

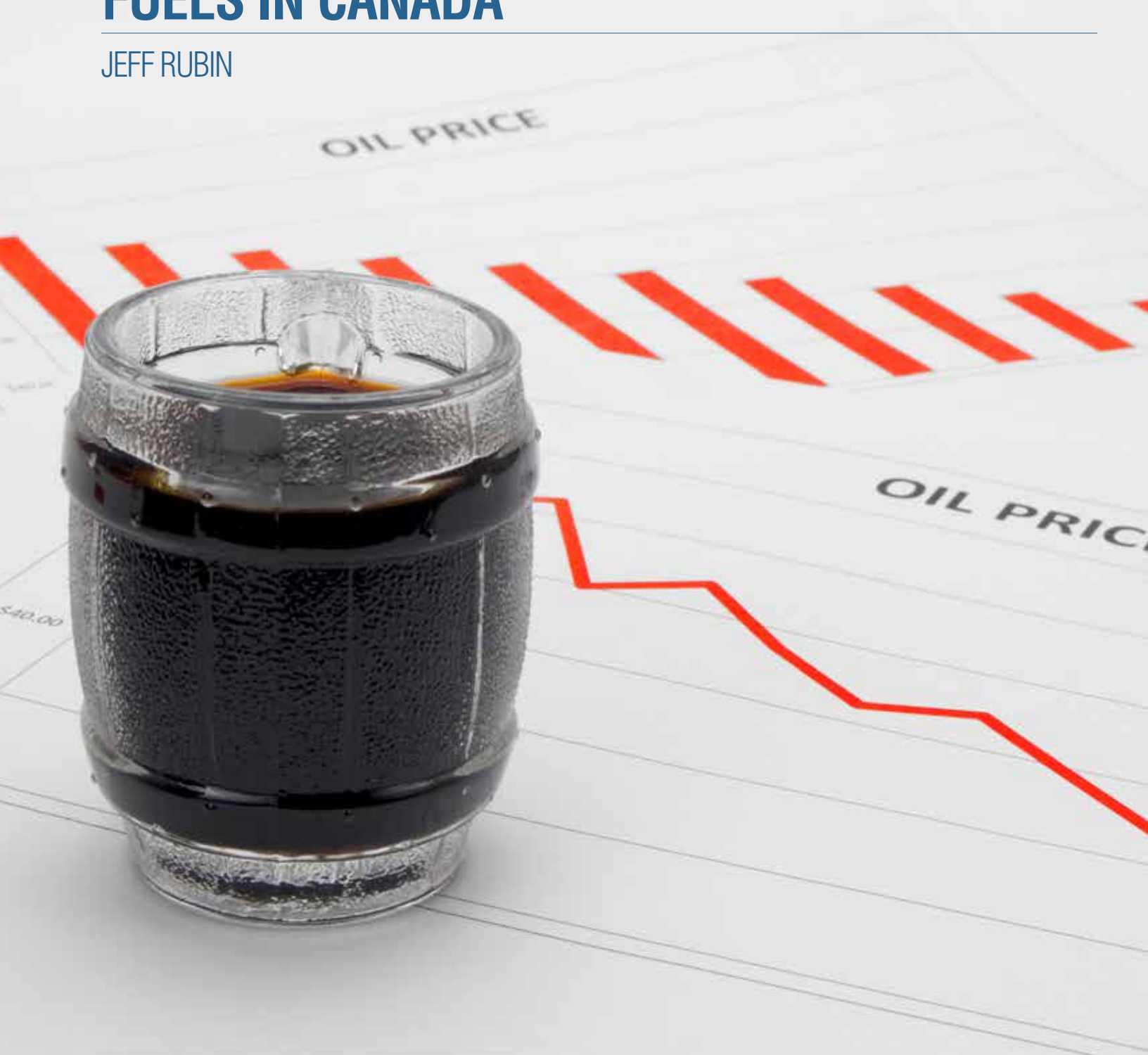


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THE CASE FOR DIVESTING FROM FOSSIL FUELS IN CANADA

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ABOUT THE GLOBAL ECONOMY PROGRAM

Addressing limitations in the ways nations tackle shared economic challenges, the Global Economy Program at CIGI strives to inform and guide policy debates through world-leading research and sustained stakeholder engagement.

With experts from academia, national agencies, international institutions and the private sector, the Global Economy Program supports research in the following areas: management of severe sovereign debt crises; central banking and international financial regulation; China's role in the global economy; governance and policies of the Bretton Woods institutions; the Group of Twenty; global, plurilateral and regional trade agreements; and financing sustainable development. Each year, the Global Economy Program hosts, co-hosts and participates in many events worldwide, working with trusted international partners, which allows the program to disseminate policy recommendations to an international audience of policy makers.

Through its research, collaboration and publications, the Global Economy Program informs decision makers, fosters dialogue and debate on policy-relevant ideas and strengthens multilateral responses to the most pressing international governance issues.

ABOUT THE AUTHOR



Jeff Rubin is a CIGI senior fellow. A Canadian economist and author, Jeff is a world-leading energy expert and former chief economist at CIBC World Markets. At CIGI, he is currently researching the impacts and opportunities for Canada in its transition toward a more sustainable economic model.

Jeff's work explores the future of Canada's oil sands in an emissions-constrained world, the divestment of Canadian fossil fuels, the case for a national carbon tax and the evolving value of Canadian resources.

One of the world's most sought-after energy experts, Jeff was one of the first economists to accurately predict soaring oil prices back in 2000. His first book, *Why Your World Is About to Get a Whole Lot Smaller*, released in 2009, was an international bestseller and was favourably reviewed in both *Time* and *Newsweek*. It was the number-one-selling non-fiction book in Canada and won the National Business Book Award.

Jeff released two further bestselling books through Random House Canada: *The End of Growth* (2012), which examines the impact of triple-digit oil prices on global economic growth; and *The Carbon Bubble* (2015), which examines how climate change would impact the Canadian economy and, in particular, the country's ambitious energy plans.

ACRONYMS

bpd	barrels per day
CalPERS	California Public Employees Retirement System
CalSTRS	California State Teachers Retirement System
COP 21	twenty-first session of the Conference of the Parties
CPPIB	Canada Pension Plan Investment Board
Gt	gigatonne
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
OPEC	Organization of the Petroleum Exporting Countries
ppm	parts per million
TSX	Toronto Stock Exchange
WCS	Western Canadian Select

EXECUTIVE SUMMARY

Emissions reduction targets pledged recently by 174 countries, including Canada, require urgent actions whose impact on global fuel demand seem incompatible with a sustained and strong recovery in fuel prices that the oil sands and other high-cost fossil fuels require to remain economically viable. Federal and provincial governments need to ensure that the financial risks posed by climate change to the oil, coal and natural gas industries are fully recognized in the investment and lending decisions of major public pensions and banks in the country.

TIMING OF FINANCIAL RISKS HAVE BEEN BROUGHT FORWARD

The call for divestment from fossil fuels has traditionally been pitched to protect the future wealth of pensioners and other long-term investors. But the time frames for action have shifted markedly over the last two years, with the collapse in coal, oil and natural gas prices already triggering a massive decline in the equity valuations of fossil fuel producers. At the same time, the strengthening resolve of the world to pursue more aggressive climate change targets at the twenty-first session of the Conference of the Parties (COP 21) to the United Nations Framework Convention on Climate Change brings forward the timing of needed reductions in global fossil fuel consumption. As measures to achieve these reductions take hold, they threaten to stymie any strong recovery in fuel prices,

without which much of today's fossil fuel industry is already at economic risk.

Canadian investors — as well as lending institutions — are particularly exposed, given the large weighting of oil and gas stocks in the Toronto Stock Exchange (TSX) Composite Index, and the loan exposure of Canadian banks to the energy sector and its high-cost oil sands. The decarbonization of the global economy sanctioned by the recent COP 21 agreement to limit the average temperature increase to between 1.5°C to less than 2°C threatens to marginalize much of Canada's carbon reserves and points to a significant downsizing of oil sands operations in the future — and, potentially, of other fossil fuel industries in the country, including coal and possibly natural gas.

Given the energy sector's importance in Canada to pensions and other institutional portfolios as well as bank lending, economic stresses in the oil sands and other fossil fuel industries could have wide-reaching effects on all Canadians. Pensions and lending institutions need to stress test their oil, gas and coal assets to verify that they will remain economically viable as Canada's commitments — as well as those of 173 other countries — to reduce carbon emissions weigh heavily on fossil fuel markets around the world.

FOSSIL FUEL DIVESTMENT MOVEMENT HAS BECOME THE FASTEST GROWING IN HISTORY

Ethical investing has a long history dating back to the eighteenth century when the Religious Society of Friends (also known as the Quakers) forbade its members from participating in the slave trade. The landscape of ethical investing has broadened considerably since then. Munitions, the former apartheid regime in South Africa, alcohol and tobacco have all been targeted by funds looking to invest in a socially responsibly fashion. More recently, executive compensation, gender and racial equality, respect for human rights and independence of corporate directors have been added to the list. Under the rubric of what is now more commonly known as responsible investing, there is a growing movement to tie portfolio selection not only to expected financial performance, but to a wide range of issues relating to corporate behaviour and governance, as well as, notably, fossil fuels.

Mounting worldwide concern over the impact of carbon emissions on climate change has recently shone the divestment movement's spotlight on fossil fuels and the companies involved in their extraction and processing. In recent years, the movement against fossil fuels has become the fastest-growing divestment campaign in history (Howard 2015). Beginning from a handful of campus movements in the United States launched by Bill McKibben's 350.org, the fossil fuel divestment movement

has mushroomed across countries and continents to include a variety of institutions — religions institutions, sovereign wealth funds, state and municipal pension plans, charitable organizations and private fund managers. Currently, more than 500 institutions have divested some US\$3.4 trillion in assets from fossil fuel extraction companies. In addition, more than 50,000 individuals have divested US\$5.2 billion from the fossil fuels sector.¹

Some of the largest divestments have been made by university endowment and pension plans. In May 2014, Stanford University's US\$18 billion endowment fund divested from coal stocks, citing its social responsibility to help mitigate climate change. A year later, the entire University of California system announced that it would be jettisoning coal and oil sand stocks from its endowment and pension portfolios, selling US\$200 million in related securities.

Student- and faculty-led divestment campaigns are under way at other prominent institutions in both North America and Europe. In the United Kingdom, both Oxford and Cambridge universities have adopted divestment policies. In Canada, divestment campaigns have been launched on no less than 30 different campuses, including the University of Toronto, McGill University and the University of British Columbia.

Since its campus origins, the divestment movement has broadened to include pension funds and other institutional investors. More than 180 pension funds, cities, foundations, charities and financial institutions around the world have made commitments to divest. A growing number of municipal governments have already taken divestment action, including such cities as Berlin, Stuttgart, Stockholm, Minneapolis, Seattle, San Francisco, Oakland, Boulder, Copenhagen and Oslo. A number of US states, including Massachusetts, Vermont and Maine, are looking at ridding their state pension funds of carbon stocks. And medical associations in the United Kingdom, Australia and Canada have opted to remove fossil fuels from their portfolios, citing the growing health risks associated with global climate change.

A number of governments have even mandated through specific legislation that funds under their jurisdiction divest. For example, California passed state laws that require the California Public Employees Retirement System (CalPERS) and the California State Teachers Retirement System (CalSTRS), the two largest public pension plans in North America, to divest from any company whose primary source of earnings is mining thermal coal.

