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Weighing Carbon Costs in Canada

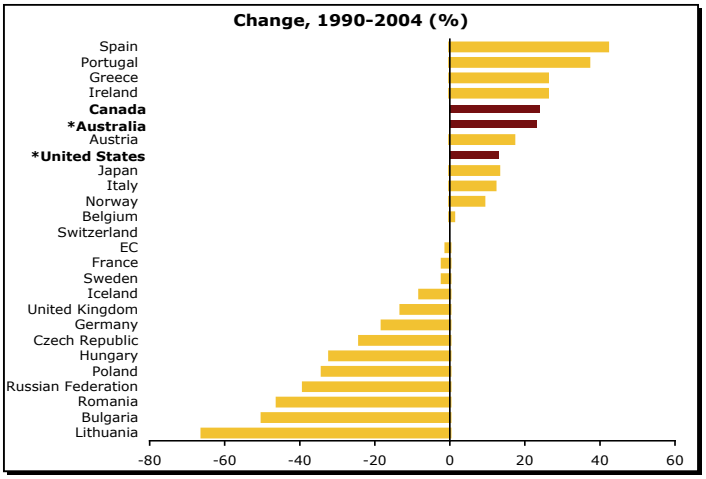
Jeff Rubin, Warren Lovely and Benjamin Tal

Past Canadian governments have been good at talking the talk on global warming, but far less adept at following up with concrete measures to limit greenhouse gas (GHG) emissions growth. While required by the Kyoto Protocol to reduce emissions to 6% below the 1990 level by 2012, Canadian emissions have soared. Environment Canada estimated that emissions had already climbed 27% above the 1990 level in 2004. Few Kyoto signatories have strayed farther from their commitments than Canada. Even the US and Australia, two countries criticized for not ratifying the accord, have posted slower emissions growth than Canada (Chart 1).

But a wave of volatile weather and a deluge of dire predictions galvanized support for taking action on climate change. As a result, arresting explosive growth in Canadian emissions has become more than a moral or economic issue, but a political issue of the highest order. Progress on this file is increasingly vital for this minority government's political survival, if not its longer-term ambitions for a parliamentary majority.

While recognizing Canada's Kyoto requirements had become untenable, Ottawa's latest plan aims to halt emissions growth in the coming three to five years, en route to a 20% (or 150 megatonne) reduction in GHG emissions by 2020 vs today's level. The scale of the emissions reduction and the time required to achieve it clearly don't live up to the country's Kyoto commitments, but if achieved, planned emissions reductions would nonetheless represent real progress. That progress won't come without adjustment, and regional, industrial and equity sector costs will, in some cases, be acute.

Chart 1
GHG Emissions Growth by Country



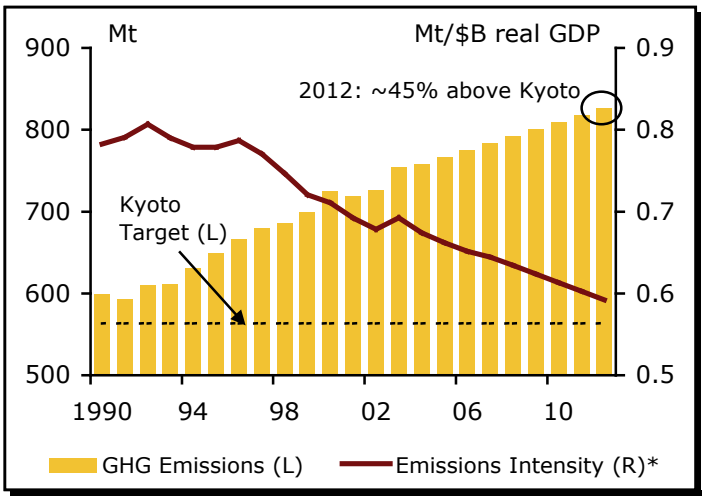
**Have not ratified the Kyoto Protocol. Source: UNFCCC (2005).*

Intensity Improvements Haven't Reined in Emissions

Until now, Ottawa had been emphasizing reductions in emissions intensity as the focus of its global warming fight, with intensity simply a measure of GHG emissions per unit of real GDP. Unfortunately, in an expanding economy, intensity targets were historically an ineffective tool for stabilizing, let alone reducing, the absolute level of greenhouse gas emissions.

The country's GHG emissions intensity was successfully cut 14% from 1990 to 2004, an average reduction of more than 1% per year. However, improvements in emissions per unit of GDP were overwhelmed by the growth of GDP itself (Chart 2).

