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FOR A LOW CARBON ECONOMY

Sustainable Prosperity is a national research and policy network, based at the University of Ottawa. SP focuses on market-based approaches to build a stronger, greener economy. It brings together business, policy and academic leaders to help innovative ideas inform policy development.

The Competitiveness of a Trading Nation:

Carbon Leakage and Canadian Climate Policy[1]

Key Messages

- One of the key obstacles to implementing carbon pricing policies in Canada is the concern that energy-intensive and trade exposed (EITE) companies will lose market share to companies located in regions without comparable policies in place, or that these companies will relocate altogether.
- While negative competitiveness impacts are a concern, they must be put in perspective. The sectors truly vulnerable to competitiveness pressures from a Canadian carbon pricing policy represent a small percentage of Canadian GDP. Policy makers must pay careful attention to how vulnerable sectors are identified and design appropriate policy measures to protect those that legitimately require it while still achieving environmental goals.

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- Given that Canada is highly dependent on trade[2], to avoid any retaliation, it is also important for Canada to implement a policy that does not have a negative impact on its key trading relationships. Putting in place measures to protect domestic firms cannot lead to explicit disadvantage for foreign industries, if retaliatory trade measures are to be avoided.
- While it is necessary to protect domestic EITE sectors, at the same time these sectors are the ones that most need to decarbonise their production processes. A carbon pricing policy compels these sectors to begin this transition, so while protecting them the incentive to decrease their carbon intensity must be preserved.
- The long-term transition to lower carbon intensity is the ultimate strategy for ensuring that Canada's economy remains competitive in a carbon-constrained world.

The issue

At present and for the foreseeable future, nations have differentiated international emission reduction responsibilities and differing domestic climate policies. In North America, provinces and states have also begun to adopt divergent sub-national commitments and policies. Some jurisdictions price carbon through a tax or a cap-and-trade system; some use regulations which price carbon through compliance costs; and some impose neither. Among those that do price carbon[3], there are wide variations in the degree of carbon constraint, the scope of coverage, and other aspects of their pricing policies. These policies are intended to decrease emissions per unit of output by raising the cost of carbon-intensive inputs (mainly energy). As production prices for carbon-intensive goods rises, market prices will rise, thus decreasing demand for these products as consumers substitute goods with lower carbon intensity.

The uneven carbon pricing playing field leads to asymmetric costs for the production of equivalent goods in different jurisdictions. Producers in jurisdictions with stringent carbon prices or constraints face higher costs than producers in jurisdictions with less stringent, or no carbon constraints (if no price equivalent substitute exists for the carbon-intensive energy input). This asymmetry in production and energy costs has closely linked, but distinct implications:

- **Competitiveness impacts** can arise if individual firms or economic sectors (e.g. steel or pulp and paper) in a jurisdiction lose market share because they have to charge higher end market prices because a carbon price has pushed up their cost of production. Conversely, the firm can choose to absorb the higher production cost and maintain market prices. To remain competitive, the firm would have to decrease wages or other costs.

2 International trade in goods and services constituted 34 percent of Canadian GDP in 2008. Organization for Economic Co-operation and Development (OECD) Country Statistical Profiles 2010, available at: stats.oecd.org/Index.aspx?DatasetCode=CSP2010

3 This paper uses the term "carbon pricing" to refer both to formal pricing tools, such as carbon taxes and cap and trade systems, and regulations which price carbon through compliance costs.

- **Carbon leakage** occurs if carbon pricing in one jurisdiction leads to increased emissions in another jurisdiction where such costs are not imposed. Leakage can arise from a shift in demand towards lower priced goods from jurisdictions without a carbon price, or from the relocation of emissions or plants to jurisdictions with less stringent carbon policies in order to avoid the associated costs of compliance. Leakage undermines the environmental effectiveness of a jurisdiction's carbon policy, as global emissions do not decrease, but merely shift outside its borders.

The ultimate solution to both of these problems is a truly global climate regime, where no jurisdiction is able to derive a competitive advantage from the absence of a carbon price. If companies face similar carbon costs no matter where they are located, there is no incentive (from the perspective of climate policy) to relocate. That scenario, however, is some way from realization.

In the absence of a global climate regime, policy makers at the national and sub-national levels must decide how best to protect vulnerable industries from the competitiveness concerns that arise as a result of uneven carbon pricing policies.

State of knowledge

Definitions and concepts

A primary concern for policy makers when considering a carbon pricing policy is ensuring the international competitiveness of domestic industries and companies, especially in the case of a unilateral policy. At the national level, competitiveness is a function of productivity growth;[4] whereas at the sector and company level, competitiveness is about maintaining (and expanding) output, profits and market share.[5] A carbon price could raise costs, especially energy costs, particularly in the short-term, but is by no means the only factor that can influence an industry's competitive position. Other significant factors include, *inter alia,* the cost of labour and capital; tax and regulatory regimes; exchange rates; and geographical considerations such as access to ports. Competitiveness impacts in Canada also depend on the degree to which trading partners implement carbon policies, and therefore relative carbon prices between Canada and other jurisdictions.[6]

4 Sartor, Olivier. 2010. "Competitiveness 101: separating feelings from facts". CDC Climate Research. Page 3.
5 Fischer, Carolyn and Alan Fox. February 2009. "Comparing Policies to Combat Carbon Leakage." Resources for the Future. Page 6.
6 National Round Table on the Environment and the Economy. 2009. "Achieving 2050: A Carbon Pricing Policy for Canada (Technical Report)." Page 115.