In June 2015, the Norwegian Parliament instructed the Norwegian Sovereign Wealth Fund, which holds more

than one percent of the world's total equity market capitalization, to divest from any firm that derives more than 30 percent of its revenues from the coal industry. To date, the fund has banned 52 different coal-based firms from its portfolio. Sweden's national pension plan has also divested from 20 fossil fuel companies.

Ironically, even the US\$850 million Rockefeller Foundation, a historic oil money fund established by the Rockefeller family — owners of Standard Oil Company, the predecessor of Exxon — has announced its intention to divest from fossil fuels entirely by 2018 and has already cut its holdings of such stocks in half over the last two years.

In many cases, funds raised from the sale of carbon stocks have been reinvested in renewable energy, which will be needed to power the post-carbon economy. The International Energy Agency (IEA) estimates that trillions of dollars of investment in renewable energy will be needed over the next couple of decades if the sector is to meet more than 80 percent of the expected increase in global energy demand over the next two and a half decades needed to stabilize atmospheric carbon at no higher than 450 parts per million (ppm).

While coal, the principal source of global carbon pollution, is most frequently targeted by divestment campaigns, a number of funds have specifically targeted bitumen from Alberta's oil sands. For example, the University of California's investment boycott of coal stocks was also extended to the oil sands on the grounds that this high-cost fuel source would not be economically viable in a world economy that will need to dramatically reduce its combustion of oil and other fossil fuels. Both the Norwegian Sovereign Wealth Fund and Sweden's national pension plan have also included oil sands stocks in their investment boycott on similar grounds. In addition, the oil sands have been specifically targeted for divestment by Cambridge University, Oxford University, the London School of Economics, the Church of England and the World Council of Churches, among others.

DIVESTMENT INCREASINGLY MOTIVATED BY ECONOMIC CONCERNS

As the divestment movement has spread to the financial community, much of its focus has shifted from social activism to portfolio management. Divestment campaigns were originally motivated by concerns that anthropogenically induced climate change threatens human civilization with potentially catastrophic consequences arising from a wide range of impacts, including the increased incidence of extreme weather events, threats to world food production, widespread island and coastal flooding from rising sea levels, and the migration of diseases.

¹ For an up-to-date tally on global divestment from fossil fuels, see the Fossil Free project's website at <http://gofossilfree.org/>.

More recently, many divestment decisions, in particular among institutional investors such as pension plans, are being based on a recognition that efforts to mitigate climate change will profoundly impact future fossil fuel use and hence the sustainability of the carbon fuel industry as we currently know it. The growing likelihood that climate change will severely limit future fossil fuel consumption not only renders much of today's fossil fuel reserves unburnable, and hence of no value, but suggests that even current production levels are unlikely to remain economically viable. That concern has taken the divestment movement from its initial adherents of activist funds and organizations to more mainstream institutional investors, who fear that a potentially massive devaluation of the share prices of fossil fuel firms could severely impact the performance of their portfolios.

Those concerns have grown in response to both the rapidly rising economic cost of climate change and the increasing urgency to reduce global emissions. In 2014, over 400 institutional funds, with US\$24 trillion under management, signed a Global Investor Statement, recognizing they have a fiduciary responsibility to their investor clients to manage climate change risks in their portfolios. These funds have formally asked major fossil fuel companies such as Exxon, Chevron and Shell to identify their exposure to climate change by stress testing the economic viability of their reserves to different assumptions about future emission regulations.

Exxon insists that the transition away from fossil fuels will take decades to achieve and that all its reserves are viable, including its extensive oil sands properties owned by its Canadian subsidiary, Imperial Oil; other companies, however, are less sanguine. Suncor, the largest oil sands producer, has recently acknowledged that some of its massive reserves of bitumen are unlikely to be developed in light of how global efforts to mitigate climate change will cap world oil production (Dawson 2016).

The urgency for dramatic action is underscored by the rapidly closing window on current global levels of fossil fuel combustion. Atmospheric carbon, already over 400 ppm, must be held to no more than 450 ppm if the world is to avoid the worst consequences of climate change. Most estimates of the world's remaining carbon budget (the cumulative amount of carbon that can still be safely emitted) range from 500 gigatonnes (Gt) to 1,000 Gt, depending on the chosen temperature target for global warming and the degree of confidence in achieving it.

Given the complex interactions among climate change variables, estimates of the remaining carbon budget are probabilistic; hence, how much carbon the global economy has left to emit depends on how confident we want to be of the resulting impact on global temperature increases. The Intergovernmental Panel on Climate Change's (IPCC's) estimate of a 1,000 Gt remaining carbon budget is based

on a two-thirds probability of resulting average global temperature increase staying within the 2°C range. The remaining carbon budget shrinks if better odds of ensuring the target is achieved are sought.

Similarly, moving the temperature target also significantly changes the size of the remaining carbon budget and hence the time left to combust fossil fuels. While a 2°C rise was once seen as a comfortable target for a tolerable rise in global temperature, that is certainly no longer the case today. Among other impacts, the resulting rise in sea levels from that increase in global average temperature would inundate many low-lying island nations such as the Kiribati in the Pacific, as well as place as many as 600 million people living in coastal areas less than 10 m above sea level at potential risk.

Those concerns were made clear at the COP 21 proceedings last year in Paris, where Canadian Prime Minister Justin Trudeau, among many other world leaders, spoke in favour of a lower 1.5°C target, which would limit the expected rise in sea levels among other beneficial impacts. The compromise position adopted at COP 21 was to seek a temperature change between 1.5°C and less than 2°C, but it is clear that there is a building international movement toward adopting the more stringent 1.5°C target.

Emission compliance for a 1.5°C increase, even with only a 50 percent probability, would chop the world's remaining carbon budget roughly in half to 550 Gt. In view of those caveats, the 2°C warming and its associated 450 ppm carbon threshold in the atmosphere is increasingly seen as a bare minimum for determining future emissions targets and policies.

Even adherence to the 2°C target does not leave much room for future emissions. At the current rate of annual emissions (33 Gt from fossil fuels and 39 Gt in total, including cement and land use), the world economy has fewer than three decades left to burn hydrocarbons. Those time frames can be extended, but only by steadily reducing annual emissions over the coming decades. For example, to stabilize carbon at the 450 ppm threshold around the middle of the century, global emissions would be required to fall to under 15 Gt by 2050. The 1.5°C target requires that global carbon emissions fall to zero by no later than 2050.

With fossil fuel combustion accounting for more than 80 percent of global emissions, the required emission targets in turn require an unprecedented and irreversible decline in the combustion of these fuels. According to the IEA's estimates for stabilizing atmospheric carbon at the 450 ppm threshold (commonly referred to as the 450 or climate change scenario), global demand for thermal coal will need to peak this decade and be nearly halved by 2040 as coal-fired power generation falls from more than 40 percent of world electricity production to as little as 10 percent over the next two and half decades. Factoring in

a smaller decline in metallurgical coal demand, total coal consumption is projected to fall by more than one-third during this period. According to the IEA, the only new coal mines that could be economically developed in this environment would be small scale and low cost.

Similarly, global oil production (currently running around 97 million barrels per day [bpd]) would have to peak by the end of the decade and fall by almost a quarter over the next two decades, dropping to 80 million bpd by 2030 and retreating further to 74 million bpd by 2040. Depletion of existing supply (estimated at a loss of about six million bpd of production a year) would still require new fields to be opened but only the lowest cost ones would be economically viable with the constraints posed by shrinking global demand on oil prices.

While the IEA's 450 scenario does not project beyond 2040, the IPCC emissions projections indicate the need for further and even more substantive declines in the consumption of both oil and coal over the balance of the century. Moreover, changing the temperature target to 1.5°C warming and raising the probability of achieving that target beyond that of the odds of a coin toss could require world oil consumption to fall to less than one-third of its current levels by mid-century.²

A CARBON BUBBLE

A number of commentators, most notably the London-based think tank Carbon Tracker, have warned of a future “carbon bubble” of imploding share values of coal, oil and natural gas firms as the bulk of their reserves are stranded in the ground by increasingly stringent regulations on carbon emissions. Stranded assets may also include current extraction operations, and their associated infrastructure such as pipelines, that are terminated well before their intended economic lifetime. Anywhere from half to more than three-quarters of proven fossil fuel reserves would not be able to be developed if atmospheric carbon is to be held at the 450 ppm threshold.

Not only does the threat of stranded assets call into question the current industry practice of spending billions of dollars of shareholder capital on discovering new reserves, but it also casts an ominous shadow over the future valuations of those companies.³

While a carbon bubble is most commonly posed as a future financial risk arising from stranded reserve assets, there is a cogent case to be made that the bubble in carbon stocks has already begun to burst, given the massive devaluation of these stocks over the last several years following the collapse in carbon fuel prices. Far more than reserve writedowns, it has been the crippling impact of plunging fuel prices on corporate cash flow and earnings that have shaved billions of dollars from the market capitalization of publicly traded coal, oil and natural gas producers.

The MSCI world energy index, a widely followed global benchmark for measuring the value of a broad cross-section of the global oil and gas industry ranging from integrated oil and gas companies, to oil and gas exploration companies to oil and gas storage, drilling and services companies, has fallen by more than one-third since early 2014.⁴ Investors in Canadian oil and gas stocks have suffered even larger declines. The TSX energy index, dominated by oil sands producers, fell by almost 50 percent during the same period.

How much of the collapse in carbon prices and the associated collapse in the stock valuations of fossil fuel companies is due to slowing global economic growth and how much is due to tightening environmental policy, in particular in the world's two largest carbon-polluting economies, China and the United States, is the subject of much debate. However, there is broad agreement that investors can expect to see ever more stringent carbon emissions targets, and related policies to achieve those targets play an increasingly large role in suppressing fossil fuel demand in the future. Moreover, whereas the time frames for facing those regulatory risks were once considered to be medium to long term, today they look decidedly nearer term in view of the pressing need to cap coal and oil combustion by as early as the end of this decade.

COAL: HAS THE BUBBLE ALREADY BURST?

As the single-largest source of global carbon pollution, thermal coal faces the deepest cuts in global consumption, potentially looking at a loss of half of its current market over the next two and half decades. Once inextricably tied to global economic growth, global demand for coal has stalled for the last two years, suggesting to some that we may already be very close to a peak in world coal consumption. Fundamental changes in coal demand in the world's two largest coal-consuming economies, China and the United States, have brought the time frame for that peak much sooner than investors in coal stocks could have predicted.

4 See www.ishares.com/us/products/239653/ishares-msci-global-energy-producers-etf.

2 Some estimates show global oil production would have to be as low as 30 million bpd. See Muttitt (2016).

3 Yet fossil fuel companies continue to divert a substantial amount of their earnings to the discovery and development of new reserves. Annual global industry expenditures on exploration and development are pegged at more than US\$700 billion a year — a deadweight industry loss if none of those newly discovered reserves can be commercially utilized. For a discussion of the declining effectiveness of this spending, see *The Carbon Bubble* (Rubin 2015, 132–34).

The deepest slowdown in China's largely coal-driven economic growth in decades, the displacement of coal by cheaper shale gas in the US power industry and tightening environmental regulations on carbon emissions in both countries have already led to a recent decline in global coal demand, with devastating impacts on coal prices and the valuations of coal-mining firms around the world.