Chart 2
Intensity Falling But Emissions Still Climbing



** Future-year projections based on trend GDP growth & a continuation of the earlier-trend reduction in GHG emissions intensity*

At current rates of economic growth, achieving the Kyoto emissions target would have required a quantum leap in energy efficiency: annual reductions in intensity that are roughly four times the current trend. Alternatively, at current rates of improvement in emissions intensity, Canada would require a GDP cut of as much as 30% by 2012 in order to wrestle emissions down to the Kyoto target.

Momentum for Carbon Abatement Started in US

South of the border, the giant energy consuming state of California has taken a harder stance, with a statewide cap and trade system for emission credits playing prominently in an ambitious plan to cut state GHG emission levels back to their 1990 level by 2020. That state joined with Arizona, New Mexico, Oregon and Washington to form the Western Regional Climate Action Initiative (WRCAI), with a view to cap the region's collective emissions.

Operating on the other side of the continent, the 10-member Regional Greenhouse Gas Initiative (RGGI) aims to cap emissions from major electric generating units beginning in 2009, with a 10% cut planned longer term. Initially established by Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont, three states have more recently joined (Maryland, Massachusetts and Rhode Island).

Meanwhile, a current bipartisan bill before Congress sponsored by Senators McCain, Obama and Lieberman would establish a nationwide cap and trade system for GHG emissions at the federal level.

Note that cap and trade systems for SO_2 and NO_x two gases commonly associated with acid rain, have been functioning for well over a decade in the US. Over time, the number of emissions permits has been reduced until the desired level of emissions has been achieved. A trading system has the advantage of enabling firms to decide for themselves who will emit through a competitive bidding process, one that not only rewards carbon efficiency but over time, provides huge economic incentives for emissions-reducing technological change.

Canada Following US Lead

Canada has generally followed US environmental initiatives at both the provincial and federal level. Already, provinces are lining up behind the Western Regional Climate Action Initiative and Regional Greenhouse Gas Initiative systems. British Columbia, having earlier committed itself to a 33% GHG reduction by 2020, has joined the WRCAI. And Ontario has flagged its interest in potentially joining both the WRCAI and the RGGI. Eastern provinces are observers in the RGGI, and Manitoba has a signed MOU with California in respect of emissions reductions.

For its part, Ottawa's freshly released plan calls for halting emissions growth in three to five years, with a 20% (or 150 Mt) reduction from today's level pledged by 2020. More specifically, most industries are required to reduce GHG emissions intensity at existing facilities by 18% in the coming three years and then a further 2% a year. Domestic emissions trading is being hailed as an important plank of the federal strategy, with a pledge to explore tie-ins to emissions trading systems in the US and/or Mexico.

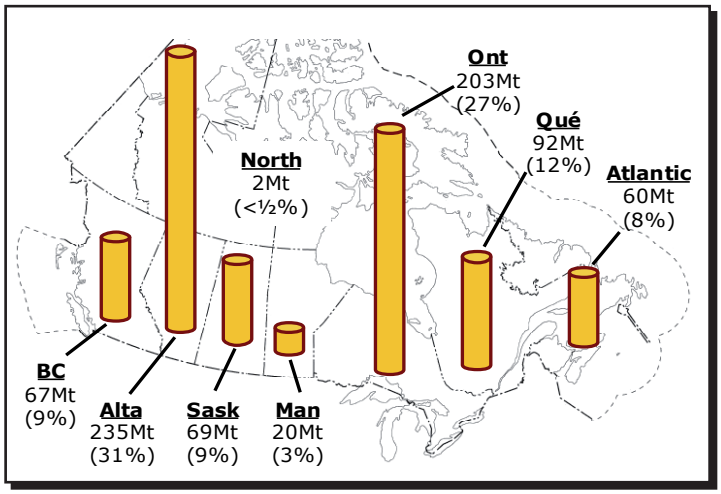
Canada's GHG commitments must control for an enormously uneven distribution of emissions across provincial boundaries, with regional disparities in emissions intensity only poised to widen further. Quite simply, emissions adjustment costs will be borne unevenly across provinces, and what today brings in billions of dollars in oil and gas royalties may tomorrow cost billions in GHG emissions credits.

