PEMBINA institute

Backgrounder

November 2012

Clearing the air on oilsands emissions

The facts about greenhouse gas pollution from oilsands development

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At a Glance

This backgrounder provides an overview of how oilsands production and expansion contributes to greenhouse gas pollution and climate change, focusing on these key issues:

- Average oilsands production is significantly more greenhouse gas-intensive than conventional oil production.
- Oilsands are the fastest growing source of greenhouse gas emissions in Canada.
- Alberta's greenhouse gas regulations do not result in meaningful reductions in emissions from oilsands operations.
- Large-scale carbon capture and storage for oilsands emissions is unlikely due to high capital cost and lack of regulatory driver.
- Oilsands expansion is a significant barrier to Canada meeting its 2020 climate commitment.
- Rising greenhouse gas pollution from the oilsands is at odds with Canada's international climate change commitments and the global need to make deep reductions to emissions.

THE FACTS

Average oilsands production is significantly more greenhouse gas-intensive than conventional oil production.

The life cycle (well-to-wheels) emissions intensity of crude from the oilsands ranges from eight to 37 per cent higher than conventional crude.

The full story

The oilsands extraction process is energy intensive, due to the large volumes of natural gas, electricity, and diesel required. As a result, producing crude from the oilsands generally results in significantly greater greenhouse gas emissions than crude from conventional sources.

However, two aspects of how emissions from crude sources are compared can result in large variations in the numbers, making it very challenging to understand the results of a particular study in proper context.

Both the definition used for 'conventional crude' and the scope of the study (production, well-to-tank, or well-to-wheels) can significantly change the magnitude of the difference between emissions from oilsands crude and conventional crudes. While all of the approaches can be technically correct if done properly, a basic understanding of life cycle assessment is often needed to accurately interpret the results.[1]

Defining 'conventional'

With respect to the definition of 'conventional' crude, it is important to understand exactly what is being compared in a study. For example, there are differences in emissions between light conventional crudes and heavy conventional crudes and, similarly, there are differences between various methods of extracting oilsands crude. When comparing oilsands crude to conventional, comparