


# THE WAR ON GLOBAL WARMING

*Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen.*

*The Investment Proposition: If we start investing 1 per cent of our annual global GDP today, we can avoid GDP losses of 5 to 20 percent tomorrow.*

by Toby A.A. Heaps



Lower Ninth Ward, New Orleans, one year after Hurricane Katrina. A 5 or 10 per cent increase in hurricane wind speed, linked to rising sea temperatures, is predicted to approximately double annual damage costs in the US.

**“EVERYBODY TALKS ABOUT THE WEATHER BUT NOBODY DOES ANYTHING ABOUT IT”  
—COMMONLY ATTRIBUTED TO MARK TWAIN, 1897**

**That was true** back in 1897, but not anymore, according to the most recent Intergovernmental Panel on Climate Change (IPCC) report. The report, which is an expert-reviewed synthesis of the most up-to-date scientific research published on climate change from around the world, upped the ante. It concluded that it is “very likely” humans are causing global warming, or, in quantitative terms, more than 90 per cent certain (up from “likely,” or more than 66 per cent certain, in 2001).

So now that we have proved Mark Twain wrong, what are we going to do to fix it?

Most people, from the leader of the Green Party to the chief executive of the Canadian Council of Chief Executives, as well as our current Prime Minister, genuinely agree that it is time to pull back on the high-carbon throttle and carve out a new low-carbon path for our economy.

Just after the IPCC report was released, Prime Minister Harper made clear which path Canada would take: “I think the first realistic step in any such plan will be to try over the next few years to stabilize emissions and obviously over the longer term to reduce them.” A few days later, the usually laissez-faire economist told an audience at the Canadian Club in Ottawa that he was going to crack down on industrial polluters and automakers with tough new regulations, concluding with the high-handed statement, “The era of voluntary compliance is over.”

But when you ask “how fast and at what cost?” the consensus fades fast. Rhetoric enters. Reason leaves. The topic of greenhouse gases leads to vast expulsions of hot air from politicians and pundits. Meanwhile, the climate warms, as carbon dioxide spews out of smokestacks and human-generated toxic emissions singe the hallowed halls of parliament.

On one side, you have the Conservative Minister of Environment John Baird, saying: Whoa, not so fast, “Canadians don’t want the country to face economic collapse.”

On the other, you have Stephane Dion, the Liberal Leader of the Official Opposition, saying: “We will make megabucks by reducing megatonnes [of greenhouse gases].”

They both sound delusional to me.

This is a war, a fight against old wasteful lifestyles and carbon-intensive ways of doing business in order to avert catastrophe and make the world safe through clean economies. Winning this war against greenhouse gases is not about economic boom or bust. It is about re-engineering the DNA of our economy. And like any fundamental change, there will be winners and losers.

Each one of us will have to give something up.

We should not sugarcoat the nature of the existential challenge facing our planet. When Sir Winston Churchill rallied the English-speaking world to defeat the Nazis in WWII, he didn’t talk about seizing export markets and profit-making opportunities. He talked about the high stakes of preserving our civilization against dark forces and the high price, “blood, toil, tears and sweat,” he personally would pay to prevail. Or, as John F. Kennedy might put it, “Ask not what your climate can do for you, but what you can do for your climate.”

It’s true that our economy might reap big dividends from early and accelerated action on implementing low-carbon technologies, efficiency improvements, and conservation measures, but we have to be ready to pay first. Trying to enlist public support with a sugarcoated version of reality is counter-

productive and unnecessary. Who cares if support for action on climate change is a mile wide, but only an inch deep? As soon as gas prices rise, heating bills climb, and a few factories close down or shift their operations abroad, public support will crumble. The talisman of tough action on climate change will turn into a hot potato that no one wants to touch.

The other delusional line of rhetoric, still clouding reality, was originally delivered by former Environment Minister Rona Ambrose. Its can’t-do, won’t-do, won’t-even-try attitude sounds like surrender, and goes something like this: “The Kyoto target is unachievable. We would have to pull every truck and car off the street, shut down every train and ground every plane to reach the Kyoto target negotiated by the Liberals.” This sounds daunting, but the situation is actually more daunting in one sense and less daunting in another. Even if we eliminated all planes, trains, and automobiles, it would not be enough to meet the Kyoto target, if that’s all we did. That’s because planes, trains, and automobiles are relative crumbs making up less than 20 per cent of Canada’s total greenhouse gas emissions. The real emissions action, almost half of the total, is happening at just a few hundred coal-fired power stations and other heavy-industry plants.

The most recent numbers have Canada behind Kyoto targets by 33 per cent (or 195 Mt). A rational person would not cherry-pick a few relatively insignificant crumbs to bear the entire burden, but rather would focus on cranking out 33 per cent emissions savings across the economy, starting with the biggest sources first.

A rational person might also ask, “What’s the rush? Why Canada?” Why Canada, indeed. A one-third reduction is a big chunk to make up in four or five years, and at just two per cent of global greenhouse gas emissions, Canada is not going to make or break the fight against global warming. Aside from honouring our Kyoto commitment and complying with international law, there are two reasons why the world needs Canada to step up to the plate now. Canada is the only country with the wealth, bulging emissions profile, and geological storage capacity to slay the carbon beast. The emis-

**IF SIR WINSTON CHURCHILL WERE ALIVE TODAY...**

**“ We shall fight on the oil patch to capture carbon. We shall fight to contain the industry smokestacks. We shall fight at the tailpipe, and in the jet stream, we shall fight in the shower with low-flow nozzles. We shall never surrender. ”**

## FROM SKEPTIC TO DISCIPLE... ?

Even the right-wing talk show hosts in Alberta have stopped making fun of global warming. Awareness reached a

tipping point when Terence Corcoran's Financial Post editorial lambasted Prime Minister Stephen Harper for being a disciple of Suzukism (as in David Suzuki). This is the same Stephen Harper who once wrote "Kyoto is essentially a socialist scheme

to suck money out of wealth-producing nations." While he is a father of two and a quick study, it's hard to say whether Harper has his heart in this fight to the same degree as someone like Stephane Dion or Green Party Leader Elizabeth May. But he does bring cool rationality to the problem, namely that any attempt to tackle climate change needs to be joined at the hip with progress on environmental near-term tangibles like cleaner water and air. In many cases, making a lower-carbon economy that is more efficient also makes for cleaner air and water, but it is good to be explicit about linking these elements by design. Otherwise, public support in the 100-year-plus battle against dangerous global warming may wane in the absence of tangible relative climate stabilization results in our lifetimes.

## THE ENERGY REVOLUTION

Many economists and members of the financial community think it is wrong to couch the climate change debate in terms of the cost to growth. They see a lot of opportunity in the low-carbon economy, particularly in the energy sector. Tim Bond, global head of asset allocation at Barclays Capital wrote in a recent report that the need to increase energy capacity by 50 per cent by 2035, while simultaneously reducing dependence on hydrocarbons, will spark an "energy revolution," adding "like all historical adoptions of general purpose technologies, the process should prove immensely stimulative to economic growth." Last year's Stern Review concluded that if temperatures rise by five degrees Celsius, 10 per cent of global output could be lost. "All of the historical changes in energy supply—from dung to wood to coal to oil—were stimulative for the economy concerned. Every major technological change was accompanied or followed by faster economic growth," he said.

sions-intensive oil sands are firing forward on a path that will triple production in the next ten years to over 3 million barrels per day. One hundred billion dollars is set to be invested in this energy-hungry sector alone in the next ten years.

This is a building binge. And it is always far cheaper to implement technology while something is being built rather than as a retrofit later, whether it's carbon capture and storage or geothermal steam generation. If Canada's energy-intensive and burgeoning resource-based economy can put the big squeeze on greenhouse gas emissions, it will be a powerful demonstration to the rest of the world.

Show-and-tell is still probably the most effective tool in international diplomacy. On a practical aspect, such a concerted effort by Canada will likely leapfrog the evolution of a range of emissions reductions technologies, including carbon capture and storage, bringing their costs down by a quarter to a half through the focus of our world-class intellectual resources on the oil patch. This advance will have stark implications beyond our borders, especially on battlegrounds where the war against global warming will be won or lost, such as China, where a 600 MW coal-fired power plant is built every two weeks.

**"CLIMATE CHANGE  
IS THE BUSINESS ISSUE  
OF THE 21ST CENTURY."  
—CONSENSUS AT THE  
2006 WORLD ECONOMIC  
FORUM IN DAVOS**

If you believe that we are entering a carbon-constrained world—and there is strong consensus that we are—it doesn't take an entrepreneur to recognize the sheer opportunity for firms and countries that can deliver carbon-reducing solutions. In global commerce, being first on the scene is half the battle.

Trimming one-third off of Canada's greenhouse gas emissions in half a decade is a monumental task. The only modern precedent is Russia, whose post-Communist economic implosion reduced their carbon footprint by 37 per cent, or 1,136 Mt, only ten years after Ronald Reagan's famous Tear down this wall! speech at the Brandenburg Gates in West Germany on July 12, 1987. (Inadvertently, the Gipper was responsible for reducing more greenhouse gases than any US president to date).

Economic implosion would not be most people's first choice for achieving dramatic

greenhouse gas emissions reductions. The better way is to decouple growing greenhouse gas emissions from economic progress. That way, people get to keep or improve their standard of living.

The recipe for achieving this type of low-carbon economy includes three key ingredients: efficiency, technology, and conservation. The trick is where to find a sufficient supply of those ingredients, which, in our case, should be enough for 195 Mt worth of reductions by 2012. The easy, and optimal, answer is to put a price on carbon, and let the economy squeeze out the bad gas through the decentralized magic of the invisible hand.

Alternatively, there is always the old top-down, five-year-plan, central committee way of issuing diktats on targets, dishing out incentives for mixing corn with gasoline, creating umpteen technology funds, and a whole grab bag of other policies aimed at micromanaging the various sectors of the economy. And, oh, by the way, if this approach doesn't work, under the Kyoto Protocol, there is always the make-good option of purchasing billions of dollars worth of hot air from Russia, which seems to undermine President Reagan's legacy in more ways than one.

As far as I can tell, there seems to be a bi-partisan consensus on the top-down approach, minus the Russian hot air, between the former Liberal plan and what the Conservatives are cooking up. While the Harper Government is a late convert to the struggle against global warming, they do seem quite earnest. One of Harper's point people on the climate file told me that there are so many reports coming out on the topic that he has "to keep the frigin' lights on all night just to keep up with them all." As we sat around a cabinet table in Parliament's centre block discussing the Conservative government's profoundly interventionist central plan of sector targets, a technology fund for this, a technology fund for that, and \$5 billion a year to be directed towards emissions reductions, I felt like I was in a Stanley Kubrick movie. I half expected Harper to poke his head in the room, donning a bearskin hat with a hammer and sickle.

Rick Smith from Environmental Defence talks about how Harper, with his strong western base, could pull off a "Nixon in China" by going to Kyoto. Try Moscow, circa 1975 at the politburo central planning committee.

There is a good reason why politicians try to avoid putting a clear substantial price

# POST 2012: THE GLOBAL CARBON TAX

## The goal:

Get a system that both China and the US can accept.



PHOTO: LouLouPhotos

From Nicholas Stern, former chief economist of the World Bank and author of the *Stern Review*, to Joseph Stiglitz and Gregory Mankiw, former chairmen of the Council of Economic Advisers for George W. Bush and Bill Clinton, people who set economic policies with global scope agree that a Global Carbon Tax is the best way to deal with global warming.

The editorial boards of the *Financial Times* and *Economist* magazine also concur.

In a July 2006 survey, research firm GlobeScan put the question: “What is the best tool to reduce emissions?” to its Climate Forum, consisting of sustainability experts and climate change solution providers. The top answer? A carbon tax.

Paul Anderson, CEO of Duke Energy, one of the largest coal power producers in the US, and Lord Ron Oxburgh, former chairman of Royal Dutch Shell PLC, one of the largest oil companies in the world, both are on the public record with strong support for a carbon tax.

Here's why they and many others support the

carbon tax: it puts a clear, predictable price on CO<sub>2</sub>e emissions, and it is less prone to political meddling and favoritism than a cap-and-trade system. In an ideal world, the cap-and-trade system would work best if all the emissions credits were auctioned off, but political pressures to hand out credits to influential economic actors prove too tempting. The other problem with a global system of caps for some countries and none for others (the poor ones who won't agree to caps), as per the Kyoto Protocol, is that it provides incentives for industry to relocate emissions-intensive activity to countries without caps, which is why the US would not have signed Kyoto even had Al Gore won the Presidency in 2000.

A drawback of a carbon tax is that it doesn't provide certainty that a specific absolute level of emissions reductions will be achieved as a theoretical cap does. But it doesn't provide a ceiling, either.

There is emerging global consensus that post-2012, Kyoto's system of divergent national

emissions caps should be and will be replaced with a Global Carbon Tax. Canada doesn't need to wait. Instead, we can blow a lot of wind into the sails of this practical mechanism by successfully implementing a consumer carbon tax and a zero-leakage carbon fee and subsidy program for industry (which amounts to a carbon tax, but has the advantage of keeping the government's hands off the money) immediately (see *Powering Canada's Green Industrial Revolution* on page 52).

Post-2012, the show will go international. Harvard University economist Richard Cooper has described how a Global Carbon Tax would work in his treatise, *Alternatives to Kyoto: the Case for a Carbon Tax*. It starts with the premise that all countries, including key developing countries must be seriously involved in any effective effort to reduce GHG emissions, and also recognizes that it is difficult to imagine a set of effective national quantitative targets that China and the USA could both agree on, to take only the leading emitters among rich and poor countries.

## AN EXCERPT FROM HARVARD UNIVERSITY ECONOMIST RICHARD COOPER'S ALTERNATIVES TO KYOTO: THE CASE FOR A CARBON TAX:

The key alternative, if action to reduce GHG emissions is to be taken, is to focus on level of effort rather than on quantitative targets: concretely, on the introduction, within an internationally agreed framework, of a domestic tax on GHG emissions, revenues to accrue to the government of each country where the emissions occur. The tax would be incremental to existing taxes (and subsidies), including those on fossil fuels, on the grounds that whatever taxes exist were introduced for reasons unrelated to global climate change, that **global climate change is a newly recognized problem for purposes of collective action**, and that all parties should add new incentives for the reduction of emissions.

Many countries would welcome the additional revenue; countries where this is not the case could use the revenues to lower other taxes.

The universal presence of the tax will also avoid geographic relocation of industries to avoid the tax—a potential problem under the Kyoto Protocol and its extensions.

Compliance would be easy to assess. Every

country has a known mechanism for promulgating new tax rates and regulations. We would know whether a country had responded to the international agreement by changing its tax regulations in accordance with it. Administratively, the tax would best be levied at the choke points for fossil fuels: main gas and oil pipelines, or refineries, and main coal shipments by rail or barge, plus allowance for pit-head power production. But this practical detail could be left to each country.

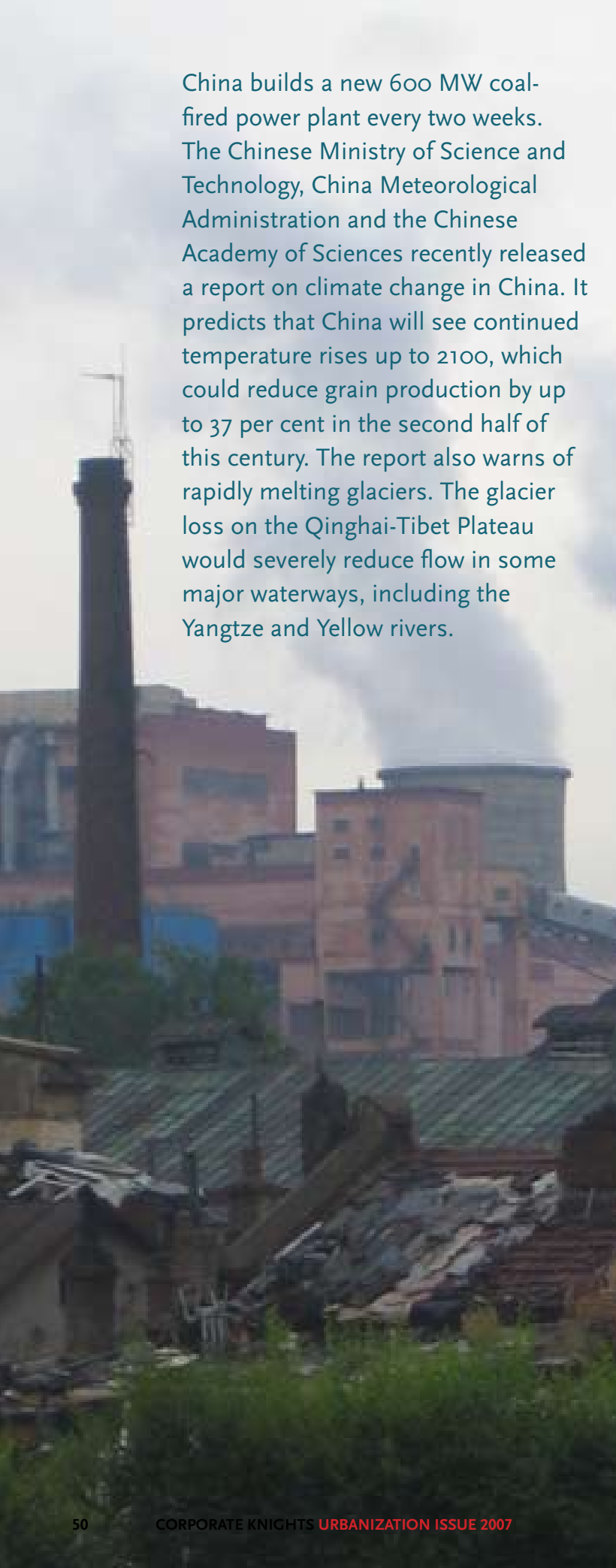
Almost all countries (Cuba, North Korea, Taiwan, and Hong Kong, along with a number of mini-states, are the exceptions) are now members of the International Monetary Fund (IMF), and as such their economic policies, including fiscal policies, are subject to detailed annual surveillance by the IMF staff. Under a carbon tax agreement, the IMF could be asked to pay special attention during these reviews to sources of revenue, and in particular to carbon tax revenues. Each country's revenue books would be open to inspection, and its tax officials available for questioning. Countries' tax systems would

also be monitored to assure that the carbon tax was not nullified by changes in other taxes which indirectly favoured CO<sub>2</sub>-emitting activities. Of course, any country that desired to cheat could do so, but that is a problem with any regime to limit emissions, and many officials would have to be brought into the conspiracy.

Furthermore, physical readings of the largest sources of emissions, such as power plants, could be taken (e.g. by satellite and by on-site inspection) as part of the compliance regime.

Presumptive cases of violation could be referred to special panels, WTO-style, for further investigation and scrutiny.

Publicity would be given to significant violations. Exports from countries with egregious and quantitatively significant violations could, by panel finding, be made subject to countervailing duties by importing countries, even under existing legislation, once the tax on CO<sub>2</sub> emissions was judged internationally to be a cost of business, subsidization of which would be treated as a conventional export subsidy.



China builds a new 600 MW coal-fired power plant every two weeks. The Chinese Ministry of Science and Technology, China Meteorological Administration and the Chinese Academy of Sciences recently released a report on climate change in China. It predicts that China will see continued temperature rises up to 2100, which could reduce grain production by up to 37 per cent in the second half of this century. The report also warns of rapidly melting glaciers. The glacier loss on the Qinghai-Tibet Plateau would severely reduce flow in some major waterways, including the Yangtze and Yellow rivers.

## CANADIAN CARBON LEADERS SMOKING OUT THE ENEMY GASES



Wayne Gretzky skated not to where the puck was, but to where it was going to be. That same sense of foresight drives a surprising number of Canada's billion-dollar companies to take aggressive action on greenhouse gas emissions (GHGs), despite the lack of a federal policy for most of the past decade. Many of these pioneers are counting on, and openly asking for, a clear policy mix of short- and long-term targets with fiscal incentives for reducing GHGs.

Since 1990, **Catalyst Paper**, one of Canada's largest newsprint and specialty paper manufacturers, with annual sales of \$1.86 billion, has slashed its direct CO<sub>2</sub> equivalent emissions by 1 million tonnes (10 times its Kyoto target) from 1,383,000 kg to a 2005 level of 398,000 kg. Over the same period, the company also reports it has improved its carbon intensity (CO<sub>2</sub> equivalent emissions per tonne of paper) by 71 percent, from 574 kg to 166 kg. This massive reduction was achieved by three initiatives: switching from fossil fuels to biomass; efficiency measures such as retiring old, inefficient wood waste boilers; and tracking GHGs monthly so everyone stays on top of the carbon file.

**Alcan** has knocked down its Canadian absolute GHGs by 30 percent since 1990, while increasing production by 50 percent. Globally, the company has reduced total GHG emissions from smelting by 25 percent while ramping up production by 35 percent. The secret to Alcan's success in GHG reduction has been putting the squeeze on PFCs, which are 6,500 times more potent than carbon dioxide.

Although PFCs accounted for about half of all GHG emissions from aluminum smelting as recently as 20 years ago, they were not really on anybody's radar because they were not a controlled substance. Since 1990, Alcan has cut its PFCs from 5.5 kg CO<sub>2</sub> equivalent per tonne of aluminum to 1.1 kg CO<sub>2</sub> equivalent per tonne — an 80 percent improvement — simply by updating its smelting technology. These actions are saving the company substantial energy costs as well. At plants like Alcan Primary Metal-British Columbia or Usine Arvida, the company still has dinosaur smelting technology in place, which in turn explains why over 60 percent of the two plants' CO<sub>2</sub> equivalent emissions — amounting to over 1.6 million tonnes — still come from PFCs. The best-of-class smelting technology that Alcan now possesses through its acquisition of Pechiney in late 2003 virtually eliminates PFCs from the smelting process, emitting a scant 0.02 kg of PFCs per tonne of aluminum. Because it saves energy as well, this "zero anode" technology has captured a dominant position, with 18 percent of the world aluminum smelting market by volume.

Since 2003, **EnCana** has injected about 5 million tonnes of CO<sub>2</sub> into its 50-year-old Weyburn, Saskatchewan, oil field that would otherwise have been vented from a North Dakota coal gasification plant. EnCana plans to inject 30 million tonnes of CO<sub>2</sub> at Weyburn over a 30-year period (equivalent to taking 6.7 million cars off the road for one year). The Weyburn sequestration project, conducted under the auspices of the International Energy Agency, led international scientists to conclude that geological storage of CO<sub>2</sub> can be safe, estimating that 99.8 percent of the CO<sub>2</sub> stored in the Weyburn field will remain underground for at least 5,000 years.

on global warming substances like carbon. It's because carbon pervades our economy like no other substance, and putting a price on it would affect every aspect of our lives, initially by making them more expensive. Anyone who has seen a lineup of cars around the block from a gas station just because gas is one cent cheaper knows how sensitive people are to energy prices.

Is Canada ready for the sacrifice? People with hair growing in their ears say "no," pointing self-assuredly to the short-lived Joe Clark government that went down in defeat trying to implement an increased gas tax, or to the recent Ottawa Mayoral election in which the tax-cutting candidate defeated the one advocating increased investment in public transit.

I think the answer is yes, for three reasons.

Reason one: There is visceral awareness of climate change today. Regardless of scientific analysis, people know something is up when they can go for a jog in their shorts on New Year's Day in Toronto, when the French are frying (to death), and when the Inuit are importing air conditioners to Nunavut.

Reason two: There is mass awareness that we are causing global warming. The media deserves credit here. It's hard to find a magazine, newspaper, radio, or TV news program that isn't running something on global warming these days. And it's not on page 6. Thanks as well to Al Gore who, as my colleague Nicola Ross at Alternatives Magazine pointed out, is a modern-day Rachel Carson. Unlike Carson, who had to rely on typeface and the printed book (*Silent Spring*), Gore has delivered a mass-media bomb with his movie, *An Inconvenient Truth*, thanks to Hollywood and Canadian billionaire Jeff Skoll's financing.

Reason three: Great civilizations achieve their meaning through struggle. No civilization can be great unless it engages in a great struggle. The collapse of communism has left a void (Reagan left his fingerprints all over this file). Chasing down a Saudi sheikh on dialysis in some cave in Central Asia does not even come close to filling this vacuum. Taking down dictators of Middle Eastern states also seems to have its drawbacks. Defeating dangerous climate change and preventing ecological devastation like Hurricane Katrina's demolition of New Orleans is a legitimate ennobling cause that the public, scientists, and business community all support. That's why the environment is polling as the number one issue in Canada right now, above health care.

## NOTHING TO FEAR BUT FEAR ITSELF

So these three forces—wacky weather, awareness that we are the reason for it, and the thirst for a grand cause—have created a public that is culturally ready to enlist in the war on global warming. But this cultural readiness will lay dormant until it is ignited by an economic signal that puts a price on carbon. There is nothing like a little push in the pocketbook to focus the mind on making good.

When I ran the numbers to see how deep we would have to dig to put Canada on an accelerated low-carbon path to Kyoto and beyond, I was staggered at how much it will cost at an aggregate level, but pleasantly surprised to discover how doable it is at an individual and firm level. Putting a clear price on greenhouse gas emissions to achieve a 36 per cent reduction from 2012 BAU levels will involve investing \$100 billion over four years, within the range that the Stern Review says will be necessary to avoid dangerous levels of global warming that could decrease GDP by 5 to 20 per cent.

But when you break it down for a company like Shell, a \$30 per tonne price on CO<sub>2</sub> equivalent emissions (CO<sub>2e</sub>) works out to \$2 per barrel (see Powering Canada's Green Industrial Revolution on page 54), including all direct and indirect emissions, or less than one-tenth the \$25 variation in oil prices over the past six months. For people dependent on coal-fired power plants for their electricity, a \$30 per tonne price on CO<sub>2e</sub> emissions increases the electricity cost by 3 cents per kilowatt hour (kWh) for a single-cycle plant that uses inefficient coal, or 2 cents per kWh if the electricity comes from an efficient coal-integrated gasification combined cycle plant. A \$30 per tonne price on CO<sub>2e</sub> emissions would increase the cost of electricity derived from natural gas by 1 to 1.5 cents per kWh. For drivers at the pump, a \$50 per tonne price on CO<sub>2e</sub> would add an extra cost of 10 cents per litre of gasoline. A \$50 per tonne price on CO<sub>2e</sub> for airplane fuel would boost the cost of a return ticket from Toronto to Vancouver by about \$45.

In the following pages, you will see how much capital would be redeployed for emissions reductions across the economy by putting a clear price on CO<sub>2e</sub> emissions. Some of the emissions reductions targets are ambitious within the 2012 timeframe, according to conventional wisdom. However, tapping Canadians' pride and yearning to do something about global warming with a clear, meaningful price on carbon

## MISSION KYOTO: IMPOSSIBLE?

### CONVENTIONAL WISDOM:

1. Policies are unlikely to have strong immediate effects because it takes time for capital stock to turnover and consumers don't generally reduce demand in response to moderate price increases.
2. Canada is expected to experience significant growth in GHG emissions from sources such as the oil sands (by 36.7 to 42.7 Mt from 2003-2010).
3. A lot of people look at how technologies may reduce emissions, but many technologies and innovations actually increase emissions (like those new kilowatt-hungry plasma TVs).
4. There are many barriers to adopting emerging technologies that reduce energy consumption or GHG emissions, including lack of awareness and access to capital. People may also be afraid of adopting a new and unproven technology.

### CORPORATE KNIGHTS:

It's a good thing that this art-of-the-impossible attitude didn't prevail among the English-speaking world in WWII; otherwise we would all be speaking German right now. The Canadian public is ready for a can-do approach that inspires the art of the possible. Business-as-usual assumptions will get us nowhere in a hurry. An efficient investment of \$100 billion over four years, along with a call to arms that stokes national pride will produce results like no one can predict. Most of the capital stock that cannot be turned over quickly can instead be retrofitted with the amount of money that is harnessed here. I don't buy the argument that it takes 20 years to do anything meaningful. We rapidly re-oriented large parts of our economy into wartime mode in WWII and it didn't take anything close to 20 years, which is a good thing as I find the German accent quite difficult.



PHOTO: Christophe Testi

## TIME TO GET ROLLING

Are we moving forwards or backwards with an economy of waste and hundred-year old combustion technology? The Model T Ford from 1908 got better fuel economy at 25 mpg than today's Ford Explorer, which only manages 16 mpg.

## CHURCHILL ON THE WAR ON GLOBAL WARMING



Arm yourselves and be ye men of valour, and be in readiness for the conflict against global warming gases; for it is better for us to perish in battle than to look upon the outrage of our nation and our altar.

Today we may say aloud before an awe-struck world: We are still masters of our fate. We are still captains of our souls.

Indeed I do not think we should be justified in using any but the most sombre tones and colours while our people, our Empire, and indeed the whole English-speaking world are passing through a dark and deadly valley of hostile climate.

Never give in—never, never, never, never, in nothing great or small, large or petty—never give in except to convictions of honour and good sense. Never yield to force; never yield to the apparently overwhelming might of the climate.

This is a war of unknown warriors; but let all strive without failing in faith or duty, and the dark curse of dangerous global warming will be lifted from our age.

We shall fight on the oil patch to capture carbon. We shall fight to contain the industry smokestacks. We shall fight at the tailpipe, and in the jet stream, we shall fight in the shower with low-flow nozzles. We shall never surrender.

## THE CARBON PLAN How a carbon tax and Carbon Innovation

SECTOR	CARBON FEE/ TAX SCHEDULE PER CO <sub>2</sub> e [a]	CAPITAL REDEPLOYED (2004 base)	2004 SHARE OF GHG EMISSIONS	METHODS FOR ACHIEVING CO <sub>2</sub> e REDUCTIONS
<b>INDUSTRIAL FACILITIES</b>		<b>\$9.6 billion</b>	<b>53.5 %</b>	
Electricity generation	<b>\$30 fee</b>	<b>\$3.8 billion</b>	<b>16.9 %</b>	E2, CCS, CONS, WH, FUG, C-NG, CoGen,
Oil and gas production, transmission and distribution	<b>\$25 blended fee [b]</b>	<b>\$3.9 billion</b>	<b>20.4 %</b>	E2, CCS, FUG, CoGen, BioD, G-Steam, C-Eth
Other industrial facilities	<b>\$15 fee [c]</b>	<b>\$1.8 billion</b>	<b>16.2 %</b>	E2, CoGen, P-Bio, G-Steam
<b>TRANSPORTATION</b>		<b>\$9.1 billion</b>	<b>23.9 %</b>	E2, Auto-Bate, CONS, BioD, C-Eth, A-Bio, Train, Tech-T, RC, D-NG, P-T
Passenger cars and trucks	<b>\$50 carbon tax</b>	<b>\$3.7 billion</b>	<b>9.7 %</b>	
Freight trucks	<b>\$50 carbon tax</b>	<b>\$3.0 billion</b>	<b>7.9 %</b>	
Railways	<b>\$50 carbon tax</b>	<b>\$303 million</b>	<b>0.8 %</b>	
Aviation (domestic)	<b>\$50 carbon tax</b>	<b>\$379 million</b>	<b>1.0 %</b>	
Other transportation (off-road, marine, buses)	<b>\$50 carbon tax</b>	<b>1.7 billion</b>	<b>4.5 %</b>	
<b>BUILDINGS</b>		<b>\$4.1 billion</b>	<b>10.7 %</b>	E2, CONS, Geo, Co-Gen, SwH
Residential buildings	<b>\$50 carbon tax</b>	<b>\$2.2 billion</b>	<b>5.7 %</b>	
Commercial buildings	<b>\$50 carbon tax</b>	<b>\$1.9 billion</b>	<b>5.0 %</b>	
<b>AGRICULTURE (APART FROM ENERGY USE)</b>	<b>\$15 fee</b>	<b>\$830 million</b>	<b>7.3 %</b>	BioD, C-Eth, A-Biogas, CT
<b>LANDFILLS</b>	<b>\$30 fee</b>	<b>\$819 million</b>	<b>3.6 %</b>	Bio-G
<b>OTHER</b>	<b>\$50 carbon tax</b>	<b>\$136 million</b>	<b>0.6 %</b>	
<b>FEDERAL GOV. OPERATIONS</b>	<b>\$30 fee</b>	<b>\$152 million</b>	<b>0.4 %</b>	

Showing the fee/subsidy or carbon tax applied to different sectors of the economy, and the amount of capital redeployed, based on 2004 emissions data. See p. 59 for a legend and description of the methods for achieving CO<sub>2</sub>e reductions.

(CO<sub>2</sub>e) would set forces in play that would massively accelerate conventional wisdom's timetables, especially if cheap capital financing was made available to eliminate one of the key barriers (high up-front capital costs) to implementation of cost-effective emissions reductions measures. Once in place, these measures would bring numerous co-benefits for the environment, health, and bottom line.

Other regulatory measures and incentives—including mandatory fuel efficiency requirements for the auto industry, minimum efficiency standards, technology and implementation funds, ramped up building code requirements, renewable energy portfolio standards and/or feed-in tariffs, and revenue neutral feebates and rebates according to automobile and appliance emissions efficiency—would also add momentum to decarbonize the economy. But everybody who knows the fiscal elements of this issue intimately agrees that these measures would be like planting valuable

seeds in a barren desert unless a meaningful price was first put on carbon (CO<sub>2</sub>e).

Putting a price on carbon (CO<sub>2</sub>e) would be the first step towards a new fiscal framework, referred to as ecological fiscal reform. This shift would internalize externalities by taxing or putting a fee on 'bads' like pollution, while reducing the tax burden on 'goods' such as individual and corporate income as well as payroll taxes.

Even if we did all this, it is possible that we may still fail to meet our 2012 Kyoto cap of reducing emissions by 6 per cent from 1990 levels, but we would have the wheels of the Canadian economy rolling quickly towards decarbonization and nobody could say that we didn't give it a good shot.

To keep our word on Kyoto, we could invest in international renewable energy projects to earn emissions credits (see Alcan solar cooker example on page 56 and [www.cdmgoldstandard.org](http://www.cdmgoldstandard.org)), and then take any remaining shortfall, plus 30 per cent, and add it to our post-2012 target, as is al-

**HOW THE MONEY IS ALLOCATED**

100 per cent of fee goes into facility account at the CIF. Facility has access to 100 per cent of its money in the CIF account for subsidies on CO2e reductions at \$30 per lifecycle CO2e tonne achieved at same facility or new lower carbon electricity installation.
100 per cent of fee goes into facility account at the CIF. Facility has access to 100 per cent of its money in the CIF account for subsidies on CO2e reductions at \$30 (\$15 for refineries) per lifecycle CO2e tonne achieved at same facility.
100 per cent of fee goes into facility account at the CIF. Facility has access to 100 per cent of its money in the CIF account for subsidies on CO2e reductions at \$15 per lifecycle CO2e tonne achieved at same facility.
50 per cent of these funds would be shifted directly in the form of an income tax rebate to the households that reported an income of less than \$80,000, those that would feel the greatest relative impact from increased gas and electricity prices. One-third of the funds, would go to a "Green Vehicle Fund" to provide rebates on purchases of bus passes and to invest in 21st century trucking and railway systems. The remaining sixth of the funds would go towards international renewable energy projects to generate emission credits.
100 per cent goes into a Green Building Fund that would provide zero-interest financing, which would remove the chief obstacle for people to switch from heating oil to geothermal and for commercial buildings to make step-change improvements in their energy efficiency through retrofits, cogeneration, and other efficiency/conservation measures.
100 per cent of fee goes into farm account at the CIF. Farm has access to 100 per cent of its money in the CIF account for subsidies on CO2e reductions at \$15 per lifecycle CO2e tonne achieved at same farm.
100 per cent of fee goes into landfill account at the CIF. Landfill has access to 100 per cent of its money in the CIF account for subsidies on CO2e reductions at \$30 per lifecycle CO2e tonne achieved at same landfill.
100 per cent of fee goes into facility account at the CIF. Facility has access to 100 per cent of its money in the CIF account for subsidies on CO2e reductions at \$30 per lifecycle CO2e tonne achieved at same facility.
100 per cent of fee goes into department's account at the CIF. That specific department has access to 100 per cent of its money in the CIF account for subsidies on CO2e reductions at \$30 per lifecycle CO2e tonne achieved at same department domain.

[a] Price Schedule for CO2e per tonne effective Jan. 1, 2008 to Dec. 31, 2012. The price schedule would be adjusted upward in 2012 to achieve desired emissions results. Estimates suggest the price of CO2e should increase by 1.5 to 3 per cent per year post-2012. [b] Oil and gas production, transmission and distribution are charged \$15 per tonne CO2e for their value-add refining activities and \$30 per tonne for other emissions. [c] Reflects the higher elasticity to energy prices and mobility to flee. This price schedule would redeploy \$70 billion over four years (2008-2012).

**WHY SHOOT FOR 80 PER CENT REDUCTIONS BY 2050?**

The EU supports cuts of heat-trapping gases by developed nations [with mature economies] of 15-30 per cent by 2020 and 60-80 percent by 2050 in order to stabilize atmospheric concentrations at 450 ppmv CO2 equivalent.

It is possible to stabilize concentrations at 450 ppmv if industrialized nations meet the Kyoto targets, global absolute emissions peak between 2010 and 2020, and global absolute emissions decline 1 to 3 per cent each year from 2020 to 2040.

The United Nations Framework Convention on Climate Change states that the objective of the

treaty is "to achieve the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." Stabilizing atmospheric concentrations at 450 ppmv CO2 equivalent provides a medium likelihood (~50%) of staying below 2 C warming. Most models suggest that delaying action would require greater action later for the same temperature target and that even a delay of 5 years could be significant.

Sen. John F. Kerry (D-MS) recently reintroduced legislation with bipartisan support in-

tended to reduce emissions of greenhouse gases to 65 percent below the 2000 levels by 2050

Introduced by Sen. James Jeffords (I-VT) this past summer, The Global Warming Pollution Reduction Act requires, between 2010 and 2020, that the US reduce its emissions to 1990 levels. By 2030, the US must reduce its emissions by 1/3 of 80 percent below 1990 levels; by 2040, emissions must be reduced by 2/3 of 80 percent below 1990 levels; and by 2050, emissions must be reduced to a level that is 80 percent below 1990 levels.

lowed under the Kyoto Protocol, assuming that the post-2012 framework stays with the national cap approach.

Kyoto's 2012 target is not the end. It is not even the beginning of the end. But it is, perhaps, the end of the beginning. Regardless of whether we win the battle to 2012, we must win the war. Canada, with the po-

tential to be a global superpower in clean energy, is well poised to lead the charge. Maybe in 2200, the Chinese head of state will visit Canada's parliament to deliver the message, "Never in the field of global warming was so much owed by so many to so few."