Emissions Skewed to West

One can view the Saskatchewan-Manitoba border as a dividing line of sorts, on either side of which you'll find 50% of the nation's GHG emissions (Chart 3). Despite a real GDP share that is little more than 10%, Alberta alone accounted for 43% of the growth in Canada's

Chart 3

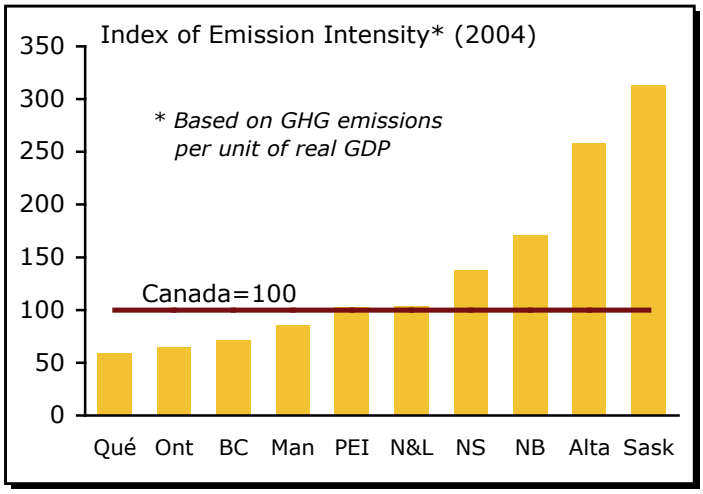
Canada's Regional Distribution of Emissions



Note: Based on 2004 emissions, figures in brackets represent share of total

Chart 4

Intensity Highest in Sask, Lightest in Québec



GHG emissions from 1990 to 2004. Saskatchewan, too, made a disproportionate contribution to emissions growth at 17%—more than five times its economic weight. Saskatchewan produces more GHG emissions per unit of GDP than any other province, with an emissions intensity (in 2004) more than three times the national average (Chart 4). Along with New Brunswick, Saskatchewan was the only other province that has failed to record a decline in emissions intensity relative to 1990 levels. And due to a declining population since 1990, Saskatchewan's emissions per capita are now almost on par with Alberta's.

Huge differences in emissions intensities magnify potential adjustment costs that individual provinces would face in meeting federally mandated carbon emissions targets. Consider a hypothetical example where reduced emissions are simply achieved by lowering economic activity, as opposed to via reduced intensity. Associated GDP cuts would be heaviest in Saskatchewan, Alberta and New Brunswick. Where emissions growth has been slowest (i.e., in Newfoundland & Labrador and Québec) the required cut to GDP would consequently be much smaller, in fact, only half the national average (Table 1).

Trading Provincial Emissions

Regional disparities in emissions growth suggest that there could be some pretty hefty interprovincial flows of emissions credits under a cap and trade system. Depending on what they cost, the trade in emissions credits may become a significant transfer payment.

Table 1

Carbon Vulnerability Varies Widely: Greatest in Saskatchewan, Alberta, New Brunswick

	GHG Emissions			GHG Intensity		Kyoto Impact	
Ranked by Emissions Intensity: Highest to Lowest	1990 Mt	2004 Mt	Change %	2004 Mt/$B GDP	Chg vs '90 %	GDP[a] % Chg vs '06	Per Capita[b] tonnes
Saskatchewan	43	69	62	2.09	22	-44	-29
Alberta	168	235	40	1.72	-16	-40	-23
New Brunswick	16	24	47	1.14	4	-38	-12
Nova Scotia	20	23	17	0.92	-13	-22	-5
Newfoundland & Labrador	10	11	4	0.69	-30	-12	-2
Prince Edward Island	2	2	10	0.69	-24	-18	-2
Manitoba	18	20	11	0.57	-13	-20	-3
British Columbia	52	67	30	0.48	-11	-33	-4
Ontario	177	203	15	0.43	-23	-22	-3
Québec	87	92	6	0.39	-22	-15	-1
Canada	**599**	**758**	**27**	**0.67**	**-14**	**-30**	**-6**

[a] Hypothetical cut in real GDP needed to lower GHG emissions 6% below 1990 levels; based on '04 emissions/intensities & relative to 2006 GDP level

[b] Per capita reduction needed to lower GHG emissions 6% below 1990 levels; based on '04 emissions & '06 population data

At $30 a tonne, widely seen as a minimum price needed to stabilize emissions growth, Canada's roughly 750 megatonnes of annual CO_2-equivalent emissions in 2004 would have a total market value of a cool $22½ billion. Of course, emissions aren't being cut to zero. Nor is every GHG emission in the economy, like those coming from privately owned motor vehicles or those coming from flatulent cows, being captured in a cap and trade system. Given a focus on the roughly 50% of emissions that come directly from identifiable industrial sources (Chart 5), the market value of emissions currently in excess of the government's 2020 emissions target would be roughly $2½ billion at $30/tonne. There are, however, other options for compliance, including investing in a technology fund, purchasing offsets and access to trading under Kyoto's Clean Development Mechanism.