Carbon leakage

If domestic industries and companies become less price competitive as a result of a carbon price, they will potentially reduce output compared to foreign competitors (who would in turn increase output), or certain companies will even possibly choose to relocate some or all facilities. This is known as carbon leakage. Carbon leakage would only occur if all of the following factors hold true:

- Carbon pricing makes Canadian industries less price competitive internationally, by increasing energy and other related costs. The greater a company's emissions intensity, the greater the cost variation between jurisdictions.[7]
- Canadian companies that can and choose to pass on higher costs will charge consumers more for the product, potentially losing market share to lower priced competition. Companies that choose to absorb carbon costs instead of passing them on (or cannot pass them on) will be forced to cut costs elsewhere (e.g. wages), eroding profit margins. If these companies are forced to reduce, close or relocate production due to their higher cost structure, this could result in carbon leakage.
- International competitors to the Canadian company are not subject to a carbon pricing regime.[8]
- There are no offsetting government policies to support Canadian industry.

Importance of time scale

Firms and industries will be most adversely affected by a price on carbon in the short term when they are unable to quickly adjust production processes to be less energy-intensive. Researchers have suggested that four time scales are relevant when assessing the impacts on competitiveness:[9]

- The very short run, where firms cannot adjust prices and profits fall.
- The short run, where firms can raise prices to reflect higher energy costs with a decline in sales as a result of product or import substitution.
- The medium run, when in addition to the changes in output prices, the mix of inputs may also change, but capital remains in place, and economy-wide effects are considered.

7 Ibid.

8 Whether foreign competitors' production is more or less carbon-intensive than domestic production matters for the net effect on global emissions, but not for carbon leakage.

9 Fischer, Carolyn and Richard Morgenstern. November 2009. "Climate Policy and Competition: US Industry's Regulatory Dilemma." Resources for the Future. Page 5.

- The long run, where capital may be reallocated and replaced with more energy-efficient technology, lowering the carbon intensity of the firm.

Defining Energy-Intensive and Trade-Exposed (EITE)

The industries most vulnerable to competitiveness concerns and carbon leakage are those sectors that are both energy-intensive and trade-exposed (EITE) (see boxes 1 and 2). The degree of risk they face is a function of their energy/emissions intensiveness and trade exposure, the extent to which they can pass costs onto customers, and other factors such as market concentration and elasticity of demand.

The definitions of trade vulnerability used in the United States[10] and the European Union[11] are provided in Boxes 1 and 2. No formal public definition of "energy-intensive and trade-exposed" exists for the Canadian economy.

Box 1
US Criteria for Trade Vulnerable Sectors

Energy or greenhouse gas intensive:
- Purchased energy and fuel costs above 5 % of the value of shipments; or
- The number 20 times the tons of direct and indirect CO_2e emissions above 5% of the value of shipments; AND

Trade intensive:
- Value of imports + exports above 15% of value of total shipments + imports.

OR

Very high energy or greenhouse gas intensity:
- Energy or greenhouse gas intensity, as calculated above, higher than 20%.

Box 2
EU Criteria for Trade Vulnerable Sectors

Increase in production costs:
- Sum of direct and indirect additional costs from carbon pricing increase production costs more than 5% of Gross Value Added; AND

Non-EU trade intensive:
- Total value of exports to non EU + value of imports from non-EU greater than 10% of the annual turnover plus total imports into the EU.

OR

Particularly high increase in production costs:
- Sum of direct and indirect additional costs from carbon pricing increase production costs more than 30% of Gross Value Added.

OR

Particularly high non-EU trade intensity:
- Total value of exports to non EU + value of imports from non-EU greater than 30% of the annual turnover plus total imports into the EU.

In most countries, the share of EITE sectors of national GDP is very small. For example, in the U.S., EITEs represent only 3 percent of GDP[12], although the figure is closer to 11% in Canada (as shown in figure 1).[13]

10 HR2454, 11th Congress, 1st Session. May 12 2010. "American Clean Energy and Security Act of 2009. Section 764 (b) (2) (A); American Power Act of 2010: discussion draft."

11 European Union. December 17, 2008. "Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community. (COM(2008)0016)."

12 Defined here as industries with energy costs above 4% of shipment value and imports above 10% of consumption. Houser, Trevor, Bradley, Rob, Childs, Britt, Werksman, Jacob and Robert Heilmayr. May 2008. "Levelling the Carbon Playing Field: International Competition and US Climate Policy Design." Page XVI.

13 Dave Sawyer. December 2009. "Better Together? The Implications of Linked Canada-US Permit Trade and Comparable Climate Policies." C.D. Howe Working Paper.

Looking on an emissions rather than GDP basis, 60% of Canada's industrial emissions are energy or emissions exposed and trade exposed under the definition in Box 1.[14]

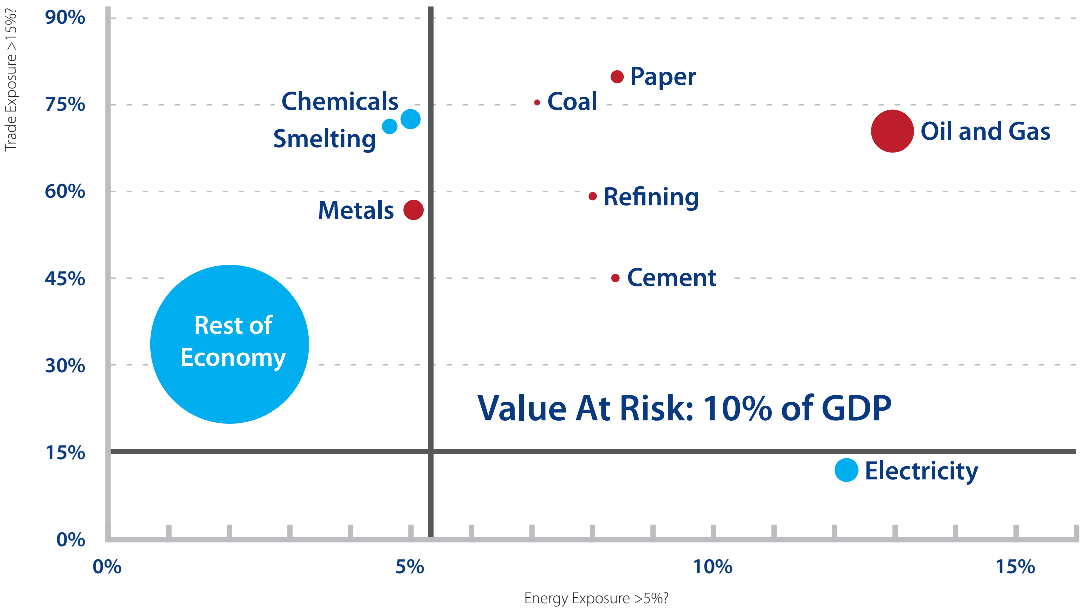

Figure 1: Canadian Value Added Potentially at Risk (using US definitions from Box 1)

Source: Dave Sawyer. December 2009. "Better Together? The Implications of Linked Canada-US Permit Trade and Comparable Climate Policies" C.D. Howe Working Paper.

An additional element to consider in the Canadian context is the degree to which energy (especially electricity) is essentially emissions free in certain jurisdictions like Quebec or Manitoba. Given that a carbon price would increase prices only on carbon-intensive energy sources, a high percentage of industrial activity in these jurisdictions would essentially avoid a carbon price. Of all EITEs, likely only a subset of industries would face material competitiveness impacts arising from a carbon policy. For sectors representing 60% of Canada's economic output, energy costs are less than 2% of total costs; only 12% of economic output comes from sectors facing energy costs of greater than 5% of total costs.[15]

At the same time, the risks to vulnerable EITE sectors must also be considered in context with the other risks that these sectors face in the normal course of doing business. For example, market prices for key production inputs fluctuate, though these are rarely mitigated through public policy. Also the threat of industry relocation is likely overblown. Firms choose to locate in a particular country or region for a variety of reasons, including

14 Bramley, Matthew, Partington, P.J. and Dave Sawyer. December 2009. "Linking National Cap-and-Trade Systems in North America." The International Institute for Sustainable Development and the Pembina Institute. Page 15.

15 Dave Sawyer. December 2009. "Better Together? The Implications of Linked Canada-US Permit Trade and Comparable Climate Policies." C.D. Howe Working Paper.

the size of the local market, access to key inputs including energy, capital, natural resources, infrastructure and labour, and the existence of supporting industries, among others.[16]

In addition, the unilateral adoption of carbon pricing in one jurisdiction alone is an increasingly outdated scenario. For example, the sub-national efforts underway in Canada and the US consist of coalitions of states and provinces together. Many of them are important trading partners for Canada (e.g. California).

International analyses

An empirical evaluation of the steel, cement, aluminum and refineries sectors under the EU ETS's first pilot period did not reveal significant carbon leakage.

Significant general equilibrium economic modeling of the competitiveness impacts of carbon pricing has been undertaken in other jurisdictions, notably the European Union (EU), United States (US) and Australia. The results of these various studies vary depending on the underlying assumptions and other parameters.

In Europe, theoretical models predicted significant leakage rates in specific sectors – from 0.5 percent to 25 percent in the iron and steel sector and between 40 percent to 70 percent in the cement sector, depending on how allowances are distributed and using a price of €20/tonne in the EU-27.[17] However, actual carbon leakage would likely be lower, since in many cases new installations built elsewhere would be more efficient than the older installations being closed.[18]

An empirical evaluation of the steel, cement, aluminum and refineries sectors under the European Union Emissions Trading System (EU ETS)'s first 2005-2007 pilot period did not reveal significant carbon leakage.[19] Another ex-post assessment of the first phase of the EU ETS demonstrates that the output and trade flows of EITE sectors (e.g. cement, iron and steel, aluminum, oil refining) were not observably impacted.[20] However, impacts may have been limited by a number of factors: prices were low; the majority of emitters were allocated free allowances; allowances were over-allocated in some sectors; long-run electricity contracts cushioned rising electricity prices through the pilot phase; and any large-scale restructuring of these heavy industries would not be observable in the three year time period of the pilot phase.[21] The carbon price in the second period is much more predictive of future price behaviour.[22]

16 Porter's diamond model of the Competitive Advantage of Nations provides a framework for understanding why industries are located where they are.

17 Demailly & Quirion 2006; Ponssard and Walker 2008, quoted in Wooders, Peter, Reinaud, Julia and Aaron Cosbey. October 2009. "Options for Policy-Makers: Addressing Competitiveness, Leakage, and Climate Change." International Institute for Sustainable Development. Page 23.

18 Yandong and Tutaka 2008 quoted in Wooders, Peter, Reinaud, Julia and Aaron Cosbey. October 2009. "Options for Policy-Makers: Addressing Competitiveness, Leakage, and Climate Change." International Institute for Sustainable Development. Page 23.

19 Julia Reinaud. 2008. "Issues behind competitiveness and carbon leakage: Focus on heavy industry." International Energy Agency.

20 Ellerman, Denny, Convery, Frank and Christian De Perthuis. 2010. *Pricing Carbon*. Cambridge University Press. Pages 202, 213, 223, 232.

21 Julia Reinaud. 2008 "Climate Policy and carbon leakage—Impacts of the European emissions trading scheme on aluminum." International Energy Agency, quoted in Wooders, Peter, Reinaud, Julia and Aaron Cosbey. October 2009. "Options for Policy-Makers: Addressing Competitiveness, Leakage, and Climate Change." International Institute for Sustainable Development. Page 22.

22 Ellerman, Denny, Convery, Frank and Christian De Perthuis. 2010. *Pricing Carbon*. Cambridge University Press. Page 157.

The vast majority of US industry would be largely unaffected by the proposed legislation.

In anticipation of a national carbon pricing framework in the United States, a great deal of modeling and analysis was conducted on the competitiveness impacts on US industries. Resources for the Future conducted a study that looked at the impact on industries over time. Using a $10/ton CO_2 price without any offsetting measures, it found that, in both the short and long-terms, the hardest hit industries would be petroleum refining, chemicals and plastics, primary metals, and non-metallic minerals.[23] However the actual increase in production costs and estimated decreases in output across all sectors is not greater than 5% for the vast majority of sectors.[24] A majority of production loss (i.e. reduced output) is not due to changes in net exports, but to reduced consumption, which reflects conservation responses to carbon pricing.[25] The US government's own analysis of one of the bills (H.R. 2454, which passed the House of Representatives on June 26, 2009) found that, given the low share (2%) of energy expenditures relative to the output of the manufacturing sector, as well as the allowance allocation treatment, the vast majority of US industry would be largely unaffected by the proposed legislation.[26]

The Australian Treasury analysis of the carbon leakage risk for Australia's formerly proposed Carbon Pollution Reduction Scheme forecast little carbon leakage, because the emission prices (at 2005 A$23-32/t$CO_2$e) were not high enough to induce industry relocation; the analysis concluded that noticeable impacts would only occur at prices above 2005 A$46/t$CO_2$e.[27] In fact, many of Australia's energy-intensive trade-exposed sectors (EITEs), such as coal, non-metallic minerals, livestock, and iron and steel, are likely to maintain or improve their competitiveness and share of global trade as other jurisdictions regulate carbon, because they are either less emission or energy-intensive than comparable sectors in competitor countries.[28]

23 Mun S. Ho, Richard Morgenstern, and Jhih-Shyang Shih. November 2008. "Impact of Carbon Price Policies on U.S. Industry." Resources for the Future. Page 39.

24 Mun S. Ho, Richard Morgenstern, and Jhih-Shyang Shih. November 2008. "Impact of Carbon Price Policies on U.S. Industry." Resources for the Future. Pages 47-54.

25 Fischer, Carolyn and Alan Fox. February 2009. "Comparing Policies to Combat Carbon Leakage." Resources for the Future. Page 5.

26 U.S. Government (Interagency). December 2, 2009. "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries: An Interagency Report Responding to a Request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown."

27 2005 A$23-32/t$CO_2$e; Commonwealth of Australia. 2008 "Australia's Low Pollution Future: The Economics of Climate Change Mitigation. Summary Document." Page 31.

28 Ibid, Page 31.

Canadian analysis

There have been limited analyses on the vulnerability of Canadian EITE sectors to carbon leakage in the case of unilateral Canadian carbon pricing. The results of one such analysis is shown in table 1, though the same study found insignificant adverse effects on the Canadian economy as a whole. Canada faces limited opportunities for low-cost abatement, because a lot of electricity generation already comes from low-carbon hydroelectric and nuclear power.[29] Emissions reductions in the oil and gas sector (where the greatest reductions are needed in Canada) are very costly.[30] Analysis by the NRTEE suggests that under a $100/tonne CO_2 price, the following sectors would be trade- and cost-exposed: coal, oil, iron and steel, and chemical products.[31] At the same time, however, it is important to understand that at least for some part of the operations of these sectors (oil and coal), the fixed nature of the natural capital upon which the business is based means that leakage (as defined by the ability to move operations to another jurisdictions) is not necessarily an issue.

Several recent studies have examined the effects of linking national cap-and-trade system between Canada and the U.S. This is an option in which the Canadian government has expressed great interest, mainly to alleviate competitiveness concerns. While linking may reduce the risk of carbon leakage, it is not by a significant amount.[32]

Many of Australia's energy-intensive trade-exposed sectors (EITEs), such as coal, non-metallic minerals, livestock, and iron and steel, are likely to maintain or improve their competitiveness and share of global trade as other jurisdictions regulate carbon, because they are either less emission or energy-intensive than comparable sectors in competitor countries.

29 Fischer, Carolyn, Moore, Eric, Morgenstern, Richard and Toshi Arimura. April 2010. "Carbon Policies, Competitiveness, and Emissions Leakage: An International Perspective." Resources for the Future. Page 7.

30 Sawyer, David and Carolyn Fischer. August 2010. "Better Together: The Implications of Linking Canada-US Greenhouse Gas Policies." C.D. Howe Institute.

31 National Round Table on the Environment and the Economy. 2009. "Achieving 2050: A Carbon Pricing Policy for Canada, Technical Report." Page 116.

32 Bramley, Matthew, Partington, P.J. and Dave Sawyer. December 2009. "Linking National Cap-and-Trade Systems in North America." The International Institute for Sustainable Development and the Pembina Institute. Page 1.

Policy options

Policy makers are concerned about reducing carbon leakage, namely keeping jobs and production local. EITE industries need protection in the short-term from the rising energy and abatement costs that result from the introduction of a carbon pricing policy. There is a delicate balance between protecting industries that legitimately require it, and retaining the incentives that a carbon pricing scheme is intended to provide, to shift towards lower-carbon production.

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The academic literature shows that market-based instruments (MBIs), such as carbon pricing, provide lower-cost emissions reductions than performance standards or other regulatory options, because they offer maximum flexibility in the means that can be used to achieve reductions.[33] They also provide a continual incentive to reduce emissions, and promote technological innovation that takes time to develop and deploy.[34]

At the same time, all policies that protect EITEs either raise the price of foreign-made goods or reduce the price of domestic goods, as shown by the three options in figure 2.[35] These policies, as a result, can raise broader trade policy concerns, inasmuch as they change the basic terms-of-trade for that particular good.

33 Morgenstern, Richard. November 2007. "Issue Brief 8: Addressing competitiveness concerns in the context of a mandatory policy for reducing U.S. Greenhouse gas emissions." Resources for the Future. Page 113.

34 Ibid.

35 Fischer, Carolyn and Alan Fox. February 2009. "Comparing Policies to Combat Carbon Leakage." Resources for the Future. Page 14.

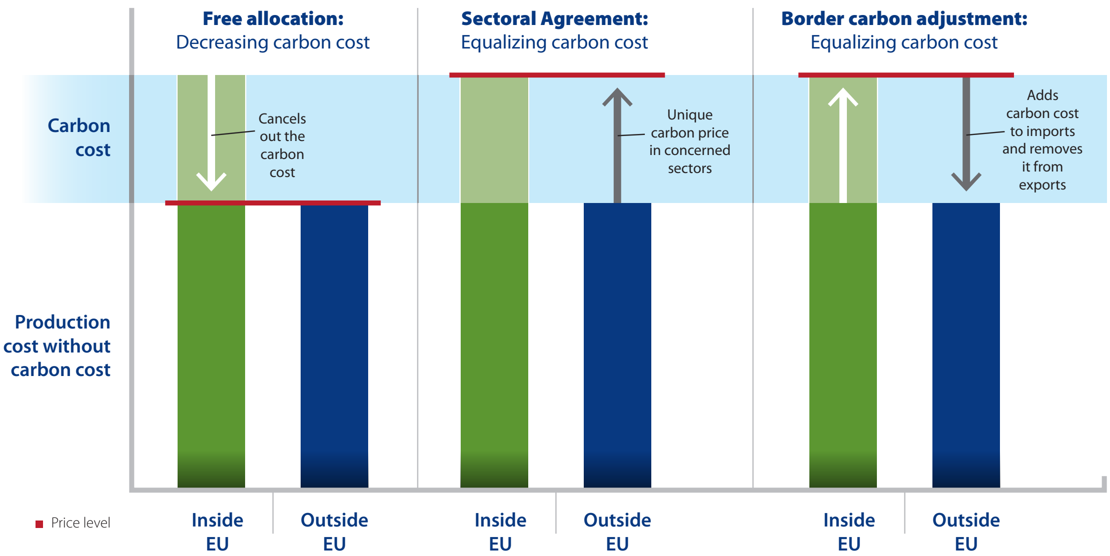

Figure 2:
Policy options to address leakage concerns

Source: Adapted from Neuhoff, Karsten. 2008. "Tackling carbon: How to price carbon for climate policy". University of Cambridge. Page 112. Available at: http://www.eprg.group.cam.ac.uk/wp-content/uploads/2009/03/tackling-carbon_final_3009082.pdf

Table 1 shows the policy options[36] that are available to minimize the financial impacts on EITE sectors. The first two categories assume that a carbon price is put in place via a carbon tax or cap-and-trade system; whereas the third presents alternatives to a market-based instrument. To varying degrees, firms will seek special protection and/or exemptions under each option, which must be considered against a sector's actual vulnerability.

36 This analysis assumes that weaker targets (in terms of emissions reductions) are not an option.

Table 1: Policy options

Category	Instrument	Details	Pros	Cons
Minimizing the costs of compliance	**Cost containment measures (e.g. safety valve, price ceiling) or inexpensive mitigation options (offsets). These contribute to a lower carbon price.**	• Safety valve: makes an unlimited number of additional allowances available at a fixed, pre-determined price • Price floor/ceiling: set by the government to constrain carbon price. • Offsets: allows companies to pay for emissions reductions undertaken by third parties.	• Lower carbon price will have a less negative impact on the economy. • Policy markers do not have to identify vulnerable industries.	• Produces lower emissions reductions and fewer incentives for technological innovation. • Competitiveness concerns will be reduced, but will remain. • Lower revenues for government.
	Exemption from the carbon policy scheme	The policy does not apply to certain sectors.	Offers the most relief to vulnerable sectors.	• Challenging to identify which sectors should be exempted. • Eliminates the incentive to reduce emissions, thereby reducing the policy's effectiveness. • Vulnerable sectors still may be indirectly exposed (e.g., through electricity price increases). • Shifts the burden onto other sectors. • Reduces the policy's economic efficiency and increases its cost because some inexpensive abatement options would be untapped. • Lower revenues for government.
	Allocation of free emission permits or carbon tax credits	Vulnerable sectors are given permits based on historical emissions ("grandfathering") or other factors. May be phased out over time as sectors adjust to the policy.	Compensates industries for losses without excluding them from the policy.	• Misses the opportunity for auction revenue (at least in the short term). • Over allocation can result in a transfer of wealth from consumers to shareholders of exposed sectors. • Challenging to identify which sectors truly require free allowances. • May be unsuccessful in combating leakage and inducing emissions reductions, depending on the basis for allocation.
	Output-based rebates	• Allowance allocations are based on a sector-wide benchmark multiplied by firm-specific output, updated over time. • Implicit production subsidy compensates eligible firms only for the cost of acquired carbon allowances while preserving incentives for performance improvements.	• Help to mitigate variable cost impacts and thereby product price effects. • Lower leakage and higher welfare than free allocation.[37]	• Lower revenues for government. • Smaller price increases mean fewer incen-tives for reducing consumption or finding substitutes. • Could contribute to a higher allowance price.
	Reducing other costs (e.g. healthcare) within vulnerable industries	Reduces other financial costs for companies to compensate for higher carbon costs.	Maintains the incentive to reduce emissions, while addressing competitiveness.	• Not aligned with the general fiscal policy principle of equal treatment for all sectors. • Cost reductions may not align with needs across specific vulnerable sectors. • Lower revenues for government.

