ENERGY SECURITY, OIL (TAR) SANDS DEVELOPMENT AND CLIMATE CHANGE: WHAT ROUTE TO TAKE IN NORTH AMERICA?

Stephan Schott
Carleton University
School of Public Policy and Administration
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Abstract
The paper discusses future energy links between Canada, the United States and Mexico and potential climate change mitigation policies in North America. A comparison of national interests and economic and political situations in each of the NAFTA countries provides supporting evidence to further integrate energy markets, while developing a common cap-and-trade carbon emission market, rather than relying on individual national energy policies and domestic emission markets or carbon taxes. The paper identifies major challenges for the further development and survival of an integrated energy market and a common emission-trading scheme. First energy security must be redefined under NAFTA from a North American perspective and not from an individual country or regional perspective. Currently NAFTA Article 605 is biased in favour of the United States' and Mexico's energy security interests. Secondly it needs to be determined how to initially allocate emission permits, how permit allocation will be varied over time and how potential revenues will be utilized or redistributed to individual countries or provinces. The paper compares various options and their feasibilities in a North American framework.
1. Introduction

The oil sands or tar sands development\(^1\) in the Canadian provinces of Alberta and Saskatchewan is often considered to be a major economic opportunity for Canada to be among the world’s largest oil suppliers and players on the international energy market. Canadian government departments such as Natural Resources Canada estimate the total employment impacts to be as much as 500,000 jobs and $ 298 billion in employment income over the 2000-2020 period. Canada’s major trading partner, the U.S., also could benefit from this economic opportunity because it will boost employment in U.S. refineries and it contributes to U.S. energy security. The U.S. is particularly concerned about securing their steadily increasing demand for oil from reliable and stable supply sources that do not try to control the market (like OPEC attempts to do), or try to strategically use their energy power (in the case of Russia) or who have anti-American sentiments (like for example Venezuela).

Despite the tremendous opportunities for both the U.S. and Canada from oil (tar) sands development, there are a number of questionable and controversial impacts from the project. Apart from the negative environmental impacts due to substantial air emissions stemming from a very energy intensive extraction and refining process, the use of large quantities of water and water contamination and land use and reclamation, there are tremendous socioeconomic impacts for the whole of North America. Further unregulated development at negligible carbon and water prices would distort a very integrated North American energy market, establish new pipelines from Canada to the United States, set up excessive refining capacities possibly in the Great Lakes area, and

\(^{1}\) Both terms are used to describe the large reserves of bitumen in the Canadian provinces of Alberta and Saskatchewan. While some argue tar sands carries a negative connotation, defendants of the term argue that oil sands are a deceiving term as it implies that oil in its conventional form is readily available.
would be a large obstacle for greenhouse gas reduction efforts in North America. Any initiative for meaningful carbon emission reductions must involve the oil and gas industry in Alberta and Saskatchewan (that has large reserves of oils sands deposits). Current greenhouse reduction plans, however, either do not involve the latter provinces (e.g. the Western Climate Initiative (WCI)\(^2\)), are based on emission intensity targets with relatively low price ceilings (the technology fund option) or count on technology fixes of the future (carbon capture and storage technologies). This paper, therefore, discusses a more viable, politically feasible North American route to energy security, greenhouse gas mitigation and oil sands development that is consistent with the interests of the Western Canadian provinces, Canada as a whole, the United States and Mexico.

The paper first evaluates national and provincial interests, and then considers the political, historic and legal context of energy and environmental policies in North America. We then discuss the feasibility and merit of using either carbon taxes or cap-and-trade markets for carbon emissions in North America and the possible design of a North American greenhouse gas reduction programme. We conclude with a number of recommended routes and point out crucial challenges that need to be overcome by drawing lessons from the European Emission Trading System (EU ETS).

2. **National and Provincial Interests and Perspectives**

2.1. **The Alberta and Saskatchewan Perspective**

 Alberta has long embraced the development of the oil industry and unconventional sources of oil such as the oil sands. Exploitation of oil sands in Canada began in 1967, after decades of research and development that goes back to the early 1900s (M. Humphreys, 2008). The Alberta Research Council (ARC), established by the provincial

\(^2\) Saskatchewan has observer status but Alberta is not involved with the WCI.
government in 1921, supported early research on separating bitumen from the sand and other materials. Oil sands development started with demonstration projects in the 1940s and 1950s but it was not until 1967 that The Great Canadian Oil Sands company (GCOS), established by U.S.-based Sunoco, later renamed Suncor, began commercial production at 12,000 barrels per day. Other jurisdictions such as Utah, Saskatchewan or Venezuela that have large bitumen deposits were more cautious and are more thoroughly researching the impacts of bitumen extraction and refinement in conjunction with government led research.

After the first oil shock of the 1970s and declining oil production in the U.S., Alberta’s oil sands were seriously considered as an alternative to conventional oil sources. Alberta began exploiting the oil sands under the leadership of Premier Peter Lougheed who initiated the Heritage Fund, which had the objective of investing royalty payments for the future wealth of Albertans, to strengthen or diversify the economy and to improve the quality of life of Albertans (Alberta Finance (2009)). The Heritage Fund started strong in its inauguration year with a deposit of Canadian $ 2.1 billion. The initial objective was to invest 30 per cent of non-renewable resource revenues into the Heritage Fund. The objective was pursued until 1987 when the Heritage Fund basically turned into an endowment fund. As of 1997 the Heritage Fund could no longer be used by government for direct economic development or social investment purposes (Alberta Finance (2009)). Despite being debt free as of the fall of 2002 no additional contributions were made to the Heritage Fund until 2005/2006, and the latter was basically only an inflation adjustment. As a consequence Alberta’s per capita heritage savings look pale in comparison to Alaska and Norway (see figure 1).