The ultimate value of emissions credits traded across provincial borders would depend on the system's design, including critically, the initial allocation of credits and the resulting price of carbon emissions. But with an already-skewed distribution of GHG emissions looking to become even more unbalanced in coming years, one can envision a healthy inter-provincial trade in carbon permits.

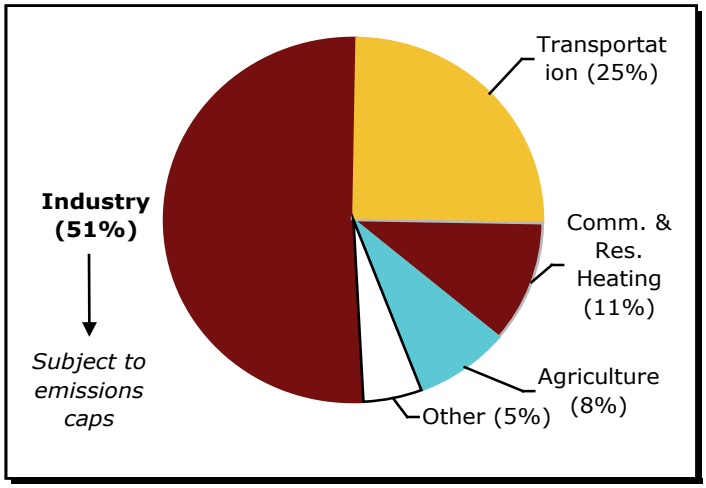
Having much heavier GHG emissions intensities, Saskatchewan, Alberta and New Brunswick could be the biggest buyers of emissions credits, with the Manitoba and Québec economies the most obvious sellers, given their already low emissions intensity and planned expansion of emission-free electricity generation. Provincial regulations could, of course, limit inter-provincial trade in emissions credits.

Emissions Cap Vulnerability by Sector

While the combustion of fossil fuels generates GHG emissions throughout the economy, emissions are heavily skewed to certain industries. The oil and natural gas sector, as well as the utility sector are two of the biggest sources, together accounting for almost 40% of total Canadian emissions. Add in industrial processes, which include emission-intensive metal refining, and the smelting sector and you are talking almost half of total emissions in the country. Those emissions are the prime targets of a Canadian cap and trade system.

Which industries will be the most affected by pricing carbon emissions? An industry's vulnerability to GHG emission caps is not simply a sole function of its absolute emissions or emissions intensity. There are other significant variables that can exacerbate or mitigate carbon risk. One is the ability to pass along the cost of emissions credits to customers as opposed to absorbing that cost in profit margins. For example, the emissions-intensive coal-fired utilities may be in a better position to pass along certain carbon costs than other sectors with less pricing power such as metal refining or oil sands production (Chart 6).

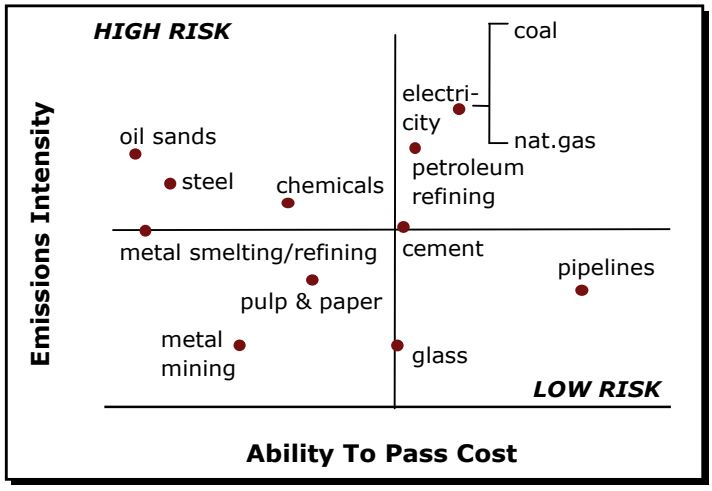
Chart 5
Greenhouse Gas Emissions by Sector, 2004



Source: Environment Canada

Another determinant of carbon vulnerability is the industry's energy intensity. To the extent that carbon emission allowances will raise the price of energy, it will penalize more energy-intensive industries even if they themselves are not major purchasers of emissions credits. The chemical industry is a case in point. Lastly, the ability of firms to abate their emissions through better carbon practices will become increasingly important as the cost of emission allowances rises over time. Abatement can reduce required allowances that might otherwise have to

Chart 6
Emission Intensity vs Ability to Pass Costs



be bought in the open market or create surplus credits that can be sold in the open market.

In order to gain an overall assessment of carbon risk, we have devised a Carbon Cap Composite Vulnerability Index, based on a weighted average of the four measures of carbon vulnerability. Emissions intensity is measured as kilotonnes of emissions of CO_2 equivalent per dollar of output. Energy intensity is measured as terajoule of energy per dollar of output. Ability to pass along carbon costs as well as scope for carbon abatement is based on data obtained from independent consulting sources. We assigned a 30% weighting to emissions intensity and ability to pass costs, while assigning a 25% weighting to scope for abatement and 15% index weighting for energy intensity (Chart 7).

Chart 7
Carbon Risk — CIBC WM Carbon Cap Vulnerability Index

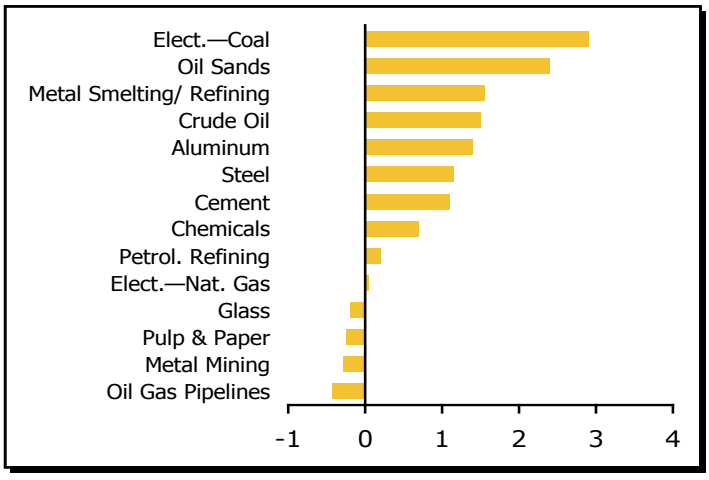
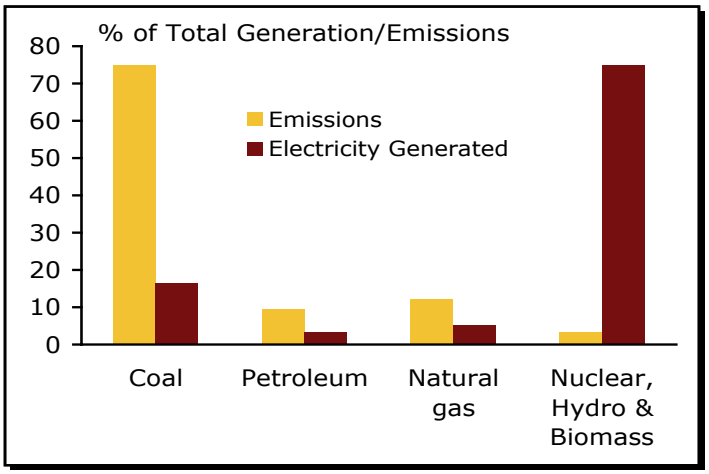


Chart 8
Emission Generation vs GHG Emissions



Coal-Fired Utilities Are Most At Risk

The coal-fired utilities sector tops our vulnerability index as potentially the most exposed sector of the economy to carbon risk, reflecting extremely high emission intensity per megawatt of power produced. While accounting for only 17% of the electricity produced in Canada, coal-fired plants account for over 70% of the emissions from all power utilities in the country (Chart 8). Conversely, roughly 75% of the electric power generated in Canada is done so carbon free, coming from either nuclear or hydroelectric sources.

Carbon pricing will adversely impact the price of coal-fired power compared to other power sources. In the short-run, that could lead to lost power sales to non-regulated commercial and industrial power customers and in the long-run lead to a loss of market share to carbon-free nuclear power generation. Within the industry, carbon pricing should promote more rapid implementation of coal gasification technologies that result in the burning of a much cleaner synthetic gas fuel and which greatly facilitates carbon capture and ultimate sequestration. Ontario's 4,000-megawatt Nanticoke plant on Lake Erie and 2,000-megawatt Sundance generator outside of Edmonton are the two largest coal-fired power plants in the country.