Trade mechanisms (Border carbon adjustments [BCAs])	**Import adjustment**	• Carbon tax: tax the imported good the amount it would be taxed had it been produced domestically. • Cap and trade: require imported goods to buy emission allowances based on the embedded carbon in the product.	• Import (export) adjustments would protect firms selling domestically (abroad) from competitiveness impacts. • Import adjustments would preserve consumer incentives to conserve. • Depending on the design, can create real incentives for trading partners to adopt climate policy (e.g., by exempting compliant countries).	• Can provoke trade disputes and provide cover for trade protectionism. • To the extent they act as barriers to trade, they are economically inefficient and costly to consumers and industries dependent on imports. • Difficult to measure the carbon content of goods. • Can undermine cooperative international efforts to address climate change.
	Export adjustment	Rebate exported goods the carbon compliance cost.		
	Full border adjustment	Combine the export rebate and import tax such that only the emissions from domestic consumption are taxed.		
Alternatives to market-based policies	**International sector-based agreements**	Primarily intended as a transitional instrument to engage heavy emitting developing countries.	All the global competitors in a sector reduce emissions and face similar mitigation costs.[38]	• Require hard to obtain data. • Could require international technology support. • Would only work for sectors that have certain characteristics, such as low number of companies, homogeneity and reliable emissions data.
	Emissions standards (i.e. maximum, average and/or tradable)	Government sets emissions standards and companies decide how to meet them. There can also be a tradable component.	• Avoid energy price increases while delivering some emissions reductions. • Decreased potential for carbon leakage.	• More likely to cost more[39] to achieve the same emissions reductions than tradable permits or price incentives. • Consumers are not encouraged to reduce consumption of carbon-intensive goods. • If standards are not tradable, they are less economically efficient, as some low-cost abatement options are left behind. • If standards are not tradable, government must estimate technology costs more precisely than under a market-based system.

Source: Adapted from: Morgenstern, Richard. November 2007. "Issue Brief 8: Addressing competitiveness concerns in the context of a mandatory policy for reducing U.S. greenhouse gas emissions". Resources for the Future.

37 Fischer, Carolyn and Alan Fox. February 2009. "Comparing Policies to Combat Carbon Leakage." Resources for the Future. Page 7.
38 Daniel Bodansky. 2007. "International Sectoral Agreements in A Post 2012 Climate Framework: Working Paper." Pew Center on Global Climate Change.
39 May not apply to tradable performance standards, because they can be similar to output-based rebates.

Policy design

Updating based on measures related to production or value is the most relevant option for addressing competitiveness effects.

There are various design issues to consider for each policy option designed to mitigate leakage and competitiveness concerns. This section will briefly cover some design considerations for several of the more prominent options.

Permit allocation

Under a cap-and-trade program, the main options for allocating emissions permits are free allocation on the basis of historical measures ('grandfathering') or on an updated basis (such as output-based allocation), and auctioning (sale of permits).

Free Allocation

Free allocation requires two decisions: how many allowances will be given away (the "cap"), and on what basis. The basis upon which allowances are given away for free has a major effect on whether the incentives for carbon abatement remain in place. For example, allocating on the basis of historical measures ("grandfathering") means that current firm performance does not change their allocation, and they are free to respond to the carbon price signal in the most cost-effective manner – including, potentially, outsourcing. Grandfathering might be based on historical emissions, or as in the EU, on the basis of an intensity benchmark (emissions intensity per unit of revenue or value added) of the most efficient installations, multiplied by historical production or capacity measures.

The basis for allocation can change over time (known as an "updating allocation"), meaning that the allocation will change based on the firm's output, production capacity, value-added, emissions, energy use, or other factors. Importantly, updating creates an implicit subsidy for the factor that determines the change in allocation. Updating on the basis of emissions or energy use thus undoes the incentive effects of the carbon price. Updating based on output, as was foreseen in Waxman-Markey[40], preserves incentives to reduce emissions intensity, but mitigates incentives to limit emissions by reducing production. Updating based on measures related to production or value is the most relevant option for addressing competitiveness effects.

Next, for updated allocations, the per-unit allocations must be determined. Some options for these benchmarks are:[41]

40 U.S. Government (Interagency). December 2, 2009. "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries: An Interagency Report Responding to a Request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown."

41 Fischer, Carolyn, Moore, Eric, Morgenstern, Richard and Toshi Arimura. April 2010. "Carbon Policies, Competitiveness, and Emissions Leakage: An International Perspective." Resources for the Future. Page 2.

- Only on direct emissions: allocations are based on the average emissions per unit of output from direct fuel consumption.
- Direct and indirect emissions: including upstream emissions from electricity consumed in the eligible sector's production.
- Best-available technology (similar to the EU).

In reality, the EU system falls somewhere in between. Within a multi-year phase, allowances are grandfathered, but allocations are renegotiated with new phases, so current behaviour can be expected to influence future allowance values. Also, while not contingent on current production levels, allocations would be adjusted if production is significantly reduced or if capacity changes.