As Churchill might also have said, "Let

us therefore brace ourselves for our global warming duties, and so bear ourselves that if Canada lasts for a thousand years, men will say, 'This was their finest hour.'" **CK**

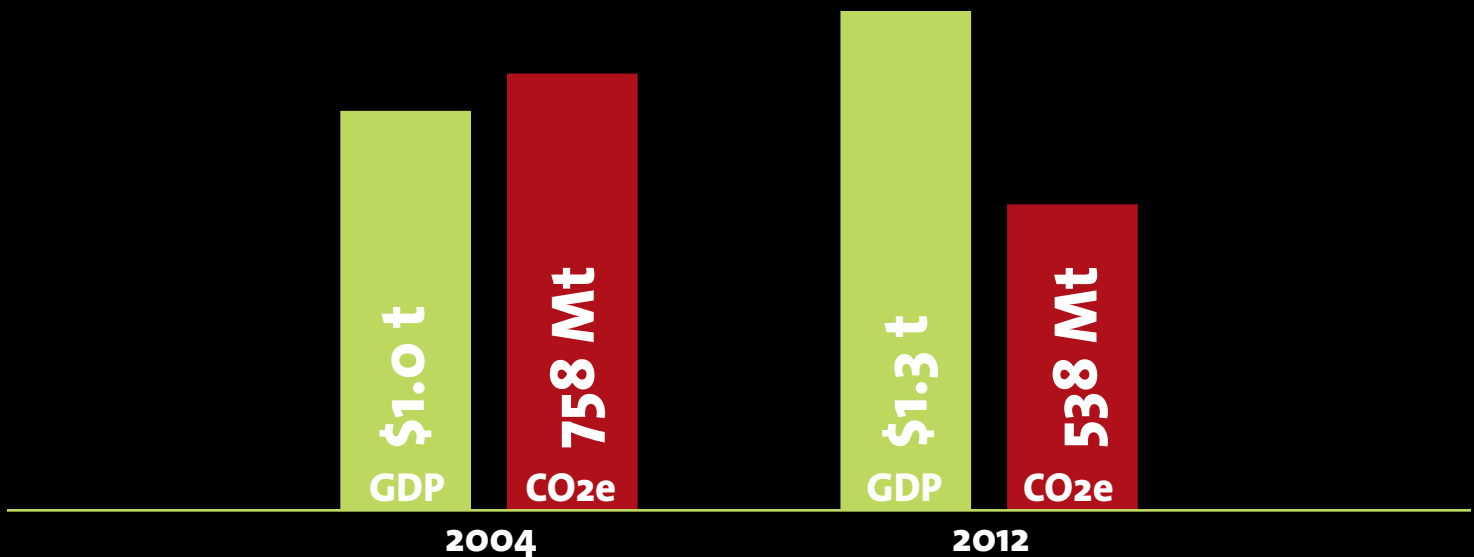
Toby A.A. Heaps is editor-in-chief of Corporate Knights magazine.

# POWERING CANADA'S GREEN INDUSTRIAL REVOLUTION

*The Consumer Carbon Tax & Carbon Innovation Fund Solution:  
A plan to get our CO<sub>2</sub>e emissions down to 538 Mt by 2012*

*Initial investment:  
\$100 billion over the next 4 years*

*The payoff:  
Cut BAU CO<sub>2</sub>e emissions by 36 %, while still growing GDP*



\* Assumes that the initial downpayment, which is actually a redeployment of capital, is a dead-weight loss. Assumes rate of GDP growth extrapolated from 2005 data at 2.8 ppa.

**YOU DON'T WANT TO TAX WHAT CAN EASILY RUN AWAY**

**"IF YOU WANT US TO REDUCE OUR CO<sub>2</sub> INTENSITY, IT'S EASY: WE'LL UPGRADE [THE OIL SANDS CRUDE] ALL IN THE UNITED STATES."**

**—PIERRE ALVAREZ, PRESIDENT OF THE CANADIAN ASSOCIATION OF PETROLEUM PRODUCERS**

**Canadian action on** climate change is unfocused, ineffective, and way too complicated.

There is, however, a straightforward mechanism that would put a substantial cork on our carbon emissions with fairness, predictability, and price certainty in one fell swoop.

It is a simple, yet elegant, consumer carbon tax combined with a Zero-Leakage Carbon Innovation Fund that would harness over \$20 billion per year to pave Canada's path towards a green industrial revolution based on a low-carbon economy to Kyoto and beyond.

First, a basic fact: close to 50 per cent of Canada's total greenhouse gas (GHG) emissions in 2004 resulted courtesy of a relatively small number of actors in Canadian industry—just a few hundred industrial facilities. The majority of these industrial greenhouse gases come from upstream oil and gas (also the fastest-growing portion), which is both profitable and immobile, and from coal-powered electricity generators, which can pass costs onto the end-user through rate increases. Just ten facilities—all oil sands and coal-generated power plants—accounted for 94 megatonnes in 2005, or about one-eighth of Canada's total greenhouse gas emissions [[www.ghgreporting.gc.ca](http://www.ghgreporting.gc.ca)].

A rational plan to reduce emissions should start with the biggest sources. It is much easier to corral emissions from these large facilities than to round up Canada's 18.2 million passenger cars and trucks, accounting for 9.7 per cent of Canada's 2004 GHG emissions.

Here's how it would work: announce the plan in 2007, effective in 2008, that all extractive industry and power-generating large final emitters in Canada will be levied an initial modest (see value of carbon sidebar on page 57) fee of \$30 per tonne of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) emissions and will have access to subsidies of \$30 per tonne of CO<sub>2</sub>e emissions reductions, accompanied by a specific schedule of the CO<sub>2</sub>e emissions price increases over the coming decades.

In order to protect against the unintended effect of driving away energy-intensive,

export-oriented industries, the CO<sub>2</sub>e fee and subsidy schedule will start at \$15 per tonne for the manufacturing sector, a sector which has a high elasticity of demand for electricity (when the price goes up, they figure out a way to become more efficient or switch to a different fuel in a hurry). See the Zero-Leakage Carbon Innovation Fund chart on page 57 for more detail on carbon fee prices by industry. Fifteen dollars per tonne of CO<sub>2</sub>e emissions would be enough to encourage and finance innovation and conservation, but not so much as to drive value-added upgrading and manufacturing companies away. In certain rare cases, however, allowances could be made for rebating carbon fees to energy-intensive exporters from the manufacturing or the pulp and paper sector, if they could prove they were in dire straits because they could not cope with the increase in input costs.

The monies flowing from this fee will be pigeonholed into each facility's individual trust account and managed by the "Carbon Innovation Fund" (CIF). The legal rights to

this money will not belong to the government, but to the facility itself with certain provisions. This will be anathema to the Federal Department of Finance, but they will have to deal with it. The facility will be able to receive subsidies from its portion of the fund (at \$30 per tonne of CO<sub>2</sub>e averted over the project's life) to finance emissions reductions projects at the facility or, in the case of an electricity provider, emissions reductions at the facility or in another in-country form of lower-carbon fully-insurable power generation or green grid extension.

Regarding electricity, it is important that the subsidy only be made available to fully-insurable forms of power generation; otherwise, it would likely be sucked up by nuclear power which already receives large subsidies from the government in the form of accident insurance that the private market is unwilling to provide at an affordable cost.

All emissions reductions financed from a subsidy will have to be verified by the Carbon Innovation Fund economists and in cases where the emissions reductions fall short, the firm will have to pay back the corresponding proportion of the shortfall to the CIF.

To spur investments in emissions reductions in the early stages, all money deposited in the Fund will have to be withdrawn in the form of subsidies within three years of being deposited. This structure will provide a double incentive to companies investing in carbon emissions reductions, in the amount of \$60 per tonne of CO<sub>2</sub>e (the facility gets a \$30 per tonne of CO<sub>2</sub>e subsidy for making the reduction, and saves \$30 per tonne on the carbon fee) over the life cycle of a facility—which makes a host of steep emissions reductions solutions cost effective.

The arrangement will keep the innovation money close to those with the most use for it, provide incentive to invest it in accelerated emissions reductions, and allay concerns about Ottawa dipping its fingers into Alberta's oil-rich kitty. From each according to their GHG emissions, to each according to their GHG reductions.

Large industrial facilities in Canada

## INVESTMENT OR COST?

Do massive reductions in carbon emissions mean a massive economic blow? Not necessarily. The crux of the cost problem is predicting how fast money-saving technical advances might develop in response to a carbon tax or fee or some other form of regulation. Notably, most economic models used today to assess the cost of reducing emissions assume that innovation proceeds at its own pace and cannot be accelerated by policy. Under this assumption, delaying efforts to cut emissions makes sense because it will allow time to develop better technology that will lower the cost of reductions. Under the contrary assumption, innovation responds strongly to price and policy signals. In this case, early policy action on climate change is advantageous, because it would stimulate the innovations that reduce the cost of making large emission reductions.

—World Resources Institute

## STEMMING THE FLOW OF CHEAP ENERGY IMPORTS

As Nobel Laureate Joseph Stiglitz points out, some countries may try to opt out of solving this global problem that requires collective action, getting “an unfair trade advantage because of their cheap energy, but while they get the benefit, the world is paying the price through global warming. This situation is totally unacceptable.” The situation can be dealt, as he suggests, by bringing a WTO case against those countries, charging unfair subsidization, which would likely result in sanctions, including import taxes for energy-intensive products from those countries. “Except in certain limited situations (like agriculture), the WTO does not allow subsidies—obviously, if some country subsidizes its firms, the playing field is not level. A subsidy means that a firm does not pay the full costs of production. Not paying the cost of damage to the environment is a subsidy. In most of the developed countries of the world today, firms are paying the cost of pollution to the global environment, in the form of taxes imposed on coal, oil, and gas. In some ways, the United States should welcome this initiative. It has often complained that one of the problems with the Kyoto Protocol is that there is no enforcement mechanism.”

spewed out 405 million tonnes of Canada’s 758 million tonnes of greenhouse gas output in 2004, which would translate to \$9.55 billion for the Carbon Innovation Fund.

While this sounds like a lot of money, it is only about 5 per cent of the quarter trillion in GDP generated by large final emitters in 2004. The most efficient oil sands producers today generate 1/15th of a tonne of GHGs per barrel of oil including all indirect and indirect emissions, or for a company such as Shell Canada Limited only \$2 per barrel, roughly one-tenth the \$25 variation in crude oil prices over the past six months. As an example, using 2004 numbers, Shell Canada (whose operations include upstream and downstream), would have paid \$206,126,597 based on a blended CO<sub>2e</sub> fee of \$25 per tonne levied on emissions of 8,245,064 tonnes of CO<sub>2e</sub>. This would have represented 16 per cent of the company’s 2004 profits of \$1.286 billion, or 25 cents per share. Of course, it would then be up to Shell how to tap into every cent of this money, deposited at the CIF, to reduce its emissions (and energy costs). That is Zero Leakage in practice.

A key advantage of the Zero-Leakage Carbon Innovation Fund over emissions credits, aside from the hot air that qualifies for credits, is that it takes the government out of deciding who gets how many credits, a process which is rich in rent seeking (i.e. companies lobbying government for bigger allotment of credits). It also does not penalize an early mover like Dofasco with a cap that is lower than their more laggardly competitors who have been biding their time.

The intended effect of the industrial Zero-Leakage Carbon Innovation Fund would be to provide a powerful and clear incentive for polluters to reduce their GHG emissions by 37 per cent from 2012 BAU levels. The annual multi-billion-dollar scale of redirected capital to emissions reductions would put Canada on track to become the world’s superpower in clean energy and decouple the growth of the blossoming oil sands from increasing greenhouse gases.

There’s no reason for the carbon buck to stop solely at industry’s doorstep. Con-

sumers have to do their part, too. Thirty million Canadian consumers are directly responsible for a relatively small portion of Canada’s overall GHGs (passenger cars and trucks and residential homes accounted for 9.7 and 5.7 per cent of total GHG emissions in 2004).

Starting in 2008, a carbon tax of \$50 per tonne of CO<sub>2e</sub> on fuels across the transportation sector (including freight trucks) will generate annual revenues in excess of \$9 billion (based on 2004 levels), and will increase the cost of gasoline by about 10 cents per litre. Half of these funds will be shifted directly in the form of an income tax rebate to the households that reported an income of less than \$80,000, those that will feel the greatest relative impact from increased gas and electricity prices. One-third of the funds, or \$3 billion, will go to a “Green Vehicle Fund” to provide rebates on purchases of bus passes, and 21st century trucking and railway infrastructure. The fuel tax and rebates will provide a double incentive to choose more emissions-friendly modes of transport, like Calgary’s wind-powered LRT.

The above plan will get the country to below 530 Mt by 2012, better than our target of 563 Mt. However, since the Kyoto measurement target is based on a four year average from 2008-2012, Canada will still have an average shortfall of 114 Mt per year, which will cost about \$3 to \$4 billion over four years to shore up.

So, the remaining sixth of the funds from the transportation carbon tax, \$1.5 billion, will go towards international renewable energy projects that generate certified emissions reductions credits, such as distributing solar cookers to rural Indian villages, and carbon capture and storage projects as part of the construction of new Chinese coal plants. These projects will deliver real benefits, burnish Canada’s reputation, and earn the clean development mechanism (CDM) emission credits needed to meet the Kyoto target. Canada will probably need to inject \$10-15 million into the UN CDM bureaucracy for capacity building so that they can process all these extra credits, which will essentially double their current load.

As an example of a potential international renewable energy project, Alcan Inc. makes a weather-resistant bright aluminum sheet that is ideal for solar cookers. Right now, about 2 billion people in developing countries use a wood-burning stove and only 5 million use a solar cooker to cook their food, primarily because they don’t have the capital to buy one, even though it only costs about \$100. Each solar cooker saves roughly 3.5 tonnes of CO<sub>2e</sub> emissions per year compared with a wood-burning stove. With an investment of \$1 billion per year, it will be possible to locally manufacture and distribute 10 million solar cookers annually (requiring 30 to 40 Kt of aluminum) to countries like Indonesia and India. This would earn Canada 35 Mt of CO<sub>2e</sub> emission credits per year. RIM’s Blackberry will no longer be the only Canadian product with an international brand; after four years and 40 million solar cookers cooking meals daily for 400 million people, Canada will be known for the Alcan Solar Cooker—while simultaneously generating annual CO<sub>2e</sub> emissions reduction credits of 140 Mt.

Moving on to our homes and workplaces, a \$50 tax on CO<sub>2e</sub> emissions at the fuel source for direct emissions from residential and commercial buildings will generate about \$4 billion per year based on 2004 numbers. These funds will provide capital for a “Green Building Fund” that gives zero-interest loans to businesses and residents who wish to switch from heating oil to a better alternative such as geothermal or natural gas, and make step-change improvements in energy efficiency through home and commercial building retrofits, cogeneration, and other efficiency/conservation measures.

The key to unlocking latent Canadian innovation coiled up and ready to power a green industrial revolution is a combination of this precision-guided carbon tax and the Zero-Leakage Carbon Innovation Fund. As we prepare for a federal election, this package could set apart the pretenders from the contenders. **CK**

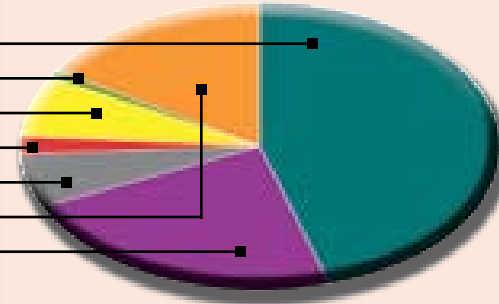
Toby A.A. Heaps is editor-in-chief of Corporate Knights magazine.

# HOW DOES IT APPLY TO YOU?

Using the GHG Calculator at [www.climatechange.gc.ca/calculator/](http://www.climatechange.gc.ca/calculator/) we plugged in the numbers for a single detached 1,800 ft<sup>2</sup> gas-heated home with CAC (built between 1946-1970) for a family of four in Ontario that drives a 1997 Ford Aerostar for 15,000 km/year.

## RESULTS

- Transportation = 46%
- Gardening = <1%
- Appliances = 7%
- Lighting = 2%
- Water Heating = 6%
- Household Waste = 16%
- Heating & Cooling = 23%



**Transportation:** Fuel efficient best-in-class for size you require; Car pool/public transit/bike/skate/walk 1 day/week; Reduce idling time on vehicle from 10 minutes/week to zero; Drive the speed limit (as opposed to 15 per cent over); Use ethanol blended gasoline/biofuel in your vehicle; Maintain the manufacturer's recommended tire pressure of your vehicle.

**Heating and Cooling:** Seal drafts with insulating foam; Draft excluders for power outlets; Geothermal heating and cooling; Green Power; Steel exterior doors; Reduce thermostat 3 degrees in day and 2 degrees at night (winter); Turn AC off when not home; Pipe insulation on runs of pipes passing through unheated spaces.

**Water heating:** Solar water heater.

**Appliances:** Use best available Energy Star appliances; No dishwasher; Use solar dryer (clothes rack);

**Gardening:** Push lawn mower rather than gas; Rake instead of leaf blower; Shovel rather than snow-blower.

**Lighting:** Replace incandescent bulbs with compact fluorescent bulbs in high traffic areas.

**Household Waste:** Reduce garbage from 4 green bags to 1 bag per week through purchase decisions, recycling and compost.

**Recreation:** If you have leisure craft, make sure you have an efficient motor

## POCKETBOOK IMPACT

Are you willing to pay to stop global warming? Here's how much a carbon tax will increase gasoline and electricity prices.

### GASOLINE

Based on \$50 tax per tonne CO<sub>2</sub>e



**10 CENTS PER LITRE**

### ELECTRICITY FROM COAL

Based on \$30 fee per tonne CO<sub>2</sub>e



**3 CENTS PER KWH**

### ELECTRICITY FROM NATURAL GAS

Based on \$30 fee per tonne CO<sub>2</sub>e



**1 CENT PER KWH**

Not as bad as you might think. Electricity prices assume entire CO<sub>2</sub>e fee is passed on to the consumer. Current Toronto electricity RPP rates: 5.5 to 6.4 cents per kWh. In Edmonton, EPCOR provides the RRO price of 8.5 cents per kWh.

## HOW WOULD A ZERO-LEAKAGE CARBON INNOVATION FUND WORK IN PRACTICE?

Ontario Power Generation's (OPG) Nanticoke Generating Station is Canada's number one source of GHGs, emitting 17,629,437 tonnes in 2005. At a price of \$30 per tonne of CO<sub>2</sub>e emissions, Nanticoke would be sending \$528,883,110 to the 'Carbon Innovation Fund' (CIF) this year. After three years, Nanticoke would have paid around \$1.5 billion to the CIF, and could access these funds at any time to invest in power projects that would lower GHG emissions.

OPG could decide to tap this money in a variety of ways: to invest in carbon sequestration and other emission reducing measures or shut down the plant and put the money towards the capital costs of lower-carbon in-country electricity generation (natural gas, wind, hydro, or biomass), with the proviso that it be fully insurable by free market operators and save an equivalent value of carbon over its lifespan.

The number two emitter in 2005 was TransAlta Utilities Corporation's Sundance Generating Plant, emitting 16,181,007 tonnes of GHGs, which would generate \$485,430,208 for the CIF. The number three emitter in 2005 was Syncrude Canada Ltd's Mildred Lake and Aurora North Plant Sites, emitting 10,357,330 tonnes of GHGs, which would generate \$310,719,908 for the CIF.

TransAlta and Syncrude could use the CIF to capture the majority of their GHG emissions at these two facilities, link into the carbon pipeline that Alberta will have up and running in the coming years, inject the GHGs into suitable geological terrain, and pay into an insurance fund to protect against the million-year liability associated with the small chance the carbon may leak out at a quicker rate than 0.2 per cent per 5,000 years. Another option for Syncrude would be to switch to geothermal energy to generate steam. TransAlta could access the CIF to subsidize investments in lower-carbon power projects and cogeneration.

## VALUE OF CARBON

A report from the UK Treasury estimates the social cost of carbon emissions at £70 per tonne of carbon in 2000, going up by £1 per tonne per year. At today's exchange rates and the C to CO<sub>2</sub> conversion factor of 3.67, this translates to a cost of £19 (CDN\$43.50) for CO<sub>2</sub>e emissions in 2000. For those counting, the social cost of CO<sub>2</sub>e in 2007 is \$59.50.

# WEDGES TO TAKE A SLICE OUT OF THE GHG EMISSIONS PIE

These wedges represent Canada's potential CO<sub>2</sub>e emissions reductions resulting from a meaningful price on carbon (see sched., p. 52) with existing technology, and wartime-style mobilization.

Business-as-usual (BAU) projections put Canada on track for 839 Mt of CO<sub>2</sub>e by 2012.\* The below wedges represent mostly proven methods and technologies that are ready to reduce the size of Canada's GHG emissions pie. **With a price on carbon (CO<sub>2</sub>e), these wedges are money-savers.** The below chart is provided for illustrative purposes. Deploying all of the below wedges in Canada over the next 4 years means **investing \$100 billion**, creating **a million new jobs**, and **saving \$200 billion** over the next twenty years. Doing nothing puts us on a course to lose trillions over the long term from climate change.

As a general rule of thumb, \$1 billion of investment in a wedge will produce 2 to 3 Mt of CO<sub>2</sub>e

savings per year for 20 years. At the consumer level, the return is 1 to 2 Mt, at the industrial level it's 3 to 4 Mt, because the emissions are more concentrated. Decentralized renewable energy at the international level nets 4 to 5 Mt. But the cheapest of all is conservation and efficiency, which nets 6 Mt or better. The awesome scale of deploying these wedges means that the government alone cannot succeed without enlisting every single Canadian household and business in this battle. Even then, that will not be enough. With a significant price on carbon, people will see the money-saving logic of the below wedges.

The biggest barrier will be the upfront capital costs today to deploy wedges that will pay for

themselves, but not for several years. The capital raised from the Carbon Innovation Fund and the carbon tax will be in the neighbourhood of \$70 billion over 4 years. The remaining crucial oxygen will have to come from the financial sector in the form of innovative, widespread, and massive schemes to supply sufficient capital to pay for the extra billions of dollars to deploy the money-saving wedges.

The labour will follow the money, and will require nothing short of a major shift of workers into the renewable energy, emissions reductions, carbon storage, and building retrofitting sectors. Call it the 'Green Corps,' and conscription starts today. *Ooh-Rah.*

SAVINGS PROJECTIONS THROUGH USE OF THE WEDGES \*\*

CAT	CODE	WEDGE	2008-09 Mt CO <sub>2</sub> e	2009-10 Mt CO <sub>2</sub> e	2010-11 Mt CO <sub>2</sub> e	2011-12 Mt CO <sub>2</sub> e
<b>BUSINESS-AS-USUAL PROJECTED GHG TOTAL*</b>			<b>803.06</b>	<b>814.73</b>	<b>826.58</b>	<b>838.60</b>
FE	FUG	Reducing fugitive emissions	1.33	2.76	4.30	5.96
DE	CCS	Carbon capture and storage / coal gasification	6.94	13.50	21.95	34.17
	C-NG	Fuel switching from coal to natural gas	2.09	4.18	6.26	8.35
	Geo	Geothermal heating and cooling for buildings	2.15	6.44	10.74	21.48
	CoGen	Cogeneration	4.75	9.64	14.67	21.26
	WH	Renewable energy in south [1]	3.39	6.88	10.48	14.17
	P-Bio	Pulp and paper industry tapping biomass potential	1.25	2.50	3.75	5.00
	G-Steam	Geothermal steam for oil sands and other applications	3.72	10.78	16.17	15.23
	SwH	Solar water heaters	0.40	0.81	1.45	2.10
	DF	BioD	Biodiesel	1.20	2.44	3.72
C-Eth		Cellulosic ethanol	1.64	4.16	7.59	11.98
D-NG		Replacing diesel gas with natural gas	0.80	1.96	3.31	5.53
GC	A-Biogas	Anaerobic digestion for biogas capture from manure	0.54	1.35	2.70	4.32
	Bio-G	Capture of biogas from landfill sites and wastewater-treatment plants	2.31	5.16	8.57	12.08
CT	CT	Conservation tillage	1.21	3.03	5.45	8.47
GM	Train	Greener mobility (long haul truck freight switch to train)	3.05	6.18	8.62	9.94
	AutoBate	Fuel-efficient passenger vehicles driven by feebates and rebates	3.51	3.56	4.51	4.58
	Tech-T	New technologies for trucking sector	2.38	5.63	8.98	11.04
	P-T	Public transport	3.89	4.74	5.61	5.69
<b>SUBTOTAL BEFORE EFFICIENCY AND CONSERVATION</b>			<b>46.54</b>	<b>95.69</b>	<b>148.82</b>	<b>207.63</b>
C	CONS	Conservation [2]	23.83	22.48	21.35	19.88
E2	EE	Energy efficiency (buildings, ind. processing, lighting, electric power plants) [2]	21.98	41.78	59.08	73.33
<b>TOTAL SAVINGS</b>			<b>92.36</b>	<b>160.13</b>	<b>229.24</b>	<b>300.84</b>
<b>FINAL PROJECTED GHG EMISSIONS AFTER WEDGE SAVINGS</b>			<b>710.70</b>	<b>654.61</b>	<b>597.34</b>	<b>537.76</b>
<b>KYOTO TARGET AVERAGE</b>			<b>563.06</b>	<b>563.06</b>	<b>563.06</b>	<b>563.06</b>
<b>GAP</b>			<b>147.64</b>	<b>91.55</b>	<b>34.28</b>	<b>-25.30</b>
<b>OPPORTUNITIES FOR CARBON SINK AND INTERNATIONAL CREDITS (below)</b>			<b>30.00</b>	<b>60.00</b>	<b>100.00</b>	<b>120.00</b>
I-DE	I-RE	International renewable energy projects	5.00	25.00	40.00	50.00
I-DE	I-CCS	International carbon capture and storage	5.00	15.00	40.00	50.00
Sink	CA	Boreal forest conservation areas	20.00	20.00	20.00	20.00

There are a range of other technologies and methods, including fuel cell technology, district heating and hydrogen infrastructure that could be introduced into the wedge mix in the near future, but not likely before 2012 on a substantial scale. Achieving the above emissions reductions would bring Canada's 2012 total CO<sub>2</sub>e emissions to **538 Mt**. However, because the compliance measurement for Kyoto is an average of emissions from 2008 to 2012, Canada would need to make up for a shortfall in reductions of about 62 Mt per year, or a total of 248 Mt. We could do this by implementing international renewable energy and carbon capture and storage projects, and possibly by earning carbon sink credits in return for designating conservation areas in the boreal forest and other parts of Canada, which combined offer emissions reduction potential of 310 Mt.

\* Canada's Emissions Outlook and statements from Prime Minister (2007) that Canada is on track to be 46 per cent above Kyoto target by 2012. This also accounts for BAU oil sands growth of 36.7-42.7 Mt. \*\* Calculations for wedge savings are made on a lifecycle basis and include emissions from deploying the wedges. [1] A Northern Green Power Corridor grid system developed for a post-2012 timeframe could tap 100,000 MW of baseload wind and hydro. [2] To avoid double-counting, efficiency and conservation assumptions are applied to the total after other wedges have been applied.