Regionally, how a province generates its electricity is often the single most important determinant of its potential exposure to carbon pricing. With 74% of electricity from coal-fired plants, Alberta's electricity generation profile is one of the most carbon-intensive in the country. Coal-fired utilities are also the predominant source of power in Saskatchewan and Nova Scotia, accounting for at least 60% of provincial electricity generation.

While Ontario relies on coal-fired utilities to provide 18% of its power—including the largest coal-fired plant (and single biggest emitter) in the country in Nanticoke—an even greater reliance on nuclear and hydro helps limit electricity-related emissions. Like hydro, nuclear is essentially a carbon-free source of power. While no new facilities have yet been approved, Ontario is exploring enhanced nuclear capacity over the next decade. Expanding transmission linkages, meanwhile, will facilitate the import of power from neighbouring provinces. That is seen as a potential avenue for lessening Ontario's reliance on coal-fired plants, which currently belch some 30 Mt of GHG emissions into the air—about 15% of total provincial emissions.

New Brunswick also relies on nuclear power to offset the heavy carbon profile of its coal- and petroleum-fueled power operations. The province is currently refurbishing the Point Lepreau nuclear generating station, which will extend the operational life of the station by a quarter century or more.

When it comes to electricity generation, the least exposed provinces to carbon pricing are Québec, Manitoba, Newfoundland & Labrador and British Columbia, all of which rely heavily on emissions-free hydroelectric power—accounting for 88% to 98% of provincial electricity generation (Table 2). The addition of hydro generation capacity will only augment the already-favourable emissions standing of some provinces. In Manitoba, for example, construction of the Wuskwatim generating station (200 megawatts) is underway, with the province also moving forward on the much larger Conawapa station (1,250 megawatts). Québec is accelerating development of its hydro capacity, including work on the 850+ megawatt Eastmain/Sarcelle project, alongside investments in emissions-friendly wind power generation. And Newfoundland & Labrador is embarking on the hydroelectric development of the lower Churchill River, currently pegged at 2,800 megawatts.

Oil Sands Vulnerable, But Higher Crude Prices Important Offset

Next to coal-fired utilities, oil sands producers rank the highest on our vulnerability index. While the oil sands accounted for only 3.5% of Canada's GHG emissions in 2004, some estimates suggest that a virtual doubling in production to 2 million barrels per day will account for over 40% of the growth in national GHG emissions over the balance of the decade. Producing a barrel of synthetic oil from the oil sands releases up to 120 kilograms of CO_2 into the atmosphere, three times the equivalent emissions associated with producing a barrel of conventional oil. The difference owes mainly to the heating requirement that is necessary to separate bitumen from the surrounding tar sands and in particular, from in situ producers with their extensive use of steam.

While oil sands operators have made credible progress at reducing emissions intensity by the equivalent of 2.6% per year over the past decade, these improvements have been overwhelmed by increases in daily production. Hence total emissions have risen sharply and are projected to continue to do so as new mining and in situ operations come on-stream over the next decade. By 2017, planned production increases would push carbon emissions from roughly 30 Mt per year to over 100 Mt per year (Chart 9).

Over time, oil sands operators may be able to improve their carbon risk on two important fronts. As oil sands production becomes more and more important on the margin to world oil supply, producers may be better able to pass on carbon costs to refineries or end users. By 2010, we estimate that oil sands production will replace deepwater wells as the single largest source of new global supply, making oil sands producers effectively the marginal supplier, with resulting pricing power.

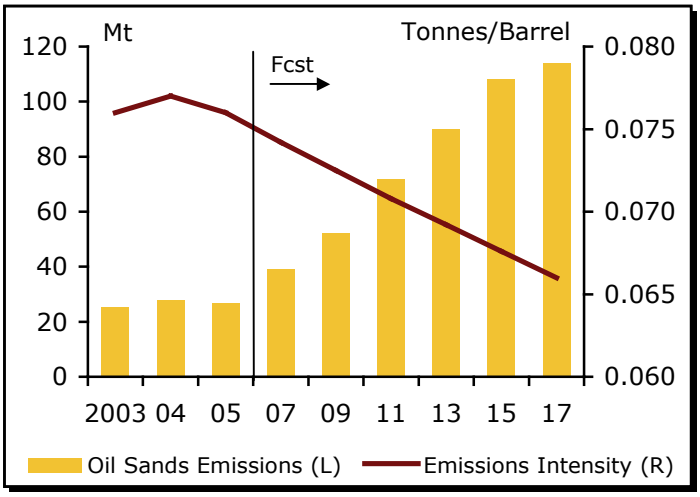
Table 2
Reliance on Coal-Fired Power Increases Vulnerability