- insert figure 1-

It is, therefore, highly questionable if the objectives of the Heritage Fund can be fulfilled and to what extent Albertans are benefitting from the current resource boom and unconstrained development of oil sands. Particularly in the period of high oil prices
(which came to an end in the fall of 2008) one project after another was approved by the Alberta government with approval of the federal government and the National Energy Board (NEB). This has resulted in immense pressure on the local housing market and municipal infrastructure that was not prepared for this kind of resource boom that had not been experienced since the Klondike gold rush of 1897. The rapid expansion of oil sands projects caused a large influx of migrant or temporary workers from other provinces and countries. The latter are not necessarily interested in the future sustainability and well-being of Alberta, which has been reflected in exceptionally low voter turnouts in recent elections and for a high preference for tax reductions or dividend cheques rather than investments into the future well-being of Albertans (according to surveys conducted by Alberta Finance).

The downside with a high dependence on oil as a revenue and employment source is that it creates volatility and instability, particularly for bitumen from oil sands extraction that achieves around $20 less per barrel on average on oil spot markets. Oil markets are also generally experiencing increasing volatility and price fluctuations (Gaudet, 2007). The last year (2008) has been a good example of a rollercoaster ride for the oil sector and especially for the oil sands projects. In the first half of the year oil prices were skyrocketing high and oil sands projects increased dramatically, while in the second half of 2008 the interest in oil sands basically came to an end (Calgary Herald (2009)) as it became increasingly difficult to break even. This calls into question the benefits of allowing uncontrolled investment in times of booms and shows the vulnerability of the economy in times of busts. Alberta needs to more carefully plan its development path and how to smoothen strains on local economies and infrastructures.

Both Saskatchewan and Alberta also have substantially increased their per capita greenhouse gas emissions since 1990 (see figure 2). Their current per capita rates are approximately three times the Canadian average, which already is significantly higher than other industrialized nations’ averages. The reduction of greenhouse gas emissions
will, therefore, pose a tremendous challenge for these energy rich provinces.

-insert figure 2-

Alberta requires facilities that emit more than 100,000 tonnes of greenhouse gases a year to reduce emissions intensity by 12 per cent, as of July 1, 2007. Firms have, however, also the option of purchasing Alberta-based offset credits, contribute to the Climate Change and Emissions Management Fund (CCEMF) at $15 per tonne of carbon or to purchase or use emission performance credits. Since there are no limits on the amounts of offset or contributions to the CCEMF the system has a safety valve of $15, i.e. is a hybrid of a carbon tax and an emission-intensity cap-and-trade programme. The CCEMF contribution of $15 was by far the most preferred option in the two years the programme has been in operation as table 1 demonstrates.

<table>
<thead>
<tr>
<th>Year</th>
<th>Improvements to Operations</th>
<th>CCEMF contribution ($15/tonne)</th>
<th>Performance credit generation</th>
<th>Offsets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>1.89 MT</td>
<td>5.5 MT</td>
<td>1.9 MT</td>
<td>2.75 MT</td>
</tr>
<tr>
<td>2007</td>
<td>1.7 MT</td>
<td>2.7 MT</td>
<td>1.0 MT</td>
<td>1.0 MT</td>
</tr>
<tr>
<td>Total</td>
<td>3.59 MT</td>
<td>8.2 MT</td>
<td>2.9 MT</td>
<td>3.75 MT</td>
</tr>
</tbody>
</table>

Table 1: The Alberta Greenhouse Gas Reduction Programme

This indicates that $15 is a rather soft price, that nevertheless creates revenues for Alberta and the advancement of emission reduction technologies.

Extraction from in situ bitumen for oil sands production\(^3\) furthermore requires large amounts of water (3 to 5 barrels for every barrel of synthetic crude oil produced.

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\(^3\) In situ production methods are used on bitumen deposits buried too deep for mining to be economical. Techniques include steam injection, solvent injection and firefloods. So far, steam injection has been the favoured method.
according to Natural resources Canada) that is currently extracted from the Athabasca River and results in tailings that contaminate the river further downstream. The Athabasca River Basin originates in the Columbia Icefield in the Rocky Mountains between Banff and Jasper, Alberta. It drains into lake Athabasca, which is for the most part in Saskatchewan and eventually into the Arctic and through the Northwest Territories. Water use and contamination is of large concern for Alberta residents, particularly around Fort McMurray and further downstream in Fort Chipewyan. Industrial water use has significantly affected the health and traditions of native bands downstream from the oil (tar) sands. This is another reason why a more controlled extraction and development rate of oil sands might be in the interest of long term residents and original inhabitants of Alberta and neighbouring provinces and territories. The fact that the Athabasca River basin is shared by two provinces and affects The Northwest Territory, as well as the very fragile Arctic ecosystem calls for substantial interprovincial/territorial cooperation and federal involvement, which we will discuss further in the next section.