1990  
599 Mt

- FE** Fugitive Emissions
- DE** Decarbonized Energy
- DF** Decarbonized Fuels
- GC** Gas Capture
- CT** Conservation Tillage
- GM** Greener Mobility
- C** Conservation
- E2** Energy Efficiency

- I-DE** International Decarbonized Energy
- Sink** Carbon Sink

GHG emissions

2004  
758 Mt

2012 BAU  
839 Mt

2012  
538 Mt

FUG	Based on eliminating 10 to 15% of fugitive emissions from the oil and gas industry from 2003 levels. In 2003, the oil and gas industry released 53 Mt of fugitive emissions. Assumes mandatory targets.
CCS	Based on adoption of CCS by 20% of Canada's existing coal-fired electricity plants (with a capture rate of 60 to 75%), 75% of all new oil sands projects (with a capture rate of 60 to 85%) and one-third of all existing oil sands projects (with a capture rate of 40 to 75%). Oil sands development is projected to contribute 41 to 47% (36.7 to 42.7 Mt) of the projected BAU growth in Canada's total annual emissions between 2003 and 2010. According to the Pembina Institute, the oil sands could be made carbon neutral by 2020 for \$2.50 per barrel. SaskPower plans to begin building the world's first virtually emission-free 400 MW coal-fired electricity plant later this year. Assumes regulations requiring all new coal-fired plants to be zero-emissions.
C-NG	Based on converting 20% of the existing coal-fired electricity plants to natural gas. The natural gas-fired generators would be gradually phased out and eventually used only to fulfill peak energy demand, while fully renewable energy sources would be gradually phased in until they could handle the entire load.
Geo	Based on a quarter of residential and commercial buildings converting to geothermal power to satisfy 45 to 75% of their heating and cooling needs. The first to convert would be houses that currently rely on heating oil. This scale of conversion would save people money in the long run, but would require special financing for the initial capital costs. Manitoba Hydro offers homeowners Residential Earth Power Loans of up to \$15,000 to cover the additional cost of installing a geothermal heat pump system as opposed to a conventional heating and cooling system. The maximum term of the loan is 15 years at a fixed interest rate of 6.5%. Since 2002, the number of annual installations of geothermal systems in Manitoba has increased almost 300%.
CoGen	Based on CoGen supplying 30 to 40% of Canada's electricity needs. CoGen currently represents 10% of all European electricity production and over 30% of electricity production in Finland, Denmark and the Netherlands. In Canada, CoGen currently represents just over 6% of national electricity production.
WH	Based on replacing 10% of coal-fired power with baseload wind and hydro power that is within range of existing grids (baseload for wind means 4 times the installed capacity). Assumes implementation of renewable energy portfolio standards/feed-in tariffs. Canada doubled its wind energy capacity in 2006, to 1,460 MW.
P-Bio	Based on the pulp & paper industry powering an additional 35 to 40% of their total operations with biomass energy (converting waste products into heat and energy). The industry currently generates 56% of its own energy using biomass. The biggest barrier to generating all its energy from biomass is the up-front capital costs. FPAC pulp and paper members have already reduced CO <sub>2e</sub> emissions from 9.7 Mt to 5.4 Mt since 1990, improving emissions intensity by 54% along the way (two-thirds of it by switching to biomass).
G-Steam	Based on 10% of current oil sands projects and 50% of future projects producing 70 to 90% of their steam using geothermal processes rather than natural gas. Geothermal power is generated from retrieving heat from deep in the Earth's crust at temperatures of 80 C to 200 C. GeoPower in the Oil Sands, a recently formed consortium including Shell Canada, is currently exploring the potential of geothermal for the oil sands. Post 2012, with rapid technological advances, the size of this wedge could grow substantially.
SWH	Based on 50% of Canadian households (7 million) switching to solar water heaters. Electric water heating accounts for about 10% of total residential electricity use.
BioD	Based on displacing 10 to 15% of current diesel use with biodiesel from efficient sources. Life-cycle GHG emissions of biodiesel from efficient sources such as rapeseed are 50 to 60% lower than those of diesel fuel.
C-Eth	Based on displacing 10 to 15% of gasoline with cellulosic ethanol. Burning cellulosic ethanol produces 85% less greenhouse gas emissions than burning reformulated gasoline. Assumes mandatory percentage requirements for cellulosic ethanol in gasoline. Substantial quantities of straw and other crop residues are already produced in Canada. Manitoba, Saskatchewan and Alberta together produce 40 million tonnes of straw annually. If one-third of this material was used to make fuel, the nation could replace 10% of its gasoline usage.
D-NG	Based on converting one-third of Canada's commercial diesel vehicles to natural gas, reducing GHG emissions by 20 to 25% per conversion. Canadian-based Westport Innovations is a pioneer in this field.
A-Bio-gas	Based on implementing anaerobic digestion to cover 60 to 80% of all large farm manure emissions, for net CO <sub>2e</sub> emissions reductions of 65 to 80%. Livestock manure amounted to 9 Mt of CO <sub>2e</sub> emissions in 2004. On-farm methane recovery can significantly reduce energy bills by providing most, if not all, of the electricity, heating and cooling required by the farm. For economical methane recovery a farm must possess a minimum of about 300 cows or 500 pigs.
Bio-G	Based on capturing 50 to 65% of the CO <sub>2e</sub> emissions released from landfills, which can then be used for electricity generation. Landfills released 27.2 Mt of CO <sub>2e</sub> in 2004. The Climate Change Municipalities Table Options Report confirmed that it is possible to double the amount of landfill gas captured at Canadian landfill sites, from 6 Mt per year of CO <sub>2e</sub> to 12 Mt. This can be doubled with a price on CO <sub>2e</sub> .
CT	Based on reducing CO <sub>2e</sub> emissions through better tillage practices at 60 to 80% of Canadian farms by 20 to 25%.
Train	Based on using trains to ship 25% of shipments usually transported by long-haul trucks. Assumes capital assistance for intermodal investments.
Auto-Bate	Based on applying a revenue-neutral rebate on the most fuel-efficient vehicles in each class and a corresponding feebate (extra fee) on the most inefficient vehicles. Assumes 20 to 25% average improvement in vehicle fuel efficiency of new light-duty vehicles sold in Canada by 2010. Assumes mandatory fuel-efficiency standards on automakers.
Tech-T	Based on implementation of a combination of engine, transmission (not including natural gas conversion), aftermarket and hybrid technologies, as well as improved fleet management to reduce emissions by 25% for two-thirds of the trucking fleet.
P-T	Based on a 5 to 8% increase in public transport utilization (by distance) that displaces trips formerly taken using a private vehicle. Assumes variable and capital investment assistance to increase capacity.
CONS	Based on fuel and electricity prices rising 10 to 20% and a consumer price elasticity of demand for fuel and electricity of 0.15. Although consumers generally don't reduce demand much in the face of moderate price increases, Louise Comeau, one of Canada's top climate change policy minds, points out that consumer response is stronger than the initial price signal if a schedule of price increases is laid out at the beginning.
EE	Based on average 10 to 20% economy-wide efficiency improvements made in response to energy/fuel price increases (not including fuel efficiency improvements on cars and trucks). Assumes minimum standards legislation, including strict residential and commercial building codes for efficiency, and declaring Energy Star the new minimum standard, using the existing National Energy Efficiency Act.
I-RE	Based on implementation of decentralized renewable energy solutions in developing countries that earn Canada 50 to 100 Mt of emissions credits per year by 2012. Ten million solar cookers deployed each year would generate 140 Mt of CO <sub>2e</sub> credits/year by year 4. There are also significant opportunities to use EDC financing and other financial incentives to get Canadian resource companies to implement industrial-scale wind/hydro projects abroad.
I-CCS	Based on leveraging EDC financing to get Canadian companies to implement CCS on all new applicable projects. Also based on Canada partnering with developing countries like China and India to install CCS technology. CCS technology achieves a 75% net CO <sub>2e</sub> emissions reductions when installed at a new 600 MW coal-fired power plant, bringing net emissions down to 3 Mt from 4.5 Mt of CO <sub>2e</sub> . Depending on whether the captured CO <sub>2</sub> is used only for enhanced oil recovery (15) as opposed to injecting it all for pure storage purposes (60), this wedge requires installing CCS at 15 to 60 new 600 MW coal plants over the next 4 to 5 years.
CA	Based on achieving emissions credits for designating two-thirds of the Boreal forest in Canada as a conservation zone. The Canadian Boreal Initiative estimates that the boreal forests in Canada have a net absorption rate of 30 million tonnes CO <sub>2e</sub> per year. Although the boreal is a source of carbon in some years, long-term trends based on 70-year analysis by Kurz and Apps suggest the boreal is a net sink over the long term.

# Greenhouse Gas Report: 50 Largest Emitters by Company, 2005

Source: Corporate Citizen Database™ and Greenhouse Gas Division, Environment Canada.

RANK	CORPORATION NAME	2005 EMISSIONS			2004 EMISSIONS			% INCREASE 2004-2005	REDEPLOYED CAPITAL (CIF)
		FACILITIES	GHG (CO <sub>2</sub> EQ.)	% OF LFE	FACILITIES	GHG (CO <sub>2</sub> EQ.)	% OF LFE		
1	Ontario Power Generation Inc	7	30,629,379	10.95%	7	27,292,451	12.2%	\$918,881,370	
2	Transalta Corporation	6	26,357,769	9.42%	6	27,615,403	-4.6%	\$790,733,081	
3	Canadian Utilities Ltd.	7	14,116,483	5.04%	6	13,948,256	1.2%	\$423,494,486	
4	Saskatchewan Power Corporation	4	13,155,502	4.70%	4	13,669,500	-3.8%	\$394,665,063	
5	Imperial Oil Limited	11	12,760,161	4.56%	11	12,939,012	-1.4%	\$301,829,312	
6	Emera Incorporated	5	10,648,422	3.81%	5	10,570,678	0.7%	\$319,452,647	
7	Transcanada Corporation	11	9,832,260	3.51%	15	8,073,992	21.8%	\$292,957,887	
8	Epcor Power LP	2	8,985,848	3.21%	2	6,898,565	30.3%	\$269,575,450	
9	Suncor Energy Inc.	2	8,524,582	3.05%	2	9,404,098	-9.4%	\$243,285,593	
10	New Brunswick Power Holding Corp.	4	7,974,064	2.85%	4	8,050,000	-0.9%	\$239,221,920	
11	Shell Canada Ltd.	11	7,952,566	2.84%	11	8,245,064	-3.5%	\$185,138,182	
12	Stelco Inc.	4	7,040,693	2.52%	3	7,182,982	-2.0%	\$110,092,458	
13	Petro-Canada	12	6,968,771	2.49%	11	7,112,131	-2.0%	\$156,948,710	
14	Alcan Inc.	13	6,182,661	2.21%	11	5,746,486	7.6%	\$92,739,915	
15	Dofasco Inc.	3	5,430,892	1.94%	3	5,198,096	4.5%	\$94,809,136	
16	Duke Energy Field Services Canada	8	4,983,290	1.78%	8	5,527,510	-9.8%	\$149,498,687	
17	Nova Chemicals Corporation	4	4,752,293	1.70%	4	5,508,971	-13.7%	\$71,284,392	
18	Lafarge Canada Inc	8	4,584,817	1.64%	7	4,490,871	2.1%	\$68,772,259	
19	Irving Oil Limited	2	3,845,946	1.37%	2	3,457,459	11.2%	\$66,180,210	
20	Canadian Oil Sands Trust	2	3,832,212	1.37%	2	3,835,961	-0.1%	\$114,966,366	
21	Algoma Steel Inc.	1	3,758,560	1.34%	1	3,893,110	-3.5%	\$56,378,402	
22	INVISTA (Canada) Company	1	3,003,897	1.07%	1	3,553,896	-15.5%	\$45,058,455	
23	Husky Energy Inc.	7	2,860,845	1.02%	5	2,857,584	0.1%	\$84,224,571	
24	Alcoa	2	2,272,775	0.81%	2	2,072,890	9.6%	\$34,091,621	
25	Agrium Inc.	3	2,100,654	0.75%	3	2,338,309	-10.2%	\$31,509,803	
26	St. Marys Cement inc.	2	2,059,328	0.74%	2	2,130,922	-3.4%	\$30,889,920	
27	St. Lawrence Cement Group Inc.	2	2,036,517	0.73%	2	1,992,366	2.2%	\$30,547,755	
28	Canadian Natural Resources Limited	2	2,005,388	0.72%	2	2,013,489	-0.4%	\$60,161,628	
29	Lehigh Inland Cement Limited	2	1,976,162	0.71%	2	1,819,753	8.6%	\$29,642,435	
30	Dow Chemical Canada Inc.	1	1,606,870	0.57%	1	1,434,027	12.1%	\$24,103,044	
31	Graymont Limited	7	1,527,704	0.55%	7	1,531,286	-0.2%	\$22,915,567	
32	Federated Co-operatives Limited	1	1,370,883	0.49%	1	1,476,158	-7.1%	\$20,563,242	
33	Essroc Canada Inc	1	1,273,739	0.46%	1	1,205,613	5.7%	\$19,106,085	
34	Encana Corporation	6	1,246,976	0.45%	5	1,159,790	7.5%	\$37,409,279	
35	Timminco Limited	2	1,239,452	0.44%	2	1,283,737	-3.4%	\$18,591,777	
36	Carmeuse Lime (Canada) Limited	3	1,233,760	0.44%	3	1,486,640	-17.0%	\$18,506,399	
37	ConocoPhillips Canada	2	1,220,143	0.44%	2	1,303,411	-6.4%	\$36,604,288	
38	Ultramar limitée	1	1,144,960	0.41%	1	1,177,335	-2.7%	\$17,174,407	
39	North Atlantic Refining Ltd.	1	1,140,998	0.41%	1	1,445,729	-21.1%	\$17,114,970	
40	Transalta Power LP	4	1,089,627	0.39%	4	1,140,886	-4.5%	\$32,688,823	
41	Newfoundland and Labrador Hydro	1	1,069,212	0.38%	1	1,300,390	-17.8%	\$32,076,349	
42	Mosaic Canada ULC	2	1,057,390	0.38%	2	1,053,458	0.4%	\$24,361,497	
43	Atco Ltd.	6	1,055,962	0.38%	4	780,188	35.3%	\$31,678,869	
44	Rio Tinto Canaa Inc.	1	1,036,514	0.37%	1	1,129,543	-8.2%	\$31,095,426	
45	Alliance Pipeline Ltd.	2	1,006,177	0.36%	2	980,641	2.6%	\$30,185,320	
46	Calpine Power Income Fund	3	991,578	0.35%	3	1,075,478	-7.8%	\$29,747,343	
47	Nexen Inc.	2	957,396	0.34%	2	1,048,973	-8.7%	\$28,721,891	
48	Maxim Power Corp.	1	919,675	0.33%	1	965,165	-4.7%	\$27,590,255	
49	Abitibi-Consolidated Inc.	6	911,520	0.33%	6	881,458	3.4%	\$17,873,388	
50	Westcoast Energy Inc.	3	880,019	0.31%	2	750,077	17.3%	\$26,400,579	
<b>TOTALS FOR THE TOP 50</b>		<b>204</b>	<b>244,613,292</b>	<b>87.43%</b>	<b>196</b>	<b>242,049,788</b>	<b>2.60%</b>	<b>\$6,251,540,512</b>	

