Saudi Arabia in terms of total oil reserves (Alberta Provincial Government, 2008). However, extraction and utilization of oil from tar sands emits levels of CO2 which compare closer to coal than oil on a kWh basis. Liming and colleagues estimate (2008) that at current rates of production, oil reserves excluding tar sands will be depleted in 158 years. Natural gas reserves which amounted to 56.1 trillion cubic feet in 2005 will be depleted in less than a decade at current rates of production (Liming et al., 2008). In coal, Canada has an estimated 7.3 billion short tons of recoverable reserves, enough to last 100 years at current production rates (Liming et al., 2008). For the Canadian government to assert that it also has the interests of future generations of Canadians in mind, the current pace at which fossil fuel reserves are being drawn down needs to be attenuated. When an opportunity exists to produce similar quantities of energy through wind power, the current pace of fossil fuel resource utilization is both myopic and irresponsible.

Fifth, the extensive environmental and health costs associated with fossil fuel combustion can be largely mitigated by a wide-scale transition to carbon-free electricity generation. The Ontario Medical Association estimated that health problems in the late 1990s stemming from pollution attributed primarily to power generation annually cost Ontario C$1 billion and contribute to over 1900 deaths (Rowlands, 2007).

Sixth, significantly enhancing wind power capacity represents one way for Canada's government to mitigate a mounting nuclear waste storage dilemma. Given that nuclear power is one of the only utility-scale, carbon-reduced alternatives to wind power, there will be increasing pressure to build more nuclear power plants in order to abate CO_2 emissions. Unfortunately, this would be a mistake that shifts the burden of nuclear waste management to future generations of Canadians. Currently, in the absence of long-term storage facilities, over 2 million 24-kg bundles of highly radioactive used fuel (enough to fit into 6 ice hockey rinks) generated since the 1950s by Canada's nuclear power plants is stored on an "interim basis" at six nuclear facilities (NWMO, 2008). Although Canada is a geographically sizable nation, the safe management and storage of nuclear waste poses tremendous technological and economic challenges (Winfield et al., 2006).

In summary, not only does Canada exhibit tremendous potential for large-scale wind power development, there are significant international, political, economic and environmental reasons to exploit this potential. Given these observations, the salient question is: *What is impeding wind power development in Canada?*

5. Challenges to wind power development in Canada

In Canada, as in most countries, cost is the critical element that stymies wind power expansion because external costs associated with fossil fuel generation are not internalized. In 2005, the average *cost* of electricity generated ranged between C$47 and C$70 per MWh (Canadian Electricity Association, 2006). Conversely, the Canadian Wind Energy Association (2006) estimated that the cost of generating wind power in 2006 ranged between C$70 and C$100 per MWh. Until wind power generation costs decline or externalities associated with fossil fuel combustion are internalized, government subsidies and support becomes essential for wind power expansion. Unfortunately, the most significant federal subsidy has been a production tax credit of C$10 per MWh (Guha et al., 2005), which is too low to bridge the cost differential. By and large, due to this low federal subsidy, wind power expansion in Canada has been driven notably by provincial government mandated renewable energy purchase initiatives which are both temporally and provincially inconsistent (Guha et al., 2005).

If legislative authority over electricity governance in Canada were centralized, a number of widely heralded policy instruments could be applied to facilitate wind power development. For example, carbon taxes could be levied to bridge the cost differential between fossil fuel-generated power and wind power. Alternatively, utilities could be compelled to gradually increase the amount of electricity generated by renewable technologies through regulatory policy and/or cap and trade systems (cf. Komor, 2004). Provinces that have high levels of hydropower could be forced to inter-connect with other provinces that do not have an abundance of hydropower in order to provide inexpensive, clean electricity back-up to compensate for power intermittency issues associated with wind. Unfortunately, as the next section will explain, Canada's legislative authority over electricity governance is not centralized.

6. The impact of Canada's separation of powers on the electricity industry

6.1. Who holds the power?

Canada is a federation of 10 provinces and three territories. Historically, the need for a federal system of government in Canada stemmed from the challenge of unifying the culturally disparate regions of Anglophone-dominated Ontario and Francophone-dominated Québec. A federal system fit the challenge because it provides citizens of disparate regions with more autonomous representation while at the same time providing centralized government services, which help to tie the regions together (Thorlakson, 2003). To this day, many political experts in Canada would agree with the contention that Canada's "separation of powers" has played a vital role in preventing national breakup (Wimmer, 2007).

Canada's Constitution, which consists of the Constitution Acts of 1867 and 1982, divides political power between the central federal government and provincial legislatures. In total, provincial legislatures were granted exclusive authority over 16 areas (Baier, 2005) including natural resources and electricity generation, which is explicated in Table 4. As a result, Canada does not have a national electricity generation strategy (Liming et al., 2008); rather, Canada's approach to electricity generation is an amalgamation of the strategic decisions made at the provincial level.

6.2. Impediments to developing a collaborative wind power development strategy

The aggregate national data on electricity generation in Canada presented earlier, fails to convey just how disparate the provincial approaches are to electricity generation and how complicated the task of developing a collaborative wind power development strategy would be.

Table 5 summarizes the sources of electricity employed in each province. As the table implies, the compulsion to embrace wind power to mitigate CO_2 emissions associated with electricity generation will vary greatly from province to province. Four provinces and one territory derive the vast majority of electricity from hydropower while another province (Prince Edward Island – PEI) generates most of its electricity from wind and tidal power. The carbon footprint of electricity generation in these regions is low. Conversely, four provinces generate most electricity through coal-fired steam power plants and two territories generate the majority of their power from fossil fuel internal combustion systems. These six regions – Alberta in particular – exert a disproportionately high carbon footprint. Finally, Ontario, which is Canada's most populated province, generates half of its electricity through nuclear power. Although it has plans to phase out coal-fired power (partly through a more aggressive approach toward supporting wind power), it currently exhibits a high carbon footprint due to extensive use of coal-fired power.

Table 5 also shows that some provinces are in a technologically superior position to adopt high levels of wind power. Labrador, Québec, Manitoba and British Columbia have high levels of installed hydropower capacity which is conducive to supporting high levels of wind power. The other provinces, which predominantly utilize either high levels of coal-fired power or nuclear power would likely need to either rely on inter-provincial grid connections or bolster reserve capacity to incorporate levels of wind power in excess of 20% (DeCarolis and Keith, 2006). Fortuitously, these six provinces all have established transmission line connections with other provinces (National Energy Board, 2004). The challenge lies in encouraging hydropower rich provinces to share their back-up capacity and bolster inter-provincial connections to create a more resilient power grid.

Disparate provincial electricity market structures and on-going liberalization programs also complicate collaboration. As Fig. 1 illustrates, electricity sectors in three Canadian provinces (PEI, Nova Scotia, Ontario and Alberta) are dominated by private suppliers while electricity sectors in the remaining provinces and territories are dominated by public utilities. Collaboration would require private "profit seeking" firms to work with public utilities that are often guided by a broader set of priorities (National Energy Board, 2004).

To compound the challenge, all 10 of Canada's provinces now have initiatives to encourage electricity market liberalization (Table 6). Not only are markets in flux very difficult to coordinate; market fragmentation, which is often ineluctably bound to market liberalization, increases the number of stakeholders that must be consulted when forming a collaborative strategy. Achieving consensus becomes more difficult with a greater number of stakeholders (Sabatier and Jenkins-Smith, 1993).

As the list of transmission interconnections in Table 6 implies, the importance of electricity as a trade commodity also differs by province. Some provinces earn substantial export revenues from inter-provincial and cross-border trade in electricity. As Table 7 illustrates, inter-provincial export of electricity is of significant economic importance to the province of Newfoundland and Labrador. Similarly, New Brunswick, Québec, Ontario and Manitoba posted sizable trade surpluses with the United States in electricity in 2007. These five provinces would exhibit considerable sensitivity in response to any attempt by federal authorities to restrict or redirect electricity trade. On the other hand, all provinces have inter-provincial electricity connections and six of the 10 provinces have cross-border electricity connections with states in the US (National Energy Board, 2004), which implies that initiatives to bolster trade in electricity would be generally well-received.

Overall this analysis of provincial electricity markets should make it abundantly clear that provinces view electricity strategies from widely varying perspectives. This implies that seeking voluntary provincial collaboration on wind power development would likely be fraught with disagreement over strategic objectives of such collaboration. At the very least, this analysis tells us that voluntary collaboration based on an appeal to one shared strategic vision (i.e. reduction of CO_2 emissions, expansion of electricity exports, etc.) will likely be unsuccessful.

Table 4
Section 92A(1) of the Constitution Act, 1867.
Source: Canada Constitution Act 1867/1982.

In each province, the legislature may exclusively make laws in relation to

(a) *Exploration for non-renewable natural resources in the province;*
(b) *Development, conservation and management of non-renewable natural resources and forestry resources in the province, including laws in relation to the rate of primary production therefrom; and*
(c) *Development, conservation and management of sites and facilities in the province for the generation and production of electrical energy.*

Table 5
Sources of electricity generation by Canadian utilities and industry in 2007 and percentage of provincial electricity mix (dominant sources are given in bold).
Data source: Statistics Canada, 2009.

	Total megawatt hours	Hydro (%)	Wind and tidal (%)	Steam (%)	Nuclear (%)	Internal combustion (%)	Combustion turbine (%)
Newfoundland and Labrador	41,583,313	**96**	0	3	0	0	1
Prince Edward Island	44,732	0	**89**	12	0	0	−1
Nova Scotia	12,574,042	7	1	**89**	0	0	2
New Brunswick	17,638,847	16	0	**49**	23	0	12
Quebec	191,962,098	**94**	0	1	2	0	2
Ontario	158,234,410	22	0	22	**50**	2	4
Manitoba	34,402,502	**97**	1	1	0	0	0
Saskatchewan	20,574,449	21	3	**69**	0	0	6
Alberta	67,432,359	3	1	**74**	0	1	21
British Columbia	71,833,012	**89**	0	7	0	0	3
Yukon	354,694	**93**	0	0	0	7	0
Northwest Territories	686,252	36	0	0	0	**43**	20
Nunavut	148,881	0	0	0	0	**100**	0

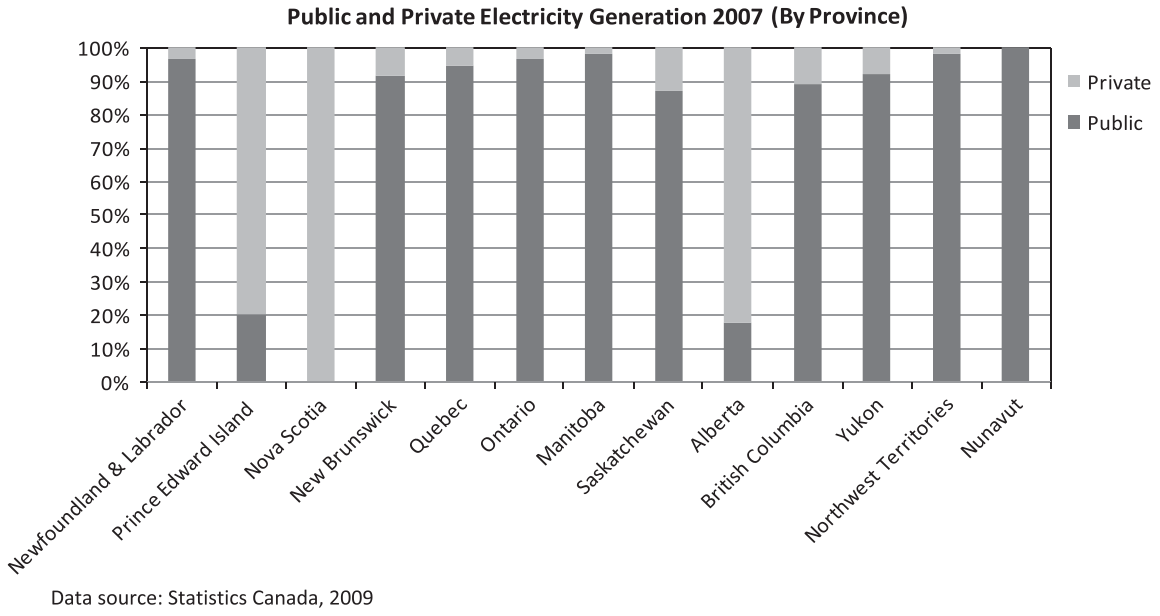

Fig. 1. Degree of electricity market privatization by province.

Table 6
Electricity market liberalization status by province.
Sources: Canadian Electric Association (www.canelect.ca) and National Energy Board (2004).

Province	Market status	Regulator	Interconnections
Alberta	Wholesale and retail open access; Functional separation	Energy and Utilities Board (EUB)	British Columbia, Saskatchewan
British Columbia	Wholesale open access; Functional separation	Public Utilities Commission	Alberta, Washington state
Manitoba	Wholesale open access; Functional separation	Province of Manitoba and Public Utilities Board	Saskatchewan, Ontario, North Dakota, Minnesota
New Brunswick	Transmission wholesale and industrial retail open access 2003	Provincial Government	Nova Scotia, PEI, Québec, Maine
Newfoundland and Labrador	Energy policies under review	Commissioners of Public Utilities	Québec
Nova Scotia	New energy policy imminent in 2002	Utility Review Board	New Brunswick
Ontario	Wholesale and retail open access; Corporate separation of generation, transmission and system control functions	Ontario Energy Board	Québec, Manitoba, New York, Michigan, Minnesota
Prince Edward Island	Distribution network only	Regulatory and Appeals Commission of PEI	New Brunswick
Québec	Wholesale open access; Functional separation	Régie de l'énergie	Newfoundland, New Brunswick, Ontario, New England, New York
Saskatchewan	Wholesale open access Functional separation	Province of Saskatchewan	Alberta, Manitoba, North Dakota

Table 7
Inter-provincial and cross-border electricity flows, 2007.
Data source: Statistics Canada, 2009.

In megawatt hours	Received from other provinces	Delivered to other provinces	Imported from US	Exported to US
Newfoundland and Labrador	16,947	30,096,817	0	0
Prince Edward Island	1,160,935	0	0	0
Nova Scotia	280,597	27,303	62,917	30,634
New Brunswick	1,466,014	1,556,758	641,755	1,780,259
Quebec	33,966,926	3,558,708	3,355,838	15,711,988
Ontario	3,711,520	4,501,487	7,070,359	11,089,756
Manitoba	173,568	1,782,187	534,285	11,092,806
Saskatchewan	1,031,828	840,178	203,343	391,579
Alberta	1,781,495	1,208,616	222,902	154,748
British Columbia	1,101,312	1,119,088	7,288,705	4,438,820
Yukon	0	0	0	0
Northwest Territories	0	0	0	0
Nunavut	0	0	0	0
Total	**44,691,142**	**44,691,142**	**19,380,104**	**44,690,590**

Table 8
Canadian wind power capacity by province.
Data source: Canada Wind Energy Association (www.canwea.ca).

In MW as of June 2009		
	Installed capacity	**% of Canada total**
Newfoundland and Labrador	54.40	2.0
Prince Edward Island	72.40	2.6
Nova Scotia	59.30	2.1
New Brunswick	96.00	3.5
Quebec	531.80	19.2
Ontario	1161.50	41.9
Manitoba	104.00	3.7
Saskatchewan	171.20	6.2
Alberta	523.90	18.9
British Columbia	0.00	0.0
Yukon	0.81	0.0
Northwest Territories	0.00	0.0
Nunavut	0.00	0.0
Total	**2775**	**100.0**

6.3. *Wind power development in the provinces*

It should come as no surprise given the varied nature of the electricity profiles in each province that installed wind power capacity also varies significantly by province (see Table 8). Intriguingly, three provinces – Ontario, Québec and Alberta – currently boast 80% of Canada's total installed wind power capacity.

Wind power success in Ontario, Québec, Manitoba and Saskatchewan highlights a historical affinity for request for proposal (RFP) and other mandatory purchase initiatives as the prime instrument for driving growth. Ontario's mandatory purchase initiatives were the most ambitious of the bunch, driven by severe public pressure to mitigate reliance on coal-fired and nuclear powered energy (Rowlands, 2007). The main drawback to mandatory purchase initiatives is that development depends on the willingness of provincial authorities to mandate wind power purchases. Overall, this approach fails to optimize wind power development because investment decisions are influenced more by the financial capacity of the provincial government or provincial electricity consumers to support such investment, rather than basing investment decisions on strategic investment criteria.[2] Moreover, with each province pursuing standalone RFP wind power procurement programs, synergies from inter-provincial cooperation are often sub-optimized.

It is worth noting that of the four provinces that have the capacity to foster the highest levels of wind power due to dominant hydropower capacities (Newfoundland and Labrador, Québec, Manitoba and British Columbia), only Québec has made significant inroads in this regard – although initiatives are currently unfolding in British Columbia and to a lesser extent in Manitoba (see Table 9). The slow uptake of wind power in these three high-potential provinces can arguably be attributed in part to hydropower inspired Dutch Disease displayed by the respective provincial electricity planning authorities that understandably are less motivated to add higher priced wind power to electricity grids that already exhibit comparatively low carbon footprints.

The points put forth in the previous two paragraphs highlight an unsettling truth about electricity planning in Canada. The provinces are akin to electricity fiefdoms. As such, success or failure of wind power development programs is dependent on malleable provincial government renewable energy policies. Table 9 summarizes the different levels of commitment to developing wind power in each province. Ontario and Québec are on track to fortify the leadership positions they've established in wind power capacity installation, British Columbia has unveiled more aggressive policies to support wind power development, Saskatchewan, Manitoba and New Brunswick have adopted rather unambitious mandatory purchase programs and Alberta is set to experience an amplified level of wind power installation, driven by private interests attracted to Alberta's liberal electricity sector.

In terms of federal support for wind power development, it is worth noting that initiatives to date have been largely peripheral. In 2002, the federal government launched a Wind Power Production Initiative (WPPI) which offers a comparatively minor financial subsidy to wind power developers (guaranteed over 10 years of the approved project) of C$12 per MWh for projects approved between 1 April 2002 and 31 March 2003, C$10 per MWh for projects approved between 1 April 2003 and 31 March 2006 and C$8 per MWh for projects approved between 1 April 2006 and 31 March 2007. However, funding for this program was terminated prematurely in 2006 to give way to the C$1.5 Billion ecoENERGY for Renewable Power program which provides a similar productive incentive of C$10 per MWh over a 10-year period for all eligible renewable energy projects commissioned between 1 April 2007 and 31 March 2011 (IEA Global Renewable Energy Database, 2009).[3] Additionally, special tax regulations allow wind power developers to accelerate write-offs of capital equipment (Liming et al., 2008). Overall, given the average electricity cost data outlined earlier, one can conclude that the federal subsidies have been too small to make wind power a commercially attractive investment in most parts of Canada. Accordingly, it can be argued that the mandatory purchase initiatives of the provincial governments have had the strongest influence in catalyzing wind power development.

If all of the provincial plans come to fruition, Canada will have approximately 16,000 MW of installed wind power capacity (4800 MW of average output capacity, assuming a 30% capacity load factor) by 2015/2016. Based on total installed electricity generation capacity in 2007 of 124,242 MW, this would represent approximately 3.8% of total output capacity. Although this would be an improvement over the current situation, it falls well short of the high levels of wind power output capacity that Canada should be aiming for.

In order to optimize the country's wind power potential, a much higher degree of inter-provincial coordination will be necessary for three key reasons. First, a high degree of spatial coordination is required in order to optimize geographic dispersion of wind farms for the purpose of reducing the disruptive influence of wind intermittency. Second, electricity transmission and distribution needs to be more actively integrated to enhance national grid stability. Integration allows provinces that lack hydropower capacity to install higher levels of wind power by tapping into the hydropower peaking reserves of neighboring provinces. Third, by more effectively coordinating transmission and distribution between Canadian and American electricity

[2] Given these concerns, it is noteworthy that Ontario's RFP program has recently been replaced by a new feed-in tariff (FIT) program, which is North America's first guaranteed pricing program for renewable energy development. The FIT program substantively offers between C$130–$190 per MWh for electricity generated by wind power (NUS Consulting, 2009). Barring further policy developments in other provinces, this program will very likely widen Ontario's lead in wind power development.

[3] International Energy Agency Global Renewable Database, Accessed on 22 November 2009 at http://www.iea.org/textbase/pm/?mode=re&action=detail&id=3829

Table 9
Provincial initiatives on wind energy (updated June 2009).
Source: Canada Wind Energy Association (www.canwea.ca).

Jurisdiction	Initiative	Status
British Columbia	Government aims to achieve energy self-sufficiency by 2016. 50% of new generation to come from clean energy sources (no specific wind energy target).	325 MW of wind energy contracts in place. BC Hydro Call for Clean Power in 2008 sought 5000 GWh and received 17,000 GWh in bids. Awarding of contracts expected by July 2009
Alberta	No provincial target	Alberta Electric System Operator (AESO) has applied to build new transmission infrastructure to accommodate up to 3000 MW of wind generation in Southern Alberta
Saskatchewan	Provincial energy plan seeks to have 300 MW of wind energy in Saskatchewan by 2011	171 MW currently in place. Preliminary results of wind integration study by SaskPower expected early summer 2009
Manitoba	Manitoba Government seeking 1000 MW of wind energy by 2016	Currently 104 MW in place. In 2007, Manitoba Hydro launched a RFP process for an additional 300 MW of wind. Resulting contracts have yet to be finalized
Ontario	The Ontario Power Authority's Integrated Power System Plan called for 4600 MW of wind energy by 2020. IPSP is currently being reviewed, following a Ministerial directive. New Green Energy Act was announced in March 2009. The Act was passed on May 14, 2009, and is awaiting proclamation (expected in summer 2009).	964 MW currently in place, with almost 400 MW of additional wind energy projects currently under construction. In January 2009, OPA announced contracts for six new wind energy projects in Ontario totaling 492 MW. The Green Energy Act puts in place a new feed-in tariff procurement process, and a streamlined environmental assessment process. The intent of the GEA is to create certainty & stability for wind energy development in Ontario
Quebec	Quebec Government seeking 4000 MW of wind energy by 2015	531 MW currently in place and nearly 3500 MW contracted. 500 MW of new Requests for Proposals for First Nations/Municipal wind projects was issued April 30, 2009
New Brunswick	NB Power seeking 400 MW of wind energy by 2016	96 MW currently in place. 300 MW of additional contracts announced in 2008

grids, Canadian power authorities could further stabilize grid operation despite incorporating high levels of wind power.

6.4. What is impeding provincial collaboration?

Consider for a moment what a shift from fossil fuel electricity generation to wind power means for a province like Alberta which currently derives 95% of its electricity from locally extracted fossil fuels. By tapping into cheap domestic fossil fuel supplies, residents and industries in the province enjoy electricity prices that are amongst the lowest in the world (NUS Consulting, 2007). If the provincial government were somehow compelled to incorporate 40% wind power into the electricity mix, the average cost of electricity would increase due to the comparably high cost of wind power. This would displease voters and make it more expensive for electricity-intensive industries to operate in Alberta. The only way the Albertan government could offset higher energy costs is by providing a subsidy to the utilities. In short, a shift to wind power would contribute to the federal goal of reducing CO_2 emissions but from the perspective of the Albertan government (and other fossil fuel-rich provincial governments), it would adversely impact economic conditions. Under such circumstances, a savvy Albertan government would likely demand some sort of federal transfer payment to accept such an economically disadvantageous policy.