2.2. The Canadian Perspective

From a national Canadian perspective the oil sands development has had mixed impacts. On the one hand it has created job opportunities for Canadians. It has, however, led to mass migration with disruptions to social and family lives and not always positive changes to labour markets. Increasing demands for Canadian oil also has contributed to a significant appreciation of the Canadian $ particularly in relation to the American $.\textsuperscript{4} This appreciation of the Canadian $ hurt the manufacturing and export sector in Canada

\textsuperscript{4}In 2007 the Canadian $ was for the first time in more than a decade at par with the American $.
(particularly the automobile sector). Furthermore Canada was quite instrumentally involved in the Kyoto Accord and ratified under Jean Chrétien’s leadership in 2002. The large increase in energy-intensive extraction from the oil sands since 2002, however, seriously impeded Canada’s efforts of meeting its Kyoto targets (see figure 3).

-Insert figure 3-

The single largest contributor to greenhouse gas emissions has become Alberta (see figure 4), recently surpassing Canada’s most populated province Ontario.

-Insert figure 4-

The Canadian government has not been able to make any progress in even coming close to its Kyoto targets or to move in any credible emission reduction direction. It ratified Kyoto without careful consultation with the provinces on how to implement its target of 6% reduction below 1990 levels. Canadian provinces have jurisdiction over natural resource and energy and, therefore, play a much more important role in climate change policies than provinces, states or Länder in other industrialized nations. Due to the recent explosion in oil sands development the reduction of greenhouse gas emissions has just become increasingly difficult from a political perspective in Canada. As figure 4 indicates any viable solution has to include serious greenhouse gas reductions in Alberta and Saskatchewan. At the moment we have a hodge-podge of approaches (Courchene and Allan (2008)) in Canada, none of which are truly stringent and cause any meaningful changes in greenhouse gas emissions yet. British Columbia has a carbon tax of $10 per tonne of CO$_2$ emissions, soon to be raised to $15 per tonne (as of July 1 2009). Every year the tax will rise by $5 until it reaches $30 per tonne in 2012. Québec has a small levy on gasoline and diesel.
The Canadian federal government’s plan (Turning the Corner (2007, 2008)) is similar to Alberta’s Greenhouse Gas Reduction Programme in the sense that it also has a carbon intensity cap and not an absolute reduction limit. It also set an upper limit of $15 per tonne as emitters can decide to contribute to the Climate Change Technology Fund (CCTF) rather than trading emission permits or reducing actual emissions. Effectively there will be a price ceiling of $15 per tonne for the cap and trade market envisioned by the Conservative government. The plan is to cut carbon emissions by 20% of 2006 emission levels by 2020 and by 60 to 70 percent below 2006 levels by 2050. The Canadian government has, however, not committed to fixed emission caps before 2020-25 (King (2008)). Instead it still counts to a large extent on technology-based standards to reduce greenhouse gas emissions, such as carbon storage and sequestration (CCS). The technology is, however, still in its infancy and likely to only be lucrative at carbon prices of at least $75-115 per tonne (The Economist, March 5th 2009). The Canadian government is considering to make CCS mandatory for new coal fired electricity plants that start up after 2012 and for new oil sands projects, rather than using harder reduction targets that would create more incentives for innovation of all kinds.

The lax approaches to greenhouse gas reduction in Canada by the federal government, Alberta and Saskatchewan are opposed by Ontario, Québec, Manitoba and British Columbia that have organized their own climate change policies together with certain U.S. states under the Western Climate Initiative (WCI). The WCI plans to start emission permit trading under a cap and trade plan in 2012 and will auction off at least 10% of the permits from the start (Courchene and Allan (2008)). The B.C. carbon tax will also be integrated into the trading plan. The WCI initiative acts like a pilot role
model for North America as it includes states and province from both sides of the border. The Canadian and U.S. governments are interested in eventually connecting to the WCI system. The biggest challenge will be to persuade both Alberta and Saskatchewan to join the WCI and to abandon their own provincial greenhouse gas reduction programmes. The Alberta programme, for example, is designed to keep all the raised revenues within the province and also only allows offsets from Alberta sources. The auctioning of permits under a WCI programme would, however, require a revenues sharing plan between participating provinces and states.

The federal government of Canada also has to deal with other interprovincial environmental and natural resource issues. As mentioned earlier, the Athabasca watershed is shared by neighbouring Saskatchewan and the Northwest Territories further downstream in the North. The federal government, therefore, has a responsibility to protect the resource, and it has the legal right to do ban discharges of substances through the Federal Fisheries Act of 1868 if fish species are threatened. It furthermore has the responsibility to set up regional water quality boards in cooperation with affected provinces and territories to design water-quality management plans of boundary waters under the Canada Water Act of 1970. The amount of water extracted for oil sands production and the quality of returned water to the Athabasca River are serious concerns. The federal and provincial responses have been slow so far and proper water quality boards have not been instituted. There has also not been enough research and analysis on water quality changes and its impacts on the river basin and the health of humans and wildlife as a cause of oil sands development. This could constitute a violation of the precautionary principle.
2.3. U.S. Interests

The U.S. has made energy security a priority in its energy policy (see for example Pasqualetti (2009)). It, therefore, has supported oil sands development and has heavily increased natural gas and oil imports from Canada in order to reduce their dependence on increasingly volatile supplies in the Middle East and South America (see figures 5 and 6).

- insert figure 5-
- insert figure 6-

A discussion in the U.S. has, however, emerged if bitumen from the oil sands should be considered “dirty oil” and therefore should be subject to other regulations. The processing of bitumen in U.S. refineries also would have negative environmental impacts for Americans, as many refinery projects are planned in the Great Lakes region if oil sands development and pipeline expansions take the planned route (see fore example D. Israelson, 2008).

There is another environmental concern stemming form oil sands development that is of considerable interest to the U.S. The U.S. increasingly is running into regional water shortages (particularly in the West) and is counting to some extent on Canada’s vast water resources in the future to supply areas in need in the U.S. in times of shortages, droughts or water crises. This has also been included in NAFTA articles (NAFTA chapter 11 and proportionality clause). Canadians has so far been vehemently opposed to bulk water exports from Canadian provinces. As soon as a province decides to trade bulk water with Mexico or the U.S. a precedent could be established that will allow easier access to Canadian water resources in the future. In any case the substantial use of water in oil sands extraction threatens the potential access of the U.S. to Canadian water
resources. And even if there are other water resources, it would become politically more
difficult to justify water exports to the U.S. after crucial watersheds have been decimated
due to oil exports to the South. The current use of water in the extraction of in situ oil
sands could already be considered a virtual bulk water export to the United States, and
could set a dangerous precedent.

For the number of environmental reasons and because of international pressure as
well as U.S. public opinion, President Elect Barack Obama is debating a North American
emission trading system that would affect extraction rates and future development of the
oil sands. It will make the tradeoff of environmental degradation, the loss of crucial
water resources and energy security more evident to Americans, and it, therefore, may
very well reduce the desire to import carbon intensive and water consuming oil from the
tar sands. It is, therefore, in the interest of U.S. Americans to properly measure the
impacts of oil sands development and not just to consider it a secure and affordable
energy source. Appropriate consideration of carbon emissions, water contamination and
water supply reductions would probably slow down the development of oil sands
projects, which to a large extent would also be in the interest for a large majority of U.S.
Americans.

We already established that more stringent and binding greenhouse gas reduction
programmes would also be in the interest of Albertans and other Canadians, as well as
water pricing and the effective control of water contamination. It remains puzzling why
we have not seen a more concerted effort to regulate oil sands development and to control
greenhouse gas emissions. A closer examination of historic energy policy developments,
political and legal constraints are necessary to understand past developments and to evaluate future policy options in North America.

3. NAFTA, NEP and Canadian Energy Security

3.1. The National Energy Program (NEP)

The uncontrolled development of oil sands projects without a proper provincial or national energy plan can at least partially be explained by Alberta’s aversion to any kind of federal control or intervention in the oil sector due to the negative experience with the National Energy Program (NEP) that was launched by Prime Minister Trudeau in the 1980s (V. McColl, 2008). Some of the main objectives of the NEP was to promote oil self-sufficiency for Canada, maintain the oil supply for the Eastern Canadian manufacturing base, promote exploration for oil in Canada and to increase government revenues from oil sales through taxes and other instruments and agreements between the federal government and provinces. The NEP also capped the price of oil for Canadian producers. The province of Alberta and Western Canadians in general felt that the NEP ripped them off and that they did not make use of a great opportunity that the oil crises offered them. Instead they had to subsidize the rest of the country. Consequently Western Canadians feel they need to make up for lost opportunities in the past by developing oil sands at a rate that is as fast as possible. The oil sands development rate, therefore, has to be understood in the context of political and policy developments in Canada. Although the environmental and socioeconomic impacts of oil sands development are detrimental to many Westerners, there is political support for an independent provincial energy policy without constraints imposed by Eastern Canadians.

3.2. NAFTA Chapter 6

The experience with the NEP was partially responsible for Canada to sign on to NAFTA article 605, while Mexico did not endorse or sign on to the latter article. Under NAFTA
article 605 Canada cannot restrict energy exports to the U.S. or Mexico unless all of the following three conditions hold:

1. Exports as a percentage of total Canadian supply do not fall.
2. Canada does not charge a higher price to the United States or Mexico by means of taxes, license fees, minimum prices or any other regulation.
3. Any restriction cannot result from a disruption of normal supply channels.

There are a number of implications of NAFTA 605 for Canada. While it shelters Western Canada from new price controls, it also imposes policy and energy security constraints for Canada. The first condition prevents domestic control or redirection of energy flows, even in times of energy crisis or serious supply disruptions. The latter could potentially affect the Eastern provinces of Canada, particularly the Maritimes and Quebec that largely depend on oil imports from Venezuela and other countries, and don’t even receive Canadian oil. It seriously impedes Canadian energy security. Further North American energy market integration, therefore, is in conflict and potentially impedes Canadian energy security. The second condition tries to prevent any repeat of price fixing or domestic price controls as under the NEP.

The third condition could potentially limit Canadian flexibility in redirecting energy flows, particularly if it commits to new pipeline projects or electricity exports though existing transmission grids. Once Canada commits to pipelines and directions of flow, “natural supply channels” are created that need to be adhered to in future exports of Canadian energy. The direction of flow in a pipeline could, for example, not easily be reversed if it violates any of the 3 conditions. ⁵ This limits Canadian options of moving Canadian oil, gas and electricity between Canadian provinces or territories. NAFTA

⁵ The direction of flow in the oil pipeline to Montreal has for example been reversed on several occasions.
Article 605 also impacts electricity imports and exports between the U.S. and Canada, which have been steadily climbing (see figure 7). Canadian provinces are largely connected to U.S. states to the South through transmission grids that are in serious need of upgrading and extensions. There is, however, discussion in Canada about new transmission grids that go in an East-West direction rather than a North-South direction. There is substantial trade potential between provinces that are endowed with abundant hydropower (such as Québec and Manitoba) and other provinces with large wind power potential such as Ontario or the Maritime provinces. The most populated Canadian provinces of Ontario and Québec also have different electricity peaks. Québec still largely relies on electric heating and therefore has the highest peaks in demand in the winter while Ontario mostly heats with natural gas but has seen major surges in electricity demand in the summer months for air-conditioning purposes. NAFTA 605 could impose barriers to the investment into new energy systems and connections that are potentially cleaner and more sustainable, which could also reduce North American energy security.

4. The Future Route for North America

4.1. Energy Policy

North American energy markets are already very much integrated (V. McColl, 2008). Canada is the number one energy supplier to the U.S. All of the electricity imports and 82% of natural gas imports in the U.S. come from Canada. Oil imports from Canada are on the rise but constitute only 18% at the moment (V. McColl, 2008). There is also already a very sophisticated infrastructure of energy trade in place. Further integration in
North American oil trade, therefore, is facilitated by the experiences in trade with electricity and natural gas and by the infrastructure that is already in place. Mexican oil production, on the other hand, has recently drastically declined (see figure 8). North America will, therefore, rely more heavily on Canadian energy in the future. Further integration of energy markets is in the U.S. American interest and also in the future Mexican interest as their oil resources are dwindling. Energy security in an integrated North American market needs, however, to be redefined.

Energy security does not just refer to the secure supply of energy from fossil fuel combustion but how to sustainably and reliably generate energy on the North American continent. This includes the electrification of the economy, wind-hydro power backup options, new nuclear, clean coal, etc. The oil sands will play a role in energy security but should not be considered as the crucial and only major component. In this increasingly integrated North American energy market it does not seem sensible to still hang on to national energy security objectives that come at the detriment of any nation’s region. A new transmission grid from hydropower-rich B.C. to Alberta could benefit the U.S. as well because it could potentially free up natural gas in oil sands extraction and/or displace coal fired generation and therefore reduces greenhouse gas emissions. The redirection of electricity flows from the U.S. to Alberta could, however, be in conflict with chapter 6 of NAFTA. The latter is clearly biased in favour of Mexico and the United States and was crafted at a time when the NEP was fresh in mind and artificial price controls were a concern. Conditions 1 and 3 of NAFTA article 605 are outdated and do not provide the flexibility we need in a more efficient, sustainable and secure North American energy market. The current motivation for the U.S. interest in oil sand development improves
energy security for the U.S. at the possible expense of Eastern Canada. For the same reason Mexico did not agree to sign on to NAFTA Article 605. In the case of serious oil supply interruptions from countries outside of North America, Eastern Canadians should have the same access to North American oil as other North Americans, no matter what traditional channels of supply were or export ratios. An equal treatment of all North Americans needs to be secured, otherwise an integrated system will run the risk of collapsing, particularly as Canada becomes a more dominant force in the energy sector.

4.2. Greenhouse Gas Reduction Policies

Integrated energy markets in North America require either the coordination of environmental regulation or an integrated approach to the use of environmental policy instruments, particularly for greenhouse gas emissions. There has been an elaborate discussion in the literature on whether to use a quantity or price instrument for the control of emissions (starting with Weitzman (1974)). This discussion has recently reemerged in the context of carbon emission regulation in the United States. In a recent symposium on U.S. climate policy instruments Keohane (2009) argues in favour or a cap and trade system to control U.S. greenhouse gases, while Metcalf (2008) proposes a carbon tax and Murray et al. (2009) suggest a Roberts and Spence (1976) type cap and trade system with an allowance reserve. We will consider their arguments for different approaches in the U.S. in the context of a broader North American system.

Energy Security, Coordination of Policy Instruments and Trade Frictions

A unilateral U.S. tax or cap-and-trade market would for example require tariffs or price adjustments for oil from oil sands production, electricity generated form coal plants in Ontario and for other energy-intensive production processes. This could cause trade
frictions and potentially redirect energy flows from the U.S. to Canada’s East, to Europe and potentially to China, and is clearly not in the interest of U.S. or North American energy security. Cap-and-trade systems can also be linked easier without explicit coordination (Keohane (2009)) as long as they have absolute caps and are not based on historic baselines and energy intensities as in Alberta and the current Canadian federal proposal. In fact the Canadian programme would not be compatible with *America’s Climate Security Act*, which states that US firms would be allowed to purchase allowances only from foreign systems that impose mandatory absolute tonnage limits on GHG emissions (King (2008)). With the adoption of emissions taxes the United States would have to agree with the Canadian federal government and several provinces (that also have jurisdiction over emissions taxes (see Courchene and Allan (2008))) upon a common tax rate and how this tax has to be varied from period to period. It is more likely that the countries agree on emission reduction caps since they already have similar greenhouse gas reduction targets.

*Efficiency and Uncertainty*

Independent policy instruments that are not linked would also not achieve the least cost reduction of greenhouse gas emissions. The larger the number of emitters that are participating in a cap-and-trade market for example, the lower the emission market prices, and, therefore, the compliance costs. The relative efficiency of the policy instrument depends on the scope of the market and the measurement errors of the marginal abatement costs and marginal benefits of greenhouse gas reductions. Both have a significant degree of uncertainty. Keohane argues in favour of a quantity instrument, i.e. a cap-and-trade market over a tax. He mentions several points in defense of a cap
and trade market in North America, and he even challenges the view that a price instrument would be preferred with the types of uncertainty we are facing with climate change. In a thought experiment he assumes a catastrophic threshold, which would make the marginal damage function \(3-7\) times steeper than the marginal abatement cost function. It consequently would be safer to specify a quantity target rather than a price target.