Border Carbon Adjustments (BCAs)

BCAs aim to protect the competitiveness of domestic industries either by ensuring that imports from foreign competitors face the same increased costs (relative to emissions), or by compensating exports by domestic industries for the increased costs they face, or some combination of both. The amount of any border adjustment may be diminished to the extent that domestic producers are effectively subsidized by a free allowance allocation. Any policies that raise domestic production also raise domestic emissions (and vice-versa for foreign emissions), thereby replacing increased foreign emissions with increased domestic emissions in a given sector.[42]

BCAs are often justified by proponents based on the assumption that foreign production is more carbon intensive than domestic production, meaning that the relocation of production would raise global emissions. However, this is not necessarily true. For Canadian goods, the emissions intensities of foreign goods are close to parity and are in some cases, lower.[43]

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The threat of imposing carbon tariffs might be used strategically, as sabre-rattling, to convince trading partners to adopt comparable carbon pricing policies. For this to be effective, the country imposing the trade tariff needs to form a large share of the demand for the exporting country's carbon intensive products – a circumstance that holds in only rare instances. Notably, one of these is the Canada-U.S. relationship. Canada sends 82% of its total exports to the United States, and receives 55% of its total imports from them, meaning that a unilaterally imposed carbon tariff by either country

42 Fischer, Carolyn and Alan Fox. February 2009. "Comparing Policies to Combat Carbon Leakage." Resources for the Future. Page 14.
43 Ibid. Page 21.

would have a significant impact and could prompt the adoption of a carbon pricing policy by the other country.

The main concern with BCAs is whether they comply with international trade law.

Border Carbon Adjustments (BCAs) and International Trade Law

A BCA must respect World Trade Organization (WTO) and other regional and bilateral trade agreement rules (i.e. General Agreement on Tariffs and Trade [GATT]). A BCA cannot discriminate against foreign producers or against specific countries on the basis of an absence of climate policy. To the extent that BCAs contribute to the conservation of the climate, an exemption under Article xx could perhaps be argued, for measures necessary to protect human, animal, or plant life or health, or relating to the conservation of exhaustible natural resources.[44]

The tax adjustments being discussed have never been negotiated or tested in the dispute resolution process.[45] In the absence of real examples, researchers have speculated on which type of instrument could pass international trade laws. Carbon taxes and cap-and-trade systems have different legal implications; as a result, the GATT may create barriers to implementing certain proposed instruments.[46] For example, while using a border tax to adjust a cap-and-trade system would likely not be WTO compatible, an emissions permit requirement for imports would be.[47] The design of the domestic climate policy is another concern. For example, auctioning may be a requirement for border adjustments since any free allocations for domestic producers would have to be granted to imports to treat them equally.[48]

Measuring carbon content

An additional challenge is actually measuring the carbon content of foreign goods. The actual embedded carbon in each product would have to be estimated (i.e. not based on a national average for the country of origin), calculated (if possible) or assessed that it falls within an upper and/or lower bound, or meets a foreign average. There are also many considerations in the choice of assessment techniques used to calculate embedded carbon (ecological footprint, hybrid) and issues of methodology, and definition of boundary.[49] Assessing carbon accurately is an administratively complex, burdensome, and costly task, though it would be necessary avoid trade challenges.

44 Ibid. Page 5.
45 Ibid. Page 3.
46 Ibid. Page 3.
47 Ibid. Page 5.
48 Ibid. Page 5.
49 Kejun, Jiang, Cosbey, Aaron and Deborah Murphy. 2008. "Embodied Carbon in Traded Goods, Background Paper, Trade and Climate Change Seminar, June 18-20, Copenhagen Denmark." International Institute for Sustainable Development.

Multilateral sectoral agreements to equalize costs

Sectoral agreements can address the competitiveness and carbon leakage concerns of the few industries – mainly aluminum, steel, and cement – that compete with firms from large-emitting developing countries.[50] Sectors with a large share of global greenhouse gas emissions that are steadily increasing, with the potential for low-cost emissions reductions and homogenous products and processes are good candidates.[51]

Sectoral agreements can be voluntary industry initiatives or government-to-government agreements. Voluntary industry initiatives aim to share experience and good practices, and to cooperate on technological development between firms in a sector. Such initiatives presently exist in the cement, aluminum, and iron and steel industries. For example, the aluminum sector signed a voluntary emissions reduction agreement with the Quebec Government.[52] However, voluntary mechanisms are unlikely to produce the kind of stringency needed.[53] Government-to-government agreements can be conducted on bilateral, regional, or multilateral bases, and can establish common approaches to emission reductions or to policies such as investment portfolios for specified sectors.

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Policy status

This section briefly highlights proposed (US) and actual (EU) actions to combat competitiveness concerns in two jurisdictions.

United States

The most recent draft American legislation, the May 2010 discussion draft of the American Power Act ("Kerry-Lieberman"), proposed to address carbon leakage and competitiveness through two mechanisms:[54, 55]

Output-based emission allowance rebates. Entities in eligible energy-intensive, trade exposed industries (see Box 1 for criteria) would receive emission allowance rebates to offset 100 percent of their cost of compliance. The list of eligible sectors would be updated every four years. From 2013 through 2015, rebates would be provided for indirect carbon emissions only; from 2016 through 2025, rebates would be based on both direct and

50 Columbier, Michel and Emmanuel Guerin. June 2008. "Sectoral Agreements; Breaking the Climate Deadlock Briefing Paper." The Climate Group. Page 5-6.