National GHG Intensity: g CO_2 eq/kWh >>	Electricity Generation By Source, 2004 (%)						Average Intensity[b]
	Coal 1,010	Petrol. 640	Nat. Gas 523	Nuclear -	Hydro -	Other[a] NA	Cda=100
Prince Edward Island	0	**100**	0	0	0	0	453
Saskatchewan	**63**	0	**21**	0	15	1	393
Alberta	**74**	2	**15**	0	4	**5**	386
Nova Scotia	**60**	**30**	1	0	8	1	340
New Brunswick	14	**40**	5	**21**	15	**5**	173
Ontario	18	1	**7**	**49**	25	1	99
Newfoundland & Labrador	0	4	1	0	**95**	0	14
British Columbia	0	0	7	0	88	**5**	11
Manitoba	1	0	0	0	**98**	0	6
Québec	0	1	0	**3**	**95**	0	3
Canada	**17**	**3**	**5**	**15**	**59**	**2**	**100**

Note: For each category of electricity generation, the three provinces deriving the greatest share of their power from that source are highlighted
[a] Includes biomass, wind, tidal and other refined petroleum product fuels, for which GHG intensity varies
[b] Based on weighted average of emissions intensities for all generating sources, based on reported/estimated results for 2004, indexed to Canada=100

Chart 9

Oil Sands Emissions Projected to More Than Double in the Next Five Years



Source: CIBCWM, Pembina Institute

Secondly, over time, there is significant scope to reduce both the energy and emissions intensity of the oil sands operations with the use of gasification and carbon sequestration technologies, as well as the potential use of nuclear power as a heat source.

Metal Smelting & Refining Disadvantaged

Metal smelting and refining ranks third on our vulnerability index. Not only does the sector rank high in terms of emissions intensity, but activity here is also extremely energy intensive. Energy represents about 30% of the total cost of production, leaving the sector highly vulnerable to the pass-through of carbon costs imposed on energy suppliers. At the same time, most smelters and refiners have little ability to pass along carbon costs to their customers in the form of higher metal prices. And in the short-run at least, the sector will be further disadvantaged by the fact that competing suppliers in the developing world would be outside the initial scope of GHG cap and trade systems. Lastly, opportunities for abatement appear limited.

Chemicals More at Risk from Higher Energy Prices than from Emissions Costs

The chemical industry is likely to be impacted by carbon trading, more through its energy intensity and use of hydrocarbon feedstocks than from its emissions intensity. Companies involved in the production of basic chemicals (e.g., ammonia, nitric acid) account for most of the industry's emissions, but on the whole, the industry is not a major emitter. This is at least in part due to the industry's own voluntary efforts to reduce emissions over the last decade and a half. Emissions per unit of output in the chemical sector have fallen by 1½% per year for the last 15 years. While the industry's self-initiative has been laudable, it at the same time has left very limited opportunities for further carbon abatement. The sector's vulnerability emanates more from its energy intensity and use of hydrocarbon feedstocks, which together can account for as much as 85% of production costs for certain chemicals. Hence carbon-induced increases in energy prices will have a disproportionately large impact on total production costs in the chemical industry.