In Canada, without the authority to force provinces to collaborate to optimize wind power development, the federal government would be compelled to offer coercive incentives to Alberta (or any other fossil fuel rich province) to engender cooperation. Unfortunately, it is unlikely that Canada's federal government, which is already wrestling with a deficit of over C$50 billion, could muster the public support for a policy of compensating fossil fuel rich provinces for playing a role in abating national CO_2 emissions (Curren, 2009). This dilemma, therefore, raises a critical question: *Is there anything the federal government can do to force provincial collaboration?*

6.5. Influencing provincial energy policy (in theory)

Constitutionally, there are at least four strategies that the federal government could attempt to apply in order to coerce provinces to collaborate on the development of a unified wind power development strategy. For starters, under Section 92A(3) of the Constitution Act, 1867 the authority granted to the provinces over the exportation of electricity is constitutionally subject to federal approval (Government of Canada, 1867/1982). Moreover, Section 91(2) of the Constitution gives the federal government authority over the regulation of trade and commerce (Government of Canada, 1867/1982). In combination, these two authorities give the federal government a theoretical right to bar provinces from exporting electricity pending provincial cooperation. As a second alternative, the federal government could theoretically establish export quotas or levy taxes on electricity exports in any manner it sees fit because the Constitution also gives the federal government authority to raise funds through taxation of any form (Section 91(3)) (Government of Canada, 1867/1982).

Third, Section 132 of the Constitution bestows the federal government of Canada with "all Powers necessary or proper for performing the Obligations of Canada or of any Province thereof, as Part of the British Empire, towards Foreign Countries, arising under Treaties" (Government of Canada, 1867/1982). The implication of this power is that the federal government has authority to compel provincial legislatures to comply with programs designed to reduce greenhouse gas emissions as per Canada's obligation under the Kyoto Protocol.

Finally, Section 91 of the Constitution bestows the federal government with all authorities which are not expressly allocated to the provinces (*residual powers*) (Government of Canada, 1867/1982). One highly relevant residual power is the federal government's authority over trans-provincial environmental governance. The federal government has a right to pass legislation which regulates trans-boundary pollution. Presumably, this includes passage of laws to regulate harmful emissions associated with electricity generation.

The current legislation that governs trans-boundary environmental issues is known as the Canadian Environmental Protection Act, 1999 (CEPA). CEPA authorizes the government to regulate products controlling toxic substances and prevent the release of potentially dangerous substances. Given the perilous nature of global warming, CO_2 emissions should theoretically fall into the category of "dangerous substances". However, as of 2007, neither authority has been exercised. CEPA also authorizes the government

to require industries to submit pollution prevention plans; but as of 2007, only seven such notices have been issued (Government of Canada, 2007). This then begs the question: *Given the theoretical powers that the federal government has to coerce provinces to collaborate on a unified energy policy, what is preventing this from happening?*

6.6. Influencing provincial energy policy (in practice)

In practice, any strategy on the part of the federal government to use its constitutional powers to influence provincial behavior can be thwarted by provincial counter-strategies. Four illustrative counter-strategies will be examined in this section.

First and foremost, the courts would likely overturn federal policies that can be shown to infringe on constitutionally-granted provincial authorizes (Baier, 2005), such as section 92A(1) of the Constitution which grants authority to provinces to *exclusively make laws in relation to… development, conservation and management of sites and facilities in the province for the generation and production of electrical energy*. This implies that policy tools that are commonly used to facilitate development of renewable energy – taxing CO_2 emissions, taxing electricity generated by fossil fuel sources, requiring utilities to incorporate specified amounts of renewable energy, placing regulatory limits on CO_2 emissions – could all be subject to legal challenges by provincial authorities as an infringement on provincial sovereignty over the generation of electrical energy.

Second, even if legal attempts to demonstrate an infringement on provincial authority were unsuccessful, Part 3, Section 36 of the Constitution Act of 1982 provides other avenues of provincial recourse (Table 10).

The two provisions embedded within Section 36 provide at least two potential constitutional grounds for challenging federal policy instruments aimed at influencing provincial energy policy. Section 36(1) compels the federal government to ensure "*equal opportunities*" and to "*reduce disparity in opportunities*". Provinces that are dependent on fossil fuel generated electricity could argue that any federal policies, which increase the comparative cost of fossil fuel electricity generation increase the cost of doing business in the province and enhance "disparity in opportunities" when compared with provinces which are for example, blessed by abundant access to hydropower. Authorities from provinces dependent on fossil fuel generated electricity could also argue that federal policies which inflate fossil fuel electricity costs impair the promotion of "*equal opportunities for the well-being* (which presumably includes economic well-being) *of Canadians*".

Section 36(2) requires the federal government to provide "equalization payments" to provinces, which are adversely affected by circumstances that result in comparatively higher costs for public services. In response to any federal policy, which increases the cost of fossil fuel electricity, authorities from provinces that are dependent on fossil fuel electricity could argue that electricity is a public service, the policy resulted in an inequitable provision of this public service and therefore, "equalization payments" are necessary. If successful, such a claim could render policy implementation financially untenable.

Third, even if provinces failed in legal actions to overturn federal policies which infringe on provincial constitutional sovereignty over electricity governance, there is also a political avenue to derail intrusive federal policies. In accordance with Section 53 of the Constitution, federal policies which seek to tax goods or services must be approved by the House of Commons which (in accordance with Section 49) requires a simple majority (Government of Canada, 1867/1982). The trouble is that the five Canadian provinces that are highly dependent on fossil fuel electricity (Ontario, Alberta, Saskatchewan, Nova Scotia and New Brunswick) hold 160 of the 295 seats in Canada's House of Commons. In short, members of the House from these provinces could conceivably block passage of such a policy.