In reality we will require a feedback rule that allows us to adjust to the information revealed to us by the policy instrument. If, for example, the price for tradable permits in a C&T systems is too low, we know we can have more ambitious targets. The same is true for a carbon tax that is set too low and triggers hardly any abatement or production process changes. The tradeoff is between achieving certain emission reduction targets at fluctuating carbon prices or to fix carbon prices but to have uncertainty about emission reductions. Most jurisdictions are constrained by specific emission reduction targets that are deemed feasible or essential. It, therefore, seems to be advantageous to try to achieve this target in the most direct manner through absolute caps, as long as carbon prices do not fluctuate too heavily.

**Price Volatility**

C&T systems have often been criticized for the emission price volatility they create. This is a valid concern as prices have fluctuated in \(\text{SO}_2\), \(\text{NO}_x\) and the European carbon market (the ETS). We need to learn from these experiences, especially from the European carbon market. Carbon is a cumulative pollutant and it does not matter much where it is created and a what time, as long as we control cumulative atmospheric concentrations. Intertemporal exchanges are, therefore, much more feasible in carbon emissions trading
than, for example, in NO\textsubscript{x} or SO\textsubscript{2} markets. In fact one could argue that the inability to bank allowances under the EU ETS system have caused volatility in the spot market for allowances (that varied between € 0-30). The forward prices for carbon allowances, on the other hand, were far more stable and varied mostly between € 15-25 (at an average price of € 20). This indicates that banking of permits would reduce price volatility. In fact 95 % of the total volume in the European carbon market is in the derivatives trade (King (2008)).

Another contributing factor in the price volatility of the EU carbon spot market is the “surprise effect” when the verified emissions report is released. The European Union has reacted to this already by not releasing all of the information at once but by slowly announcing partial emission reports. There are, therefore, crucial C&T design features that could control price volatility. The banking and borrowing of emission permits as well as forward and options markets can significantly reduce price uncertainty.

*Flexibility*

One big advantage of a C&T market is the flexibility it offers in terms of permit allocation and revenue generation. A tax always raises substantial revenues unless a certain proportion of emissions is exempt from taxation. The burden on emitters is often very high with a tax and can, therefore, become a stumbling block for its introduction. A C&T market, on the other hand, can generate the same revenues as a carbon tax if all the permits are auctioned off. On the other hand it does not need to raise any revenues if permits are completely grandfathered or freely allocated. The permit price will always be the efficient one no matter how permits are initially allocated, which means the minimum marginal abatement costs will always be revealed. A viable North American plan will
need to be flexible but transparent, i.e. without a number of loopholes and alternative options that avoid emission reductions or the purchase of emission permits on the official, undistorted C&T market.

Safety Valves

There is some support for safety valves or a hybrid between a tax and a C&T system for the U.S. and Canada respectively. This seems to reduce the stringency of the approach as the experience in Alberta has shown where most emitters have chosen to pay the tax and contribute to a technology fund, rather than purchasing emission credits, offset or to invest in changing production processes. With a safety valve we cannot predict what actual emission reduction will be and we don’t know what the actual minimum marginal abatement costs are. In the Alberta system, for example, there is no information on the market price for emissions permits that would emerge if there was no safety vale. We, therefore, do not know to what extent firms are constrained by the emission reduction programme.

Innovation and R&D

The Canadian government and the province of Alberta both count quite considerably on CCS to provide a solution for significant greenhouse gas reductions in the future. The Alberta and Canadian technology funds presumably will finance pilot projects and research and development of CCS. It is ironic that the relatively low technology fund fees, however, reduce innovation and R&D incentives as they provide a lower cost option to an otherwise higher price that would prevail in the C&T market. It would be preferable to maintain the highest possible innovation incentives so that the industry can determine what viable innovation options are (with some basic public R&D support) and
to reward promising ideas and progress with appropriate incentive structures. A proportion of annual emission permits could, for example, be allocated based on technological or abatement innovation efforts of individual firms or industries.

*Political Feasibility*

An important point raised by Keohane (2009) is that “price and quantity instruments frame political debates very differently”. A federal Canadian emissions tax could be seen as a redistribution of revenues from oil-rich provinces to other provinces, which is a delicate subject in Canada. It also would burden the oil and gas sector disproportionately, and could have strong short term employment and other negatively perceived economic effects that would be strongly opposed in Western Canada (with the possible exception of British Columbia). Emission taxes are furthermore generally unpopular in most parts of North America, and a carbon tax would probably be even less popular in Canada than in the U.S. In a recent political campaign for the federal election in the fall of 2008 the Liberal Party of Canada experienced a terrible defeat. The central focus of their campaign was a revenue neutral carbon tax of $40 (“The Green Shift”). For the latter reasons the current federal Canadian government (that partially originated from a Western Canadian Interest Party) has chosen a hybrid cap-and-trade system with emission intensity baselines and a technology fund contribution option.