China's transformation from a backward agrarian economy in the 1970s to today's industrial colossus was primarily driven by soaring coal consumption, which has increased more than ten-fold, from 300 million tonnes per year to four billion tonnes. As coal drove China's economic growth, it also drove the meteoric rise in the country's carbon emissions. China's voracious appetite for coal has accounted for more than half of the increase in global CO₂ emissions over the last decade, and has made the country the world's largest source of carbon emissions, accounting for a quarter of the global total.

But economic growth in China has faltered, in particular in energy-intensive industrial sectors such as steel. With official GDP growth rates now below seven percent, and actual rates widely believed to be considerably less, the pace of economic growth is its slowest in well over a decade. The impact of slowing economic growth on coal demand is magnified by the on-going structural shift in the Chinese economy away from energy-intensive investment and exports to much less energy-intensive consumer spending on domestic services.

Coal demand in China has not only had to contend with sluggish growth and on-going structural change in the economy away from energy-intensive industries, but for the first time has also had to confront tough new environmental regulations. The nation's horrendous air pollution levels in major cities such as Beijing and Shanghai, which often register anywhere from eight to 30 times the standards set by the World Health Organization, have spurred unprecedented action against the country's carbon emissions.

After signing a bilateral agreement on carbon emission management with the United States (the world's second-largest coal-consuming nation and second-largest carbon polluter) in 2014, China announced a number of policy moves, including a sweeping upgrade of the country's outdated environmental laws, a massive increase in its already world-leading investment in renewable energy and a ban on the construction of new coal-fired power plants around Beijing and other key cities. China has also committed to implementing a national cap-and-trade system that will make the country's largest carbon emitters pay for their emissions.

All of these measures are intended to allow China to cap its emissions by no later than 2030 and reduce the carbon intensity of its GDP by 60 percent over that period. Many

believe that in view of the country's reduced rate of economic growth and new policy measures, China will achieve these emissions goals well in advance of official targets. Since the country's emissions are, for the most part, coal based, achieving emissions targets requires that the country rein in coal use. That process may have already started: Chinese coal consumption fell in both 2014 and 2015, while the country's rapidly growing carbon emissions seem to have plateaued.

China's coal consumption may soon follow in the footsteps of the US coal market. Coal combustion has fallen dramatically over the last decade in the United States, the victim of both technological change in the form of hydraulic fracturing and horizontal drilling that has made cheap and abundant shale gas accessible, as well as much more stringent federal regulations on carbon emissions aimed directly at new coal-fired power-generating stations.

The US power industry uses 20 percent less coal than it did before the last recession, as coal's once-dominant share of US electricity production has plunged from roughly half to a current all-time low of just over one-third. With more than 90 percent of all the coal in the US economy burned by the power sector, domestic demand for coal has nosedived. US coal production has shrunk to its lowest level in three decades, while almost 200 coal-fired generating stations (roughly one-third of all the coal-fired power generating capacity) in the United States have already been shuttered.

While technological change has undermined the US coal industry in the last decade, policy measures threaten to downsize the industry over the next decade. The Environmental Protection Agency introduced ceilings on emissions levels for new power plants that effectively preclude coal-fired generating plants from being built without prohibitively expensive carbon capture and sequestration mechanisms. Moreover, US President Barack Obama's Clean Power Plan targets reducing power sector emissions 30 percent below 2005 levels by 2030 — a mandate that, if implemented, will effectively force the closure of hundreds more coal-fired generating plants over the next decade.⁵

With China and the United States together accounting for more than 60 percent of the world demand, global coal consumption fell in 2015 by an estimated 2.5 percent, almost double the decline seen in the last recession, after registering no growth the previous year (Boren and Myllyvirta 2015).

The decline in global demand caused coal prices, already on a down track since early 2011, to plunge. Newcastle spot prices in Australia, a price reference point for thermal

5 The coal emissions regulations are being challenged in the US court system, with the Supreme Court temporarily staying the regulations while the case proceeds through the lower courts.

coal prices, collapsed from over US\$140 a tonne in early 2011 to as low as US\$53 a tonne by January 2016, triggering mine closures around the world and the bankruptcies of some of the largest coal companies in the world.⁶

Peabody Energy, the largest publicly listed coal stock in the world, lost more than 90 percent of its market capitalization since 2011 before finally declaring bankruptcy in April 2016. Similar fates have befallen other US coal giants Alpha Resources and Arch Coal, which also lost more than 90 percent of their market cap during the last four and a half years. According to Fitch Rating Agency, over a dozen US coal firms have declared bankruptcy (Kary, Loh and Polson 2016).

In Canada, Teck Resources, the country's largest mining company, with about one-third of its business in metallurgical coal, has lost more than 30 percent of its share price since 2012 and was downgraded by rating agencies below investment grade (CBC News 2015). Globally, the KOL index, an exchange trade fund that holds the largest publicly traded coal firms in the world as well as major coal terminal operators, has lost more than three-quarters of its value since 2011.⁷

While a growing number of pensions and endowment funds are adopting specific policies to divest from coal, an even greater number may be prevented from investing in the sector simply because there are fewer and fewer pure play coal stocks that qualify as investment grade (rated BBB and above by credit rating agencies) securities eligible to be held in institutional portfolios.

NEXT TO COAL, OIL SANDS OPERATIONS ARE MOST AT RISK

The two and half million barrels of oil produced from the oil sands every day represent more than 60 percent of Canada's total oil production and are by far the largest component of Canada's fossil fuel extraction industry. Prior to the collapse in oil prices, production from the oil sands was scheduled to double to more than five million bpd over the next decade and a half — an increase that would have catapulted Canada into the front ranks of world oil producers. But whereas the growth of the high-cost unconventional supply was once seen as crucial to meeting ever-growing global demand, oil sands production has become largely redundant in a saturated global oil market flooded by US shale production and record OPEC and Russian output. And as one of the highest-cost sources of oil in the world, oil sands production is particularly

vulnerable to increasing global efforts to reduce carbon emissions and, at the same time, world oil consumption.

With new project costs as much as double oil prices, some US\$50 billion of planned investment in oil sands expansion has been cancelled in the face of the world's largest supply glut in more than three and half decades. Not only has the collapse in investment spending applied a huge brake on Canada's economic growth, but the collapse in earnings has been an albatross on the country's stock market and hence a major drag on the earnings of Canadian pensions and other institutional investors who have typically held them in their portfolios.

Oil sands producers number among the largest stocks on the TSX. Canadian Natural Resources, Cenovus Energy, Encana Corporation, Husky Energy, Imperial Oil, Suncor and Teck Resources (a partner in the huge Fort Hills oil sands project) all number among the 100 largest stocks on the TSX Composite Index by market capitalization. Together with conventional oil and gas stocks and pipeline companies in the energy sector, oil sands stocks represent the second-largest component of the TSX, accounting for roughly one-fifth of the total market cap of the index. That weighting renders the TSX as one of the most carbon intensive bourses in the Organisation for Economic Co-operation and Development — a key factor in the underperformance of the TSX Composite Index relative to the S&P 500 and other major international equity market benchmarks over the last several years. The heavy weighting in oil and gas stocks ensures that most Canadian pensions and other institutional funds, which are at least in part measured by their portfolio performance against the TSX Composite Index, will typically hold oil sands stocks in proportions close to their market weighting in the index.

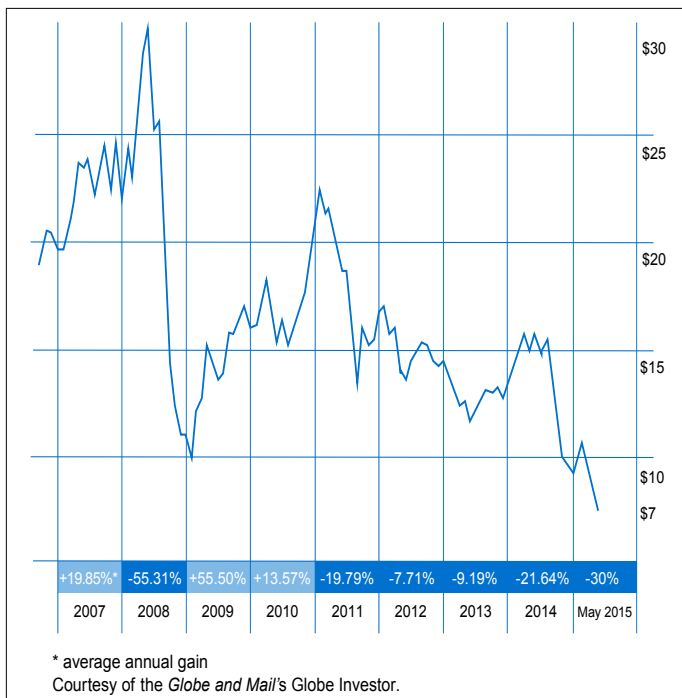
Not only has the performance of the TSX suffered from its heavy oil and gas weighting, but its oil sands-dominated energy sector has performed worse than most others around the world. The financial performance of oil sands stocks listed on the TSX is shown by BlackRock's iShares Oil Sands Index, an exchange trade fund that included all of the TSX-listed oil sands operators. From 2011 up to May 2015, (when BlackRock delisted the iShares Oil Sands Index), it had lost almost 70 percent of its valuation (see Figure 1). Since then, investors have, on average, lost more than 10 percent on 13 major public stock offerings of Canada's largest oil companies (Willis, Kildze and Cryderman 2016) as the sector continues to struggle with oil prices that are still languishing well below the break-even points of most operators.

While lower-cost shale operators in the United States have cut back production in the face of plunging oil prices, the Canadian oil sands — other than when forced temporarily to shut in by the horrendous wild fires in the Fort McMurray area in May 2016 — continue to grow

6 See www.indexmundi.com/commodities/?commodity=coal-australian&months=120.

7 See <https://ca.finance.yahoo.com/echarts?s=KOL#symbol=KOL;range=5y>.

Figure 1: BlackRock iShares Oil Sands Index Exchange-traded Fund 2007–2015



Source: Rubin (2015). Reprinted with the permission of Penguin Random House Canada.

uneconomic production. The Suncor-led Fort Hills project will add as much as 180,000 bpd of new production (*Canadian Mining Journal* 2013) while the expansion of Canadian Natural Resources' Horizon Mine will add another 45,000 bpd to oil production, even as current oil prices are dictating production shut-ins from the sector (Cryderman 2016). Husky expects to ramp up production from its Sunrise operation to 60,000 bpd (Healing 2016), while ConocoPhillips is expecting production at its newly opened Surmont 2 in situ project to grow to as much as 118,000 bpd by 2017 (World Oil 2015).

South of the border, production is heading the other way, with total US crude output already down by more than one million bpd from its peak in April 2015, led by declines in shale output. The US Energy Information Administration expects oil production from shale formations to fall from a 2015 peak of 4.9 million bpd to 4.2 million bpd by 2017, as depressed oil prices continue to sideline drilling operations.

The failure of oil sands producers to pare back production as shale operators have done is all the more problematic considering the prices they receive for their shipments of largely unprocessed bitumen. Western Canadian Select (WCS), the benchmark price for heavy oil produced from the oil sands, trades at a sizeable discount to conventional oil prices. WCS traded as low as US\$15 a barrel in January 2016 and even today trades at barely above US\$35 a barrel, almost one-third less than either West Texas Intermediate,

the US price benchmark, or Brent, the world oil price benchmark.

The pricing differential has been used by the oil sands industry as a compelling rationale for building new pipelines to tidewater to allow oil sands producers to capture much higher world oil prices, arguing billions of dollars have been needlessly lost through the price discount they are forced to take in their one and only North American market. But the industry argument so frequently heard in Canada's business press ignores the fact that bitumen trades at a sizeable discount to conventional oil anywhere in the world, not just in North America, since it is a lower quality crude with a high sulfur content requiring greater processing to convert it into refined products such as gasoline or diesel.

Contrary to industry claims, overseas markets in Europe and Asia, which could be accessed through new pipelines to the Atlantic and Pacific coasts, typically pay less for bitumen and heavy oil than the US Gulf Coast, home to the world's largest heavy oil refinery hub. For example, comparable grades of heavy oil such as Mexico's Maya crude have traded at more than US\$3 a barrel less in Europe and more than US\$8 a barrel less in the Far East compared to the prices paid in the Gulf Coast (McKinnon et al. 2016). Neither TransCanada's proposed Energy East pipeline, which would allow bitumen to be shipped to European refineries, nor Kinder Morgan's planned twinning of its Trans Mountain pipeline, which would serve as a conduit to Asian refineries, would boost the pricing power of oil sands' unprocessed heavy crude.

Indeed, they would only facilitate shipments to foreign markets that have typically paid less, not more, than North American refineries for unprocessed bitumen and other forms of heavy oil.

Of course, the more fundamental issue facing the oil sands is that even if bitumen producers could capture today's world oil prices for light conventional oil, those levels would still leave the bulk of current oil sands production and virtually all planned increases in production uneconomic. Most current in situ production requires prices of US\$65 per barrel to break even, while new projects can require prices as high as US\$80–US\$100 a barrel.⁸

That scale of recovery in prices for conventional oil, let alone in the price for raw bitumen, looks less and less likely in the near term with few producers — other than those in US shale regions — willing to cut production.⁹ As the

⁸ See Rubin (2016, 8) for a discussion of break-even points for oil sands operations.

⁹ While OPEC announced in September 2016 a modest (as little as 750,000 bpd) future production cut, failure to specify revised lower quotas for specific member nations led to widespread skepticism of how significant this action will be.

timing for an expected recovery in oil prices gets pushed further into the future, the more that recovery is threatened by tightening global emissions restrictions that will soon dictate a secular decline in world oil consumption.

Even if oil sands production was to be cut strictly proportional to the reduction in global demand required in the IEA's 450 scenario, more than 600,000 bpd of current output would have to be permanently shut in over the next two decades. But with costs anywhere from five to six times those of major OPEC producers such as Saudi Arabia, Iraq and Iran, the oil sands will have to bear a much heavier burden of the production cuts dictated by a shrinking global oil market, pointing to ultimate cuts that are a multiple of its proportional share. And to the extent that the world pursues a more stringent 1.5°C warming target, requiring a much larger reduction in future world oil consumption, the downsizing of oil sands production would be all the more severe.

NATURAL GAS: A HIGHLY QUESTIONABLE BRIDGE

Natural gas, the least emissions-intensive of the carbon fuels, is often claimed by its proponents as a bridge to a carbon-free energy system for the world economy. For example, in the IEA's 450 scenario, global consumption of natural gas continues to grow over the next several decades, albeit at a much slower rate than the current pace, as the cleaner burning carbon fuel displaces coal in power generation. But environmental factors as well as economic ones are increasingly calling this outlook into question.

While average emissions from natural gas are considered to be roughly half those of coal to produce a standard unit of energy, recent evidence on fugitive methane emissions, in particular from fracked shale wells, points to a much larger carbon footprint. Methane, the principal component of natural gas, has a greenhouse gas effect about 20 times more potent than that of carbon dioxide, although it is much shorter lasting in the atmosphere. President Obama and Prime Minister Trudeau have announced a joint initiative to reduce fugitive methane emissions to 40 percent below 2005 levels by 2025, on both sides of the border. In addition, a number of provinces and states, including New York, Vermont and New Brunswick, have declared moratoriums on fracking, in view of the risks it poses not only for fugitive emissions but also for local groundwater contamination and induced seismic activity.

On the economic front, natural gas is increasingly being challenged around the world by renewable energy, whose costs continue to plummet with rapidly growing use. In 2015, new renewable power projects — wind, solar and geothermal — were by far the single largest source of new energy generation in the world, adding more to global capacity than all other sources combined. The current

challenge from renewables is, for the most part, in power generation, but may soon extend to home heating as well.

Renewables (wind, solar, hydro, tidal, geothermal and biofuel) already account for more than one-quarter of total electricity generation in the European Union and 14 percent of total energy consumption. By 2020, the European Union has targeted that 20 percent of its total energy will come from renewable sources. Nine EU members have already achieved this level, including Sweden, where renewables meet more than half of the country's energy requirements.¹⁰

In the United States, tough new emissions reduction targets for the power sector have set the stage for rapid growth in wind and solar over the next decade and a half. According to Bloomberg New Energy Finance Group, growth in renewables, largely from solar and wind, will account for as much as 40 percent of US power generation, almost four times its current share. In contrast, coal's share of the US power market, already at postwar lows, will be cut by a further two-thirds to just above 10 percent.

In China, the world's largest energy market, renewables are growing faster than any other energy source, holding out the promise that a decarbonizing Chinese economy may, for the most part, switch directly from coal to power sources such as wind and solar, and largely bypass a gas-powered phase of power generation. Although renewables (including hydro) only account for 20 percent of the country's electricity, China is already the world's largest producer of solar power and wind power and is far and away the largest investor in those power sources, accounting for more than one-third of global spending (Rumney 2016).

While wind and solar power costs are still higher than natural gas-generated power in many jurisdictions, costs have tumbled with exponential growth in recent years. The cost of solar energy already fell by two-thirds between 2008 and 2014. Current industry trends indicate every doubling in world solar panel production is associated with a 26 percent cost reduction and every doubling in wind power reduces costs by 19 percent (Randall 2016). Given those rates of cost reduction and further improvements in battery technology, Randall (2016) estimates that both wind and solar will provide cheaper energy than either coal or natural gas within a decade, pointing to a not-too-distant peak in the use of both fossil fuels for power generation.

Natural gas is also being challenged in its other major commercial use — as an energy source for heating residential and commercial properties — which accounts for roughly one-third of the gas use in North America. Ontario, for example, which currently relies on natural gas

¹⁰ See http://ec.europa.eu/eurostat/statistics-explained/index.php/Renewable_energy_statistics.

for three-quarters of its household heating needs, intends to phase out natural gas heating and will require that by no later than 2030, all new buildings in the province will be heated by some form of renewable energy, such as geothermal, biogas or hydroelectric.

POLICY RECOMMENDATIONS

Pension plans and other investors around the world have already suffered hundreds of billions of dollars of losses from their exposure to fossil fuel industries with the recent collapse in coal, oil and natural gas prices. The large weighting of oil and gas stocks in the TSX Composite Index suggests that Canadian pension plans have been significantly affected. While a lack of disclosure of carbon holdings makes it difficult to assess fund-specific losses, one study estimated that the five largest funds in Ontario lost somewhere in the neighbourhood of CDN\$2.4 billion on their stock holdings of fossil fuel companies over the second half of 2014, with the largest fund, the Ontario Teachers' Pension Plan, estimated to have lost more than CDN\$1.7 billion.¹¹

In view of broad-based international commitments made at COP 21 to reduce global emissions, pensions and other institutional investors can expect to incur further losses from their oil, natural gas and coal holdings as tightening global regulations on carbon emissions downsize fossil fuel markets. The time frames for facing that regulatory risk are drawing ever nearer, with global emissions reduction targets pointing to a peak in both oil and coal demand by possibly as soon as the end of this decade and permanent reductions in fossil fuel consumption thereafter.

Canadian pensions and other institutional investors in the country are particularly exposed, both as a function of the large weighting of the oil and gas (energy) sector in the TSX Composite Index, as well as the heavy weighting within the TSX energy sector of high-cost oil sands operations. Sudden regulatory changes can strand carbon assets. For example, the decision by Alberta's New Democratic Party government to phase out coal-fired power generation in the province by 2030 has already had a significant negative impact on the share valuation of TransAlta, the coal-based power provider in the province. The penchant for most institutional funds not to stray far from index weighting all but assures that their portfolios remain highly exposed to the future performance of fossil fuel stocks, and in particular to highly vulnerable oil sands operations.

There is also broad systemic risk to Canadian banks from their loan exposure to the oil and gas industry as well as to coal mining and coal-fired power generation.

Including untapped credit lines, which can be readily drawn down, Canada's six major banks have an estimated CDN\$107 billion exposure to the oil and gas sector (Alexander and Loder 2016). The superintendent of financial institutions has already questioned whether Canadian banks have put aside adequate reserves for potential loan losses in the area, in the face of a rising rate of loan impairment of energy loans (Trichur 2016) and widespread credit downgrades in the sector (Encana, Cenovus, Canadian Oil Sands and Teck Resources).

While standard risk management practice ensures that banks stress test energy sector loans, global efforts to combat climate change could easily render former benchmarks, such as past price cycles, unreliable for measuring lender risks. If fossil fuel producers face a secular decline in global demand as a result of increasingly stringent global emissions restrictions, long-term loans to develop unviable reserves would become impaired, forcing significant writedowns. Moreover, much of current production from the oil sands could be forced to shut down, resulting in potential bankruptcies similar to those already seen across the US coal industry.

In an effort to mitigate the adverse financial impacts of climate change on pension plans and banks, the following measures should be considered by the federal and provincial governments.

Recommendation 1

Ontario and Quebec should consider joining California, their Western Climate Initiative and cap-and-trade partner, in condoning divestment from fossil fuels by pensions directly under their jurisdiction. Restrictions on fossil fuel stockholdings similar to those that currently apply to CalPERS and CalSTRS could be adopted by the Caisse de dépôt et placement du Québec, the Quebec Government and Public Employees Retirement Plan and the Ontario Public Service Employees Union Pension Plan, among any other plans that fall directly within the two provinces' jurisdiction.

Recommendation 2

The federal government should ensure that the Canada Pension Plan Investment Board (CPPIB), as well as all other pension plans under federal jurisdiction, provide full disclosure of their holdings of fossil fuel companies in all of their portfolios including private equity holdings.

Recommendation 3

The CPPIB, as well as any provincial or federal government pension plan that chooses to continue to invest in fossil

¹¹ A study by Mark Lee and Justin Ritchie of the Canadian Centre for Policy Alternatives estimated the portfolio losses on carbon stock holdings of the 20 largest public sector pension plans in Canada, using their exposure to various equity markets as a rough guide of their carbon holdings. See Lee and Ritchie (2015).

fuel companies, should be required to stress test the economic viability of those investments against the market conditions that would follow from the international commitment to hold the rise in global temperatures to between 1.5°C and 2°C.

Recommendation 4

Similarly, the Office of the Superintendent of Financial Institutions should order Canada's six major banks to stress test their loan exposure to oil, coal and natural gas producers to ensure that they will remain viable in light of future market conditions that would follow from the recent commitments made by the Canadian government as well as the governments of 173 other countries to dramatically reduce their future carbon emissions.

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