Fourth, if all legal challenges and all political resistance failed to derail federal efforts to pass policies that would force provincial cooperation in developing a unified wind power development strategy, the efficacy of the policy could still be undermined by political gamesmanship. For example, a jaded provincial authority could counter a national carbon tax with a package of provincial subsidies to fossil fuel electricity generators in order to dilute the coercive efficacy of the federal policy. Alternatively, a provincial authority could discourage federal authorities from adopting provincially unpopular policies by threatening to withhold cooperation in other areas (i.e. the collection of federal income taxes) in order to place pressure on federal authorities to negotiate less coercive energy policies. Given the need for cooperation in key areas such as social security, agricultural policy and education, it does not serve the federal government to alienate the provinces.

In summary, the Constitutional authorities outlined earlier *theoretically* provide the federal government with coercive mechanisms for compelling provincial governments to collaborate on a national wind energy development strategy; however, in practice, coercive federal strategies can be rendered ineffective due to legal, political or administrative resistance by the provinces. Braun and colleagues referred to these resistance tactics as "thrust and riposte" (Braun et al., 2002). In fact, even the threat of challenging a federal policy on any of these grounds could serve as a deterrent to implementation.

The threat of thrust and riposte strategies applied at both federal and provincial levels prompted the International Energy Agency to conclude, "*the only viable approach in addressing the most important energy policy challenges seems to be a process of intensive dialogue and consultation to achieve a national consensus on the goals and needs of energy policies, but this process takes time*" (IEA, 2004). As the chairman of the Canadian Electricity Association summarized, "*the debate is not about the merits of long-term reductions in greenhouse gases or air emissions, but over how quickly we can get there, at what cost and who pays*" (Canadian Electricity Association, 2008).

In the next section, we will draw upon this analysis of the complexities inherent in Canada's federal system and endeavor to create a conceptual framework to understand how different assignations of authority influence the viability of renewable energy policy instruments. By creating such a framework, the list of feasible policy instruments for facilitating a collaborative approach to wind power development in Canada will become clearer.

Table 10
Part 3, Section 36 of the Constitution Act, 1982.
Source: Canada Constitution Act 1867/1982.

Commitment to promote equal opportunities:
36. (1) Without altering the legislative authority of Parliament or of the provincial legislatures, or the rights of any of them with respect to the exercise of their legislative authority, Parliament and the legislatures, together with the government of Canada and the provincial governments, are committed to

(a) *promoting equal opportunities for the well-being of Canadians;*
(b) *furthering economic development to reduce disparity in opportunities; and*
(c) *providing essential public services of reasonable quality to all Canadians.*

Commitment respecting public services:
(2) Parliament and the government of Canada are committed to the principle of making equalization payments to ensure that provincial governments have sufficient revenues to provide reasonably comparable levels of public services at reasonably comparable levels of taxation.

7. A framework for guiding policy instrument selection in a federal system

7.1. Developing the framework

Prior to examining the policy instrument options open to the Canadian federal government for facilitating a more aggressive, provincially collaborative approach to wind power development, it serves to first review the types of policy instruments that are popularly employed for supporting development of renewable energy. Theodore Lowi's taxonomy for classifying policy instruments is employed for this review (Lowi, 1972) in part because of the clarity with which it enables classification of renewable energy development policy tools.

It should be evident from Table 11 that Canada's constitutional separation of powers renders application of regulatory or redistributive policies problematic in regard to supporting wind power development. Any regulatory or redistributive policies which adversely affect the fortunes of some provinces over others (contravening section 132 of the Constitution Act, 1982) or infringe on the constitutional authority granted to the provinces over electricity generation (contravening section 92 of the Constitution Act, 1867) could be challenged by the provinces in the courts. As mentioned earlier, even if legal recourse is unsuccessful in nullifying adverse regulatory or redistributive policies, there are other "thrust and riposte" techniques that provinces can employ to stymie federal incursion into provincial sovereignty.

Insights from the earlier analysis pertaining to the viability and efficacy of different policy instruments in encouraging enhanced wind power development in Canada can be used to guide the construction of a rough framework that attempts to summarize the influence that a federal form of government has on policy instrument design and implementation. Although admittedly done at a high level of abstraction and generalization, Table 12 summarizes the efficacy of different policy instruments in areas which are subject to federal, regional (provincial) or shared (concurrent) authority. The stars convey a loose ranking (see legend of Table 12) of the viability and efficacy of federally employing each instrument under the various delegations of authority. Generalizations of this sort assume that there are no extant socio-cultural, political, bureaucratic or economic conditions that justify the use of one policy instrument over others. In short, Table 12 answers the question "ceteris paribus, which policy tools can be effective in a federal environment?"

National regulatory policies can be effective in policy fields over which the federal government has constitutional authority; however, even in areas of federal jurisdiction, there is always the possibility that regions which are disadvantaged by the policy will provide active resistance through political gamesmanship. Conversely, in policy areas over which the regional government has constitutional authority, direct regulatory policies are not generally workable. A more viable regulatory approach in such circumstances is to try to identify peripheral areas over which the federal government has sovereignty to enact regulatory policies. For example, rather than placing regulations on CO_2 emissions from electric utilities (over which the provincial government has authority), a peripheral regulation would be to regulate national CO_2 emissions by allocating quotas to the provinces (which would be justified by the federal government's authority over interprovincial environmental governance). In general, federal attempts to regulate areas under regional authority increase the propensity for federal-regional conflict, which rarely results in a win-win outcome. Lastly, in policy areas where concurrent authority exists, federally designed regulatory policy is an option; however, negotiation between the federal and regional authorities that share concurrent authority typically leads to the design of regulations which have been diluted through the negotiation process (Braun et al., 2002). Canada's failed Clean Air Act, 2006 is illustrative of an ineffective regulatory policy which attempted to federally regulate activities over which the federal and provincial governments have concurrent authority.