Revenue recycling or trying to achieve a double dividend from displacing current distortionary taxes such as payroll or income taxes with an externality correcting tax like an emission tax is generally a very good idea. This can, however, also be achieved with a C&T market that auctions off at least a proportion of emission permits.
A North American C&T carbon emissions market as well as independent Canadian and U.S. C&T carbon emissions markets seem much more politically feasible than carbon taxes. A Canadian C&T market would, however, currently involve a safety valve in the form of a technology fund distribution fee and would not have binding absolute caps. A more stringent and efficient C&T plan would only be politically feasible if the initiative came from the oil industry’s major customer: the United States. We already see a lot of pressure on Canada to change their climate change action plans to be more consistent with the U.S. programmes. An integrated North American energy and climate change policy could, therefore, be the most promising route to take as long as standards are stringent enough and national governments are equally involved in the design of such a system. The threat for economically smaller nations such as Mexico and Canada is that national sovereignty could be sacrificed to some extent. In the case of Canada, however, energy and environmental policy have been politically hijacked and are not necessarily in the best interest of Canadian and Albertans as we have shown in this paper. It is in the interest of all North Americans that water is priced at its best alternative value (besides bitumen extraction use) and that the total emissions created by resource extraction and energy creation are fully priced through efficient policy instruments. The oil sands should be no exception. If it becomes too expensive to convert bitumen into conventional oil than we are better off leaving the resource in the ground for a while, conserving precious water resources, depending on less secure sources or eventually finding other alternatives to fossil fuel dependence. An artificially low tar sands price distorts investments and the allocations of resources and further
delays the adoption of new technologies that cannot compete with implicitly subsidized oil sand resources.

A North American carbon C&T market, therefore, seems to be the most desirable and politically feasible route to take. The major challenge will be the initial allocation of permits, the proportion of permits that will be auctioned off and the distribution and the use of revenues.

4.3. How to Set up a North American Carbon Market

There are a number of major lessons we can learn from the only large scale carbon trading market, the EU ETS as it involves a number of sovereign countries under one trading scheme. A North American market would probably at first only involve the U.S. and Canada and later on Mexico. Canadian provinces have, however, sovereignty over natural resources and energy matters, much more so than in most of the European countries (some of which have very centralized governments (e.g. France)). A North American carbon market would, therefore, need to give more discretion to the needs and demands of individual provinces and states.

1. Carbon Emission Registry

One of the key features of the EU ETS is that absolute caps are determined by a newly created international institution, the European Commission’s Emissions Trading Directorate (EC ETD). It is, however, up to that national governments how to allocate emission permits and engage in the monitoring of emissions levels. This caused a number of problems and challenges. In the first phase of the EU ETS permits were grandfathered based on historic emissions, which is politically more feasible since it does

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6 For a detailed analysis of the European experience with carbon emissions trading see King (2008) and Ellerman and Buchner (2007, 2008)
not impose large upfront costs to emitters; however, it relies on accurate historic emissions information that was not available in Europe. In fact only Denmark had created a carbon emission registry (Ellerman and Joskow (2008)). National governments also had an incentive to overstate their emissions in order to get a larger proportion of grandfathered permits. The lack of national carbon registries made it more difficult to determine proper emission caps since it was not even entirely clear what total emissions in Europe were when trading first started. The first verification report of emissions in April of 2006 revealed that total emissions were less than the total cap, and the price of permits dropped drastically from € 29.20 in early April to € 10 by May of 2006. The lesson for a North American carbon emissions market is that we need very reliable national carbon registries before the allocation and trading of permits. In order to avoid measurement errors and inconsistencies between provinces and states, it would be recommendable to have third party verification of provincial and state registries. There is the additional advantage of improving price stability in the C&T market when the verification process is more transparent, frequent and standardized between jurisdictions.

2. A North American Emissions Directorate

The second step in a North American carbon market would be to form a Directorate similar to the EC ETD that will set absolute emission reduction targets once national carbon registry data has been verified. The directorate would also determine the proportion of emission permits that would be auctioned off initially and in subsequent periods. The challenge will be how to distribute revenue between individual provinces and states or national governments, or how to invest the money into research and development and new technologies, such as CCS, solar or nuclear. Here we can see a
clear link between energy security and greenhouse gas reductions. North American governments need to find a common route that is sustainable in terms of emissions, resource availability and energy security. Certain funds need to be made available for the development of technologies of the future. It would probably be more promising at a larger North American scale to conduct R&D rather than at state or provincial levels. The development of CCS is for example a large and expensive undertaking that might provide large cost reductions as we learn how to reliably and efficiently use it. It would require research at large scale, with many pilot sites and over a long time range. Its implications could be significant for energy security and greenhouse gas emissions as coal and oil sands or oil shales are widely abundant in North America. There are, however, other alternatives such as wind, solar and nuclear that also can provide energy security and might come at lower social costs. The auctioning off of at least a small proportion (for example 10% as the WCI intends to start off with) is also advantageous as it provides us with information about the marginal abatement costs of firms and gives us some idea where carbon emission permit prices will be trading at. To some extent it provides more price stability as information is revealed upfront about market price expectations.

3. Centralized versus Decentralized Allocation of Permits

The allocation of permits to individual emitters in Europe was up to the national governments to decide which caused a number of repercussions. Some emitters reaped in large windfall gains, while others (with steeper marginal abatement cost curves) incurred very large expenses. Windfall gains could be avoided through a centralized auctioning off or permits, but the latter would increase the total expenditures for emitters that find it
costly to reduce emissions. The right balance between auctioning off and free or grandfathered allocation of permits must be established. It also need to be determined what government level will decide on the allocation of non-auctioned permits and what discretion they have on the allocation mechanisms (i.e. grandfathered, allocated according to other criteria (e.g. industry benchmark) or further auctioning of permits).