## LEGEND:

% of LFE: Percent share of GHGs emitted by all Large Final Emitters that report to the GHG Emission Reporting Program ([www.ghgreporting.gc.ca](http://www.ghgreporting.gc.ca)). Capital Redeployed to the Carbon Innovation Fund under the carbon plan is in millions of dollars, based on each company's 2005 emissions. Emissions data is given in tonnes CO<sub>2</sub>e.

# Greenhouse Gas Report: 50 Largest Increasers by Company, 2005

Source: Corporate Citizen Database™ and Greenhouse Gas Division, Environment Canada.

RANK	CORPORATION NAME	2005 FACILITIES	2005 EMISSIONS GHG (CO <sub>2</sub> EQ.)	% OF LFE	2004 FACILITIES	2004 EMISSIONS GHG (CO <sub>2</sub> EQ.)	INCREASE 2004-2005	REDEPLOYED CAPITAL (CIF)
1	Ontario Power Generation Inc	7	30,629,379	10.95%	7	27,292,451	<b>3,336,928</b>	\$918,881,370
2	Epcor Power LP	2	8,985,848	3.21%	2	6,898,565	<b>2,087,283</b>	\$269,575,450
3	Transcanada Corporation	11	9,832,260	3.51%	15	8,073,992	<b>1,758,268</b>	\$292,957,887
4	Alcan Inc.	13	6,182,661	2.21%	11	5,746,486	<b>436,175</b>	\$92,739,915
5	Irving Oil Limited	2	3,845,946	1.37%	2	3,457,459	<b>388,487</b>	\$66,180,210
6	Atco Ltd.	6	1,055,962	0.38%	4	780,188	<b>275,774</b>	\$31,678,869
7	Dofasco Inc.	3	5,430,892	1.94%	3	5,198,096	<b>232,795</b>	\$94,809,136
8	Manitoba Hydro	1	588,018	0.21%	1	357,649	<b>230,369</b>	\$17,640,554
9	Alcoa	2	2,272,775	0.81%	2	2,072,890	<b>199,885</b>	\$34,091,621
10	Dow Chemical Canada Inc.	1	1,606,870	0.57%	1	1,434,027	<b>172,842</b>	\$24,103,044
11	Canadian Utilities Ltd.	7	14,116,483	5.04%	6	13,948,256	<b>168,227</b>	\$423,494,486
12	Lehigh Inland Cement Limited	2	1,976,162	0.71%	2	1,819,753	<b>156,409</b>	\$29,642,435
13	Simplot Canada Limited	1	838,395	0.30%	1	694,692	<b>143,703</b>	\$12,575,922
14	PCI Chemicals Canada	2	301,356	0.11%	1	164,859	<b>136,498</b>	\$4,520,345
15	Westcoast Energy Inc.	3	880,019	0.31%	2	750,077	<b>129,942</b>	\$26,400,579
16	Elkem Métal Canada	1	124,862	0.04%	1	121	<b>124,741</b>	\$1,872,930
17	Irving Paper Limited	2	225,620	0.08%	1	121,769	<b>103,851</b>	\$5,200,157
18	Lafarge Canada Inc	8	4,584,817	1.64%	7	4,490,871	<b>93,947</b>	\$68,772,259
19	Hydro Aluminium Canada and Co. Ltd.	1	179,139	0.06%	1	89,709	<b>89,430</b>	\$2,687,092
20	Aluminium Austria Metall (Québec) Inc.	1	179,139	0.06%	1	89,709	<b>89,430</b>	\$2,687,092
21	Encana Corporation	6	1,246,976	0.45%	5	1,159,790	<b>87,186</b>	\$37,409,279
22	Emera Incorporated	5	10,648,422	3.81%	5	10,570,678	<b>77,743</b>	\$319,452,647
23	Sherritt International Corporation	2	347,222	0.12%	1	275,580	<b>71,642</b>	\$6,232,053
24	Northland Power Income Fund	3	359,899	0.13%	3	290,099	<b>69,800</b>	\$10,796,975
25	Essroc Canada Inc	1	1,273,739	0.46%	1	1,205,613	<b>68,126</b>	\$19,106,085
26	Japan Canada Oil Sands Limited	1	230,082	0.08%	1	165,208	<b>64,874</b>	\$6,902,460
27	Albecour inc	1	116,441	0.04%	1	58,311	<b>58,130</b>	\$1,746,610
28	City of Calgary	1	170,687	0.06%	1	121,779	<b>48,908</b>	\$5,120,610
29	Wabush Resources Inc.	2	187,039	0.07%	1	139,279	<b>47,760</b>	\$5,611,170
30	Weyerhaeuser Company	4	654,644	0.23%	4	607,641	<b>47,003</b>	\$9,819,657
31	St. Lawrence Cement Group Inc.	2	2,036,517	0.73%	2	1,992,366	<b>44,151</b>	\$30,547,755
32	Orica Canada Inc	1	756,112	0.27%	1	714,530	<b>41,582</b>	\$11,341,673
33	Fraser Papers Inc.	2	332,656	0.12%	2	299,811	<b>32,845</b>	\$4,989,838
34	Columbian Chemicals Canada Ltd.	1	217,292	0.08%	1	185,143	<b>32,149</b>	\$3,259,380
35	Canfor Corporation	2	260,777	0.09%	2	228,805	<b>31,972</b>	\$3,911,662
36	Labrador Iron Ore Royalty Income Fund	1	172,077	0.06%	1	140,425	<b>31,652</b>	\$5,162,304
37	Fording Canadian Coal Trust	4	767,392	0.27%	4	735,791	<b>31,600</b>	\$23,021,748
38	Marubeni Metal & Minerals (Canada) Inc.	1	62,699	0.02%	1	31,398	<b>31,301</b>	\$940,482
39	Abitibi-Consolidated Inc.	6	911,520	0.33%	6	881,458	<b>30,062</b>	\$17,873,388
40	Alliance Pipeline Ltd.	2	1,006,177	0.36%	2	980,641	<b>25,536</b>	\$30,185,320
41	MEGlobal Canada Inc.	2	500,126	0.18%	2	478,572	<b>21,554</b>	\$7,501,885
42	ExxonMobil	1	243,297	0.09%	1	225,909	<b>17,388</b>	\$7,298,917
43	Devon Canada Corporation	1	148,148	0.05%	1	131,473	<b>16,675</b>	\$4,444,449
44	Wabush Iron Co. Ltd.	1	149,142	0.05%	1	134,305	<b>14,837</b>	\$4,474,272
45	Apache Canada Ltd.	1	144,724	0.05%	1	132,234	<b>12,490</b>	\$4,341,706
46	Investment Saskatchewan	1	480,866	0.17%	1	468,851	<b>12,015</b>	\$7,212,996
47	City of Winnipeg, Water & Waste Dept.	2	507,447	0.18%	2	497,549	<b>9,898</b>	\$15,223,410
48	Pengrowth Energy Trust	2	253,161	0.09%	2	245,920	<b>7,241</b>	\$7,594,825
49	Cabot Canada Limited	1	231,735	0.08%	1	226,547	<b>5,188</b>	\$3,476,029
50	KRONOS Canada, Inc.	1	185,295	0.07%	1	180,838	<b>4,457</b>	\$2,779,430

# Greenhouse Gas Report: 50 Largest Emitters by Facility

Source: Corporate Citizen Database™ and Greenhouse Gas Division, Environment Canada.

RANK	FACILITY NAME	LOCATION	PROV.	REPORTING COMPANY
1	Nanticoke Generating Station	Nanticoke	ON	Ontario Power Generation
2	Sundance Generating Plant	Duffield	AB	TransAlta Utilities Corporation
3	Mildred Lake and Aurora North Plant Sites	Fort McMurray	AB	Syncrude Canada Ltd.
4	Genesee Thermal Generating Station	Warburg	AB	EPCOR Power Development Corporation
5	Lambton Generating Station	Courtright	ON	Ontario Power Generation
6	Suncor Energy Inc. Oil Sands	22 km NE of Fort McMurray	AB	Suncor Energy Inc. Oil Sands
7	Boundary Dam Power Station	Estevan	SK	Saskatchewan Power Corporation
8	Sheerness Generating Station	Hanna	AB	Alberta Power (2000) Ltd.
9	Keephills Generating Plant	Duffield	AB	TransAlta Utilities Corporation
10	Battle River Generating Station	Forestburg	AB	Alberta Power (2000) Ltd.
11	Dofasco Hamilton	Hamilton	ON	Dofasco Inc
12	Lingan Generating Station	Lingan	NS	Nova Scotia Power Incorporated
13	Cold Lake	Bonnyville	AB	Imperial Oil Resources
14	Poplar River Power Station	Coronach	SK	Saskatchewan Power Corporation
15	Algoma Steel Inc	Sault Ste Marie	ON	Algoma Steel Inc
16	Lake Erie Steel (formerly Stelco Lake Erie)	Walpole Township	ON	Stelco Inc
17	Refinery	Saint John	NB	Irving Oil Limited - Refining Division
18	Belledune Generating Station	Belledune	NB	NB Power Generation Corporation
19	Hamilton Steel (formerly Stelco Hamilton)	Hamilton	ON	Stelco Inc
20	NOVA Chemicals Corporation (Joffre)	Red Deer	AB	NOVA Chemicals Corporation
21	TransCanada Pipeline System, Ontario	Kenora	ON	TransCanada Pipelines Ltd.
22	INVISTA (Canada) Company- Maitland Site	Maitland	ON	INVISTA (Canada) Company
23	Coleson Cove Generating Station	Saint John	NB	NB Power Coleson Cove Corporation
24	TransCanada Pipeline System, Alberta	Fairview	AB	Nova Gas Transmission Ltd.
25	Wabamun Generating Plant	Wabamun	AB	TransAlta Utilities Corporation
26	Trenton Generating Station	Trenton	NS	Nova Scotia Power Incorporated
27	Scotford Upgrader and Upgrader Cogeneration	Fort Saskatchewan	AB	Shell Canada Limited
28	Point Aconi Generating Station	Point Aconi	NS	Nova Scotia Power Incorporated
29	Wolf Lake/Primrose Thermal Operation	Bonnyville	AB	Canadian Natural Resources Limited
30	Shand Power Station	Estevan	SK	Saskatchewan Power Corporation
31	Aluminerie de Baie-Comeau	Baie-Comeau	QC	Alcoa Limitée
32	Sarnia Refinery Plant	Sarnia	ON	Imperial Oil
33	TransCanada Pipeline System, Saskatchewan	Burstall	SK	TransCanada Pipelines Ltd.
34	Fort Nelson Gas Plant	Fort Nelson	BC	Duke Energy Gas Transmission
35	Dalhousie Generating Station	Dalhousie	NB	NB Power Generation Corporation
36	Western Canada Operations	Fort Saskatchewan	AB	Dow Chemical Canada Inc.
37	Edmonton Refinery	Edmonton	AB	Petro-Canada
38	St. Marys Cement Bowmanville	Bowmanville	ON	St. Marys Cement Inc.
39	NOVA Chemicals - Corunna Site	Corunna	ON	NOVA Chemicals (Canada) Ltd.
40	Alcan Inc - Kitimat works	Kitimat	BC	Alcan Inc 1188 Sherbrooke Ouest Montreal H3A3G2
41	Canadian Fertilizers Limited	Medicine Hat	AB	Canadian Fertilizers Limited
42	Strathcona Refinery	Edmonton	AB	Imperial Oil Limited
43	CCRL/NEI Refinery-Upgrader Complex	Regina	SK	Consumers' Co-operative Refineries Limited
44	Montreal East Refinery	Montreal	QC	Shell Canada Products
45	Nanticoke Refinery	Nanticoke	ON	Imperial Oil
46	Tufts Cove Generating Station	Dartmouth	NS	Nova Scotia Power Incorporated
47	Muskeg River Cogeneration Power Plant	Fort McMurray	AB	ATCO Power Canada Ltd.
48	Picton Plant	Picton	ON	Essroc Canada Inc
49	Sarnia Regional Cogeneration Plant	Sarnia	ON	TransAlta Energy Corporation
50	Mississauga Plant	Mississauga	ON	St. Lawrence Cement Inc.