Redistributive policies share many similarities with regulatory policy in terms of feasibility and efficacy of application within federal systems. If a redistribution policy is implemented in a policy area under federal jurisdiction, it can be effective provided it does not induce opposition by regional authorities or voters. In policy areas under concurrent authority, redistributive policies suffer the same weakness as regulatory policies – compromises frequently dilute the efficacy of the measure (Braun et al., 2002). Lastly, redistributive policies are largely ineffective in policy areas under regional jurisdiction because regions, which are adversely affected will resist federal intrusions on regional authority. With that said, redistribution policy may be viable in spite of regional resistance if there is strong enough public (voter) support for such a policy. For example, 20 years ago, there was not enough public support in Canada for wind power to justify federal taxes on carbon emissions. However, 84% of all Canadians now support further development of wind power, while 42% are opposed to further expansion of fossil fuel power plants of any type (Saint Consulting, 2007). The viability of redistributive policies in areas

Table 11
Lowi's policy instrument taxonomy and renewable energy policy instruments.

Instrument classification	Examples of renewable energy policy instruments
Distributive policy	Feed-in tariffs, production subsidies, subsidies for technology development, land grants for siting renewable energy facilities, R&D funding
Regulatory policy	CO_2 emission regulations, CO_2 emission cap and trade systems, mandatory utility purchase of renewable energy (renewable portfolio standards)
Redistributive policy	Carbon taxes, CO_2 emission taxes, taxes on fossil fuel resources
Constituent policy	Establishing an agency for unifying national energy strategy, media campaigns emphasizing the imperative for CO_2 emission reduction

Table 12
A framework for policy tool implementation in a federal government system.

	Authorities presiding over relevant policy field		
	Federal authority	Regional authority	Concurrent authority
Regulatory policies	★★★	×	★★
Redistributive policies	★★★	★	★★
Distributive policies	★★★	★★★	★★★
Constituent policies	★★	★★	★★

★★★★=highly effective, ★★★=effective, ★★=marginally effective ★=largely ineffective, ×=unworkable.

Table 13
Efficacy of different types of policy tools for Canada wind power development.

	Regional authority	Examples of instruments
Regulatory policies	×	CO_2 emission regulations, CO_2 emission cap and trade systems, mandatory utility purchase of renewable energy (renewable portfolio standards)
Redistributive policies	★	Carbon taxes, CO_2 emission taxes, taxes on fossil fuel resources
Distributive policies	★★★	Feed-in tariffs, production subsidies, subsidies for technology development, land grants for siting renewable energy facilities, R&D funding
Constituent policies	★★	Establishing an agency for unifying national energy strategy, media campaigns emphasizing the imperative for CO_2 emission reduction

★★★★=highly effective, ★★★=effective, ★★=marginally effective, ★=largely ineffective, ×=unworkable.

of regional jurisdiction depends on the creation of policies that are not unfairly biased to punish one region and reward another (Bird and Vaillancourt, 2001).

Distributive policies are usually the most well-received policy instruments from a regional perspective because federal distributions are perceived as "free money" for the regions, despite the fact that distributive policy funding comes from tax payers (Bemelmans-Videc et al., 2003). In Canada, many of Canada's federal policies are distributive in nature (Wimmer, 2007). The obvious weakness associated with a distributive policy is that such policies must be federally financed by either further taxation or fiscal cuts in other areas. This is a particular weakness in relation to supporting wind power development because the financial requirements for subsidizing wind power development could amount to tens of billions of dollars (to be discussed in Section 7.2). Due to the financial imposition of distributive policies on national budgets, they have been allocated three instead of four stars in Table 12 matrix.

Finally, the value of constituent policies for supporting other policy instruments should not be overlooked. Constituent policies policy are frequently less expensive to implement than distributive or regulatory policies (Bemelmans-Videc et al., 2003) and can typically be customized to fit any power-sharing scenario. The drawback to constituent policies is that they are frequently less influential in altering behavior; and as a result, when they are applied alone, they rarely achieve the impact associated with the other three types of policy instruments (Hood, 1986).

In summary, under a federal government system, distributive, redistributive or regulatory policy instruments are more or less equally feasible and effective when dealing with policy areas that fall under the constitutional authority of the federal government. However, in dealing with policy areas that fall under the constitutional authority of regional governments, policy instruments vary in terms of viability and efficacy. Regulatory and redistributive policies can be particularly problematic under such circumstances if regional authorities perceive the federal policies to infringe on regional sovereignty. As for areas of concurrent authority, all policy instruments are feasible; however, they vary in degree of efficacy. Under concurrent authority, the efficacy of regulatory and redistribution policies tends to be diluted by compromise. Consequently, distribution policies (despite their high costs) and constituent policies (despite lower levels of impact) tend to be more effective.

7.2. Applying the framework to the Canadian wind power development challenge

Given these initial observations, it is possible to link the emergent framework back to the challenge faced by the Canadian federal government in facilitating a national wind power development policy. Table 13 integrates the analysis of the challenge that the Canadian government faces in facilitating a more effective wind power development strategy back to the framework presented in the previous section and qualitatively attempts to approximate the efficacy of various policy instruments.

As Table 13 implies, some form of enhanced distributive policy may be the most effective approach for encouraging more aggressive provincial wind power development strategies. Interestingly, in the federation with the greatest success in wind power development (Germany), a feed-in tariff and land lease grants played major roles in catalyzing development (Komor, 2004; Wizelius, 2007). Similarly, production subsidies were instrumental in supporting wind power development in two other federations, the United States (Production Tax Credit) and Spain (Mallon, 2006). In Canada's case, the imposition of a national feed-in tariff would be problematic without support from the Provinces that have sovereignty over the provincial electricity regimes. Accordingly, of the distributive policies which have been successful in other countries, introducing a production tax credit is perhaps the least contentious alternative.

The main hurdle to introducing a Federal Production Tax Credit as a distributive policy to promote wind power development comes down to program cost (or rather revenue foregone). To illustrate, assume that federal policymakers wanted to introduce a Production Tax Credit program of 15-year duration (to provide financial certainty to developers) at C$60 per MWh (which would make wind power projects attractive even in provinces with the lowest electricity prices), valid to a total capacity of 20% of total national electricity generation capacity. Once the program reaches full capacity, the federal government would be foregoing approximately C$8.6 billion per year in tax revenue.[4] For a government that is currently wrestling to bring down a federal deficit of C$50 billion, foregoing tax revenue of this magnitude would be politically untenable.

7.3. The value of combined policy instruments

The general consensus amongst policy instrument scholars is that cobbling together a program employing various policy instruments often delivers enhanced results (cf. Hood, 1986; cf. Salamon, 2002; Bemelmans-Videc et al., 2003). There is anecdotal evidence that this tenet extends to federal systems. For example, in support of regulatory activities associated with the Canadian Environmental Protection Act of 1999, the federal government undertook an extensive public relations campaign to explain its impact. Moreover, a Council of Ministers of the Environment (which includes all 13 regional Environment Ministers and the federal Environment Minister) meets bi-annually to "develop

[4] In 2007, electricity production in Canada was 617,469 GWh (Statistics Canada, 2009). Assuming a yearly increase in production of 1.3% (EIA, 2008), by 2012 electricity production will have increased to 715,815 GWh. Accordingly, assuming that all wind turbines were in place by 2012, the annual total payments required to provide a subsidy of C$60 per MWh would amount to C$8,589,789,641 for 143,163 GWh (20% of 715,815).

national strategies, norms, and guidelines that each environment ministry across the country can use" (www.ccme.ca). The combination of these policy instruments allowed a federal regulatory act to be implemented even though it intrudes on areas of provincial authority.

Combining policy instruments to improve policy program efficacy presents some intriguing possibilities in regard to developing a collaborative wind power development program in Canada. For example, although electricity policy falls under provincial sovereignty, could the federal government succeed in implementing a carbon tax (a redistributive policy) or cap and trade system (a regulatory policy) if it supplemented the program with an enhanced production tax credit policy (distributive policy), initiated a campaign to engender public support (constitutive policy) and delegated program design to the Council of Energy Ministers to minimize provincial opposition through collaborative policy setting (constitutive policy)? If so, a combined approach to policy setting could significantly spread-out the burden of subsidizing wind power development initiatives when compared to the distributive policy outlined earlier.

Regardless of the ultimate policy package, delegating the development of a policy program to the Council of Energy Ministers (or some other unified body) represents sound judgment. Currently, this Council of the 13 regional (provincial and territory) Energy Ministers plus the Federal Energy Minister meets annually to discuss provincial collaboration and share information. In Canada, where policy decisions are best designed and operationalised through consultation with the provinces (IEA, 2004), it seems logical to task this group with the responsibility to cobble together a unified policy approach. Failure to enlist provincial support in developing a collaborative strategy increases the possibility that provincial authorities will consider emergent strategies to be unwarranted intrusions on provincial sovereignty over electricity governance.

Considering financial feasibility, a combination of policies may represent a way for the federal government to enact a collaborative approach to wind power development without having to foot the entire bill associated with an enhanced federal production subsidy program. Unfortunately, an absence of empirical research comparing the efficacy of different combinations of renewable policy tools in a federal environment stymies identification of an optimal policy mix for Canadian policymakers. Accordingly, it is hoped that the conceptual cornerstones established in this paper will encourage more extensive research into the efficacy of combined policies in a federal setting. All 24 of the world's federal nations would benefit from further research in this regard.

8. Conclusion

Research into the nexus between federal political structure and policy implementation has tended to focus on pieces of the puzzle. Some have endeavored to examine the efficacy of different federal structures in specific contexts such as industrial relations (Patmore, 2009), domestic peace (Wimmer, 2007) or intergovernmental relations (Baier, 2005). Others have explored the inner-workings of the federal-state (province) interface (Erk, 2006). Still others have undertaken comparative studies to better understand the influence that a federal structure has on policy-making by examining either broad differences between federal nations (Braun et al., 2002; Thorlakson, 2003) or more detailed comparative analysis between nations (Rich, 2004). However, all have approached such enquiry in an ad hoc manner, pursuing specific themes of interest rather than focusing on a macro analysis of how federal structure influences policy instrument choice and efficacy.

Conversely, this study which uses the challenge of unifying National Energy Policy for supporting wind power development in Canada has attempted to employ critical analysis to better understand the nexus between policy instruments and federal political structures from a macro level. To the best of the author's knowledge the framework put forth in Table 12 and subsequently applied to a specific context (wind power development policy) in Table 13, represents the first attempt of its kind to explicate the relationship between the various manifestations of power found in federal systems and the types of policy instruments that in theory should be more effective. As an emergent taxonomy, the author does not claim that the framework represents the final word on understanding this nexus; however, it does represent the establishment of a conceptual starting point around which empirical testing can be devised.

Clearly there are exceptions, which will challenge the predictive and applied efficacy of the framework outlined in Table 12. In fact, this paper has already identified two such exceptions. Firstly, the Canadian Environmental Protection Act of 1999 which was a federal regulatory policy which infringed on areas of provincial sovereignty, yet it succeeded. Although part of the success stems from the collaborative approach taken through the Ministers of the Environment to implement the Act, its success reminds us that policy approaches that may be problematic if applied in isolation can be effectively applied by combining different policy approaches to offset negatives with positives. In focusing on policies applied in an isolated manner, the framework put forth in this paper does not yet address this important area of policy-making strategy. Secondly, Section 7.2 demonstrated how one distributive policy (a production tax credit) could be effective to facilitate enhanced development of wind power but another distributive policy (a feed-in tariff) may be resisted by provincial authorities. This tells us that policies of the same classification are not all the same. Accordingly, much more research is needed to highlight the nuances of different types of policies within the same classification.

In conclusion then, the framework put forth in this paper is admittedly raw, but it is a step forward and fills an important gap in understanding the nexus between policy instrument efficacy and federal political structure. As the Chinese are fond of saying, "a journey of a thousand miles begins with one step". But at least this journey will have the wind at our backs.

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