The perception of fairness and political feasibility of the initial allocation depends to a large extent on public opinion, culture and technological industry specifics in a given country or region. It is, therefore, recommendable give some discretion to provinces or states about permit allocation. Some provinces/states might find it appropriate to auction off additional permits (in addition to centralized auctioning), while others might find it more acceptable to allocate all of them for free. This depends to a large extent also on trade relations, public or private ownership of energy sources and electricity generation capacity and public perception of the “polluter pays principle”.

4. Safety Valves, Offsets and Price Uncertainty

Finally I think it would be a mistake to allow a price ceiling or safety valve in the North American market. The more complicated a system is and the more loopholes it offers, the less transparent and effective it becomes. Furthermore less information is provided by a market that has all kinds of other options to buy out emission reductions with lower cost alternatives that additionally have to be verified (such as offsets). With offsets it is often questionable if they have been created through the system of if the emission reductions would have occurred anyways. If we are worried about price volatility and the burden on specific emitters it would be much more efficient and insightful to hedge risk with future or options markets and to give certain emitters the opportunity to bank
permits for the future or to borrow permits from future allocations if possible. This is another shortcoming of the European system that it did not allow emitters to hang on to their emission permits to the next trading phase. Permits, therefore, became worthless as the total cap turned out to be not binding. By allowing borrowing against future allocation it would also set strong innovation incentives because emitters have less permits available in the future.

5. Conclusion

Currently there are at least a dozen different greenhouse gas reduction programmes and plans for large emitters in North America. Some consist of taxes, some of hybrid systems (C&T and price ceilings), some are based on emissions trading schemes with absolute caps and some have emission intensity targets. The diversity of approaches already is creating trade frictions and barriers to further energy integration in North America, as the example of the oil sands development in Alberta and future plans in Saskatchewan have shown. A bill introduced in the U.S. House of Representatives in April of 2009 would impose border duties on importers whose home governments are deemed to be lax in limiting the amount of greenhouse gases their industries can emit, and would offer rebates to energy-intensive industries to help with the cost of compliance. The Canadian Minister of the Environment, Jim Prentice, replied by saying that “Ottawa would align its overall reduction targets, reporting rules, enforcement mechanisms and regulations for specific industries with whatever system emerges in the United States” (The Globe and Mail, April 9th, 2009). Instead of being a follower to regulatory development in the South, it would be advantageous for Canada and its provinces to be actively involved in the design of a truly North American carbon emissions trading system. The latter would
strengthen energy market integration and North American energy security, and would eliminate trade frictions, and could make real advances in greenhouse gas reductions as the experience in Europe has shown. The EU ETS has resulted in a modest reduction of greenhouse gas emissions but has set ambitious targets for the near future. More importantly it has caused more rigorous verification and announcement of actual emissions, has exceeded expectations in emission reductions and has been a major learning exercise. It has taught us lessons about design features that can be incorporated in a North American system.

A North American carbon market might not involve as many nations as in Europe, and, therefore, appear to be quite different. Canadian provinces, however, have as much sovereignty over energy and natural resource sectors as EU countries and are probably even less controlled by centralized policies. Some Canadian provinces are already working on a common carbon emissions market through the WCI. It, therefore, seems natural to set up a system that builds on the WCI and includes all states and provinces and eventually also Mexico. It will involve three tiers of government rather than two as in the EU ETS. This could be an advantage in this case, as it has increasingly become difficult in Canada to conduct national energy and environmental policy. A good example has been Canada’s reluctance to implement carbon emission targets without any serious commitment by the U.S., although Canada was instrumental in signing of the Kyoto Accord and its ratification. The same is true for other environmental policies that are always considered in the context of trade impacts and potential harmonization with U.S. American policies.

The energy markets in North America are already very integrated. Energy is
being used more efficiently when markets emerge that price energy at marginal cost. An integrated North American emissions trading market would do the same for the price of carbon. Viewing energy security from a national or regional perspective does not make much sense for an integrated system. It could divide energy markets into West versus East or North versus South. We need to make sure that countries, provinces or states do not engage in price (including emission prices) discrimination against others, as the NEP in Canada did in the 1980s. To force the same historic proportion of energy exports that flow into the U.S., or to commit to specific natural supply channels for energy flows imposes serious constraints on dynamic energy markets and does not allow to utilize the full potential for trade, and, therefore, could threaten the integrity of a North American energy and emissions system.
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Figure 1: A Comparison of Resource Rent Investments across Industrialized Oil-Endowed Jurisdictions
Source Data: Alberta Chambers of Commerce, 2006, Executive Summary Table: Fund Comparisons
Figure 2: Per capita greenhouse gas emissions (in tonnes of CO₂ equivalent)
Figure 3: Canadian Greenhouse Gas Emissions and Kyoto Target

Figure 4: Distribution of Greenhouse Gas Emissions in Canada
Figure 5: U.S. Natural Gas Imports from Canada

Figure 6: U.S. Crude Oil Imports from Canada, Mexico and the Rest of the World
Figure 7: Electricity Trade between the United States and Canada

Figure 8: Drastic Decline in Mexican Oil Production