51 Bodansky, Daniel. 2007. "International Sectoral Agreements In A Post 2012 Climate Framework: Working Paper." Pew Center on Global Climate Change.

52 For more details, see: http://www.mddep.gouv.qc.ca/changements/plan_action/mesures/secteur-industriel-en.htm

53 OECD. 2003. "Voluntary Approaches for Environmental Policy: Effectiveness, Efficiency and Usage in Policy Mixes."

54 Pew Centre on Global Climate Change. 2010. "Pew Centre Detailed Summary of the American Power Act of 2010 (Kerry-Lieberman)." Pages 65-67; and Larsen, John, Bradbury, James, Kelly, Alexia, Bishins, Allison and Micah Ziegler. 2010. "WRI Summary of the American Power Act (Kerry-Lieberman Discussion Draft)." World Resources Institute.

55 Though Kerry-Lieberman is cited, the competitiveness-related parts are nearly identical to those in Waxman-Markey, known as H.R. 2454.

indirect emissions. Eligible entities whose emissions would not covered under the cap would be provided rebates for indirect emissions only. Allowances would be phased out by 20 percent each year between 2026 and 2029, unless extended by the President if necessary to prevent carbon leakage. If a facility ceased operations, the owner would no longer receive allowances, would have to surrender any received for future years, and would have to return, on a pro-rated basis, any allowances received for that year.

Import adjustments. If by 2020 the President determined that the allowance rebate program were not sufficient to compensate eligible sectors for their compliance costs (e.g., a multilateral agreement consistent with US policy has not entered into force), an international reserve allowance program would be established requiring the purchase of allowances for imported goods in EITE sectors, as well as manufactured goods that are primarily composed of the products from those sectors. This would not apply if more than 70 percent of global production in a sector a) came from countries party to an international treaty committing to emission reductions equivalent to the US; b) came from countries party to an international sectoral agreement including the US; or c) had energy or greenhouse gas intensities no higher than the US.

European Union

Revisions to the European Union's Emissions Trading Scheme, formally adopted in April 2009 for implementation in 2013, address carbon leakage and international competitiveness through free allowances to specific sectors.

Sectors exposed to significant risk of carbon leakage (see Box 2 for criteria) will receive 100% free allowances. This contrasts to full auctioning from 2013 onwards for the power sector, and 80 percent free allocation in 2013 for other sectors transitioning to 30 percent by 2020.

Free allowances will be allocated on the basis of product-specific benchmarks multiplied by historical production figures. These average the 10 percent most greenhouse gas efficient installations in a sector and take into account the most efficient techniques, substitutes, and alternative production processes. The share of emissions allocated freely to industries at risk of carbon leakage cannot exceed their share of total EU emissions in 2005 to 2007, and the absolute number will decline in line with the 1.74 percent annual decline in the emissions cap.

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Implications for Canadian policy makers

Canadian policy makers need to consider policy options to protect vulnerable sectors both in the case of Canada developing a unilateral carbon pricing policy; as well as Canada being subject to protectionist trade policies from its trading partners who implement carbon pricing. This policy brief is primarily concerned with the former. With regards to protecting domestic sectors, the two key challenges for policy makers are to identify the industries hardest hit by a carbon policy, and to understand the full extent and likely duration of the impacts.[56] Although all sectors may desire relief from carbon pricing policies, few actually require it to remain competitive.

In this respect, it is clear from our overview of this issue that work is needed to more clearly and definitively identify the sectors that are truly energy-intensive and trade-exposed in Canada. Policy makers, for example, need to better understand the role of fixed natural capital and the relatively low carbon-intensity of the Canadian electricity system in making that assessment.

It is clear from our overview of this issue that work is needed to more clearly and definitively identify the sectors that are truly energy-intensive and trade-exposed in Canada.

In designing an effective carbon pricing policy, a key feature is the mechanism used to protect domestic industries and companies from leakage concerns. Policy makers should consider the best option that would minimize costs for energy intensive, trade exposed (EITE) sectors once those are defined, while retaining strong mitigation incentives.

Once a policy direction has been determined (i.e. carbon tax, cap-and trade, etc.), table 1 details the mechanisms that can be built into the policy design to minimize the impact on EITE sectors. Given the dependence of the Canadian economy on trade, especially with the US, it is unlikely that Canada would, or even could, impose unilateral trade actions.[57] At the early stage of implementing a carbon pricing policy, the preferred approach has been full or partial allocation of free emission permits or distribution of output-based rebates, using energy/emissions and trade intensity criteria to determine eligibility. In the case of free allocations, incentives for emissions reductions can be maintained by allocating them on an emissions intensity basis benchmarked to the most efficient production in a sector, as in the EU. The experience of the EU in phase one of the EU ETS should be taken into account in that over-allocation will drive down the carbon price and reduce the effectiveness of the policy.

Policies can also evolve over time; a policy that is weaker in the short-term can be made more aggressive as industries have the chance to adjust.

56 Ho, Mun S. Morgenstern, Richard and Jhih-Shyang Shih. November 2008. "Impact of Carbon Price Policies on U.S. Industry." Resources for the Future. Page 39.

57 National Round Table on the Environment and the Economy. 2009. "Achieving 2050: A Carbon Pricing Policy for Canada, Technical Report." Page 59-61.

Protecting EITE industries has environmental trade-offs. These sectors are the ones that most need to reduce their energy and emissions intensiveness. A steadily rising carbon price provides the greatest incentive for firms and sectors to make the transition to a low-carbon economy. So while EITE sectors should be protected, over time the protection should diminish so they can make the transition to low-carbon production.

This long term transition is the ultimate strategy for ensuring that Canada's economy remains competitive in a carbon-constrained world.

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