## LEGEND:

% of LFE: Percent share of GHGs emitted by all Large Final Emitters that report to the GHG Emission Reporting Program ([www.ghgreporting.gc.ca](http://www.ghgreporting.gc.ca)). The Fee/Subsidy refers to the rate corresponding to the facility's NAICS category, according to the carbon plan (see page 52) based on each facility's 2005 emissions. Capital Redeployed to the Carbon Innovation Fund under the carbon plan is in millions of dollars. Emissions data is given in tonnes CO<sub>2</sub>e.

% OF LFE	NAICS6 CODE	NAICS CATEGORY	2005 EMISSIONS GHG (CO2 EQ.)	2004 EMISSIONS GHG (CO2 EQ.)	% INCREASE 2004-2005	FEE/ SUBSIDY	REDEPLOYED CAPITAL (CIF)
6.30%	221112	Fossil-Fuel Electric Power Generation	17,629,437	14,715,952	19.8%	\$30.0	\$528.9
5.78%	221112	Fossil-Fuel Electric Power Generation	16,181,007	16,463,579	-1.7%	\$30.0	\$485.4
3.70%	211114	Non-Conventional Oil Extraction	10,357,330	10,367,463	-0.1%	\$30.0	\$310.7
3.20%	221112	Fossil-Fuel Electric Power Generation	8,949,492	6,792,442	31.8%	\$30.0	\$268.5
3.12%	221112	Fossil-Fuel Electric Power Generation	8,738,072	7,208,141	21.2%	\$30.0	\$262.1
2.75%	211114	Non-Conventional Oil Extraction	7,694,458	8,599,254	-10.5%	\$30.0	\$230.8
2.41%	221112	Fossil-Fuel Electric Power Generation	6,751,088	6,570,850	2.7%	\$30.0	\$202.5
2.33%	221112	Fossil-Fuel Electric Power Generation	6,522,557	6,639,622	-1.8%	\$30.0	\$195.7
2.20%	221112	Fossil-Fuel Electric Power Generation	6,143,809	6,032,213	1.8%	\$30.0	\$184.3
1.96%	221112	Fossil-Fuel Electric Power Generation	5,498,404	5,185,675	6.0%	\$30.0	\$165.0
1.62%	331110	Iron and Steel Mills and Ferro-Alloy Manufacturing	4,541,174	4,863,485	-6.6%	\$15.0	\$68.1
1.59%	221112	Fossil-Fuel Electric Power Generation	4,442,966	4,496,941	-1.2%	\$30.0	\$133.3
1.48%	211114	Non-Conventional Oil Extraction	4,128,065	4,174,980	-1.1%	\$30.0	\$123.8
1.47%	221112	Fossil-Fuel Electric Power Generation	4,117,314	4,401,400	-6.5%	\$30.0	\$123.5
1.34%	331110	Iron and Steel Mills and Ferro-Alloy Manufacturing	3,758,560	3,893,110	-3.5%	\$15.0	\$56.4
1.28%	331110	Iron and Steel Mills and Ferro-Alloy Manufacturing	3,575,266	3,488,631	2.5%	\$15.0	\$53.6
1.17%	324110	Petroleum Refineries	3,279,878	3,264,271	0.5%	\$15.0	\$49.2
1.14%	221112	Fossil-Fuel Electric Power Generation	3,188,245	3,090,000	3.2%	\$30.0	\$95.6
1.13%	331110	Iron and Steel Mills and Ferro-Alloy Manufacturing	3,166,622	3,470,509	-8.8%	\$15.0	\$47.5
1.09%	325110	Petrochemical Manufacturing	3,049,253	3,195,293	-4.6%	\$15.0	\$45.7
1.08%	486210	Pipeline Transportation of Natural Gas	3,032,974	2,148,538	41.2%	\$30.0	\$91.0
1.07%	325190	Other Basic Organic Chemical Manufacturing	3,003,897	3,553,896	-15.5%	\$15.0	\$45.1
1.04%	221112	Fossil-Fuel Electric Power Generation	2,918,154	3,000,000	-2.7%	\$30.0	\$87.5
0.82%	486210	Pipeline Transportation of Natural Gas	2,282,656	2,179,577	4.7%	\$30.0	\$68.5
0.78%	221112	Fossil-Fuel Electric Power Generation	2,183,399	3,190,437	-31.6%	\$30.0	\$65.5
0.72%	221112	Fossil-Fuel Electric Power Generation	2,028,040	2,142,006	-5.3%	\$30.0	\$60.8
0.69%	211114	Non-Conventional Oil Extraction	1,932,046	2,016,452	-4.2%	\$30.0	\$58.0
0.67%	221112	Fossil-Fuel Electric Power Generation	1,882,861	1,439,347	30.8%	\$30.0	\$56.5
0.67%	211114	Non-Conventional Oil Extraction	1,880,603	1,896,050	-0.8%	\$30.0	\$56.4
0.66%	221112	Fossil-Fuel Electric Power Generation	1,851,462	2,226,250	-16.8%	\$30.0	\$55.5
0.66%	331313	Primary Production of Alumina and Aluminum	1,833,958	1,639,036	11.9%	\$15.0	\$27.5
0.61%	324110	Petroleum Refineries	1,715,193	1,675,863	2.3%	\$15.0	\$25.7
0.58%	486210	Pipeline Transportation of Natural Gas	1,628,488	1,083,406	50.3%	\$30.0	\$48.9
0.58%	213118	Services to Oil and Gas Extraction	1,623,028	1,898,625	-14.5%	\$30.0	\$48.7
0.58%	221112	Fossil-Fuel Electric Power Generation	1,617,665	1,690,000	-4.3%	\$30.0	\$48.5
0.57%	325190	Other Basic Organic Chemical Manufacturing	1,606,870	1,434,027	12.1%	\$15.0	\$24.1
0.55%	324110	Petroleum Refineries	1,533,512	1,399,234	9.6%	\$15.0	\$23.0
0.53%	327310	Cement Manufacturing	1,496,312	1,576,809	-5.1%	\$15.0	\$22.4
0.53%	325110	Petrochemical Manufacturing	1,487,810	1,994,812	-25.4%	\$15.0	\$22.3
0.52%	331313	Primary Production of Alumina and Aluminum	1,457,641	1,471,931	-1.0%	\$15.0	\$21.9
0.51%	325313	Chemical Fertilizer (except Potash) Manufacturing	1,436,568	1,619,815	-11.3%	\$15.0	\$21.5
0.49%	324110	Petroleum Refineries	1,374,102	1,499,694	-8.4%	\$15.0	\$20.6
0.49%	324110	Petroleum Refineries	1,370,883	1,476,158	-7.1%	\$15.0	\$20.6
0.47%	324110	Petroleum Refineries	1,319,952	1,231,625	7.2%	\$15.0	\$19.8
0.47%	324110	Petroleum Refineries	1,305,998	1,220,329	7.0%	\$15.0	\$19.6
0.46%	221112	Fossil-Fuel Electric Power Generation	1,286,456	1,322,815	-2.7%	\$30.0	\$38.6
0.46%	221112	Fossil-Fuel Electric Power Generation	1,285,325	1,152,866	11.5%	\$30.0	\$38.6
0.46%	327310	Cement Manufacturing	1,273,739	1,205,613	5.7%	\$15.0	\$19.1
0.45%	221112	Fossil-Fuel Electric Power Generation	1,271,501	1,326,222	-4.1%	\$30.0	\$38.1
0.44%	327310	Cement Manufacturing	1,231,209	1,178,549	4.5%	\$15.0	\$18.5

The top 10 facilities (not companies) account for over 11 per cent of Canada's total GHG emissions, or more than that of all passenger cars and trucks combined.



# RECYCLE HEAT INTO ELECTRICITY

Combined Heat and Power Plants are the 'Blue Box' for Energy

**We're all familiar** with the Three Rs as they apply to waste management, but they're just as relevant to managing energy use.

Reduce—the first R—includes the many unglamorous, yet effective ways to cut energy bills and pollution through enhanced energy efficiency and conservation. With Canada ranked 27th out of 29 OECD countries in terms of energy efficiency, we obviously have a lot of room for improvement. But that will not be enough.

Fortunately, there's an energy equivalent of the 'Blue Box' recycling program that reuses (the second R) the heat currently discarded as waste and recycles it (the third R) into useful energy. Just as Blue Boxes reduce landfill loads, combined heat and power (also known as cogeneration) plants can capture and recycle heat that's currently wasted in electricity generating stations, factories, offices and homes. The plants then use this heat for industrial processes, to heat water or buildings, or even cool them (using steam-powered chillers).

The potential is huge. An Ontario Ministry of Energy study shows that more than half of the province's electricity needs could be met through such plants at existing sites.

Most people are surprised to learn that more than two thirds of the energy in the fuel that goes into conventional electricity generating stations (like coal plants) disappears up the stack as waste heat or is lost in the transmission line, benefiting no one. And most industrial facilities such as steel mills, refineries, sewage treatment plants—and even commercial and industrial facilities like shopping malls, hospitals and office towers—burn large amounts of fossil fuels for heat, yet simply throw away the potential for generating electricity.

So, rather than inefficiently producing electricity in one place and heat in another, why not do both at once, in the same place? Combined heat and power plants can increase the efficiency of fuel use from 30 per cent (in a coal-fired generating station) to 80 or 90 per cent, and thus achieve greenhouse

gas and smog reductions while earning new revenue from the sale of heat and electricity or avoiding the need to purchase power from the grid.

These plants can be scaled in size to meet the needs of a single home (an increasingly popular option in Japan), a hospital, shopping mall, apartment block, office building or even an entire neighbourhood. The City of Markham, for example, built a 3.5 megawatt combined heat and power plant in 2000, after the ice storm made clear the business advantages of a reliable electrical supply. This plant provides electricity as well as hot water for heating and chilled water for air conditioning to the local IBM Software Solutions Laboratory, the Motorola complex and the adjacent local hydro building. It has since been complemented by a 5 megawatt plant that provides heating and cooling to a YMCA and a Tridel condominium. There are plans to connect a new high school and several million square feet of new residential and commercial development soon. Their long-term goal is to meet all of downtown Markham's needs through the combined heat and power solution.

Heavy industries such as refineries or steel and pulp mills can also use their waste heat to produce electricity. Many pulp and paper mills already do this (some even burn waste wood to produce the heat, cutting greenhouse gas emissions even further). Other big industrial sites are catching the combined heat and power wave, like the Algoma steel mill in Sault Ste. Marie. It's currently installing equipment that will use heat from the blast furnace and coke oven gases to generate 70 megawatts of electricity as well as process steam for plant operations.

Both the environmental and economic bottom-lines benefit. By doubling or tripling the efficiency with which a fuel is used, emissions of greenhouse gases and other pollutants are reduced. By generating power close to where it's needed, there's less stress on the transmission grid, possibly avoiding the need for expensive new power lines

while improving reliability. Furthermore, less energy is lost sending power over the grid. Being diverse, the electricity supply is far less vulnerable to massive failure or attack.

These plants also offer businesses the ability to generate their own power, reduce energy bills and potentially sell surplus electricity to the grid. With energy prices rising and businesses struggling in light of intense international competition and a high dollar, cogeneration plants are an attractive way to reduce total energy costs, shield against future increases, maintain markets and preserve existing jobs.

There are currently about 200 combined heat and power plants operating in Canada, with a total electrical generating capacity of 6,800 megawatts (i.e., more power than all of Ontario's coal plants, or the province of Manitoba, can generate, but still a relatively small part of the country's electricity supply). Most of this capacity has been added since 1995, but Canada is still far behind countries like Denmark where 50 per cent of electricity comes from combined heat and power plants.

For this to really take off, provincial governments will need to make some policy changes. These include fairer access to the electrical grid, and reasonable stand-by charges and staffing rules. They'll also have to pay a fair price for the power, including recognition of the benefits of reducing stress on the transmission and distribution systems.

Municipalities will play a key role in a decentralized energy future. Through community energy plans, they can work with their citizens and businesses to not only transform the way we think about energy production and use, but also take practical Three-R-style actions to stem the flow of climate-warming gases. **CK**

Keith Stewart is the manager of WWF-Canada's climate change campaign.