Table 3

GHG Emissions from Reporting Facilities, 2005

Rank	Company Name	GHG Emissions, Facility Based (2005)				Company Ownership		
From	Parent Company with	Facilities	Emissions	Share	Largest Emissions Source	Publicly Traded		Gov't
1-12	Whole/Part Facility Ownership	#	Mt	%	Facility Name (Mt)	TSX	Other Exch	Enterprise
1	Ontario Power Generation	7	30.6	10.9	Nanticoke Gen. Stn. (17.6)			X
2	TransAlta	6	26.4	9.4	Sundance Gen. Plant (16.2)	X		
3	Canadian Utilities / ATCO[a]	13	15.2	5.4	Sheerness Gen. Stn. (6.5)	X		
4	SaskPower	4	13.2	4.7	Boundary Dam Power Stn. (6.8)			X
5	Imperial Oil	11	12.8	4.6	Cold Lake Oil Sands (4.1)	X		
6	Emera	5	10.6	3.8	Lingan Gen. Stn. (4.4)	X		
7	TransCanada	11	9.8	3.5	Ontario Pipeline System (3.0)	X		
8	EPCOR	2	9.0	3.2	Genesee Thermal Gen. Stn. (8.9)	X		
9	Suncor Energy	2	8.5	3.0	Suncor Oil Sands (7.7)	X		
10	NB Power	4	8.0	2.8	Belledune Gen. Stn. (3.2)			X
11	Shell Canada[b]	11	8.0	2.8	Scotford Upgrader/Cogen. (1.9)		X	
12	Stelco[c]	4	7.0	2.5	Lake Erie Steel (3.6)	X		
SUB-TOTAL: Top 12 Companies		**80**	**159.0**	**56.8**				
TOTAL: All Facilities Reporting		**336**	**279.8**	**100.0**				

[a] Combines emissions for Canadian Utilities (member of ATCO Group) with other ATCO companies; both companies are TSX Composite members

[b] Shell Canada acquired by Royal Dutch Shell, which trades on NYSE and European exchanges

[c] Stelco is TSX listed, but is not a Composite member

Firm Level Details Reveal Heavy Concentration of Emissions

Canada's Greenhouse Gas Emissions Reporting Program details the country's dirtiest facilities. Covering everything from coal-fired generation plants to oil sands upgraders, steel mills to municipal landfills, 336 facilities reported 280 Mt of CO_2-equivalent emissions in 2005. Consistent with the earlier discussion of carbon vulnerability by sector, eight of Canada's top ten facilities for GHG emissions are electricity-generating stations.

Facility emissions comprise effectively one half of the country's total emissions, excluding non-stationary sources tied to transportation. Some 170 companies hold full or partial ownership of reporting facilities, but a core group "owns" the majority of related emissions. The top 12 companies were responsible for 159 Mt of GHG emissions, a 57% share of total facility emissions, qualifying this group as a veritable "dirty dozen" (Table 3).

Not all carbon emitters are in the investment domain. For instance, government claims responsibility for three of the top 12, including the single largest emitter. The rest are publicly traded companies, and most are TSX Composite members. All told, fully one half of the emissions reported in 2005 could be traced back to TSX Composite companies, which together hold a 27% weight in the index. A further 4% of emissions were linked to other TSX listed firms. Publicly traded firms headquartered in the US or overseas held a roughly 20% share of domestic facility emissions, with a similar portion residing in the public sector. Privately owned firms accounted for the rest.

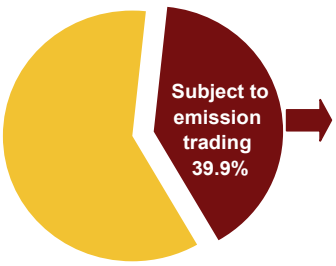
40% of TSX To Be Impacted

We estimate that some 40% of the TSX market capitalization will be directly affected by emissions trading, of which the vast majority will be adversely affected (Chart 10). The domain of the TSX's large emitters is almost exclusively the utilities, energy and materials GICS. While utilities firms hold a mere 1% weight in the index, they account for 45% of emissions linked to TSX firms. That captures a reliance on coal-fired power generation, one of the most carbon-vulnerable activities there is, and supports our recommended underweight for the utilities sector. Carbon vulnerability is not limited to those with ownership interests in high-emissions facilities. But reporting facilities are some of the most easily identifiable emitters in the country, and represent obvious targets when it comes to combating climate change.

The full extent to which corporate valuations will be impacted by carbon risk will depend on the distribution of permits, the initial severity of the emissions caps and the rate at which they are lowered over time. At the end of the day, legislators will determine those parameters. But investors beware: carbon emissions are very soon going to carry a price in the Canadian economy.

Chart 10

40% of TSX Will be Directly Impacted by Emissions Trading



	%	Net Impact
O&G Exploration/Prod.	14.8	-
Integrated O&G	6.7	-
Gold	6.6	-/+
O&G Stg & Transp.	2.6	+
Aluminum	1.9	-
Diversified Metals & Mning	1.5	-/+
Coal & Consum.Fuels	1.4	-
Utilities	1.4	-
Precious Metals/Min.	0.9	+
Steel	0.6	_
O&G Drilling	0.5	_
Commod. Chemicals	0.4	_
Forest Products	0.4	+
O&G Refin'g/Marketing	0.2	-
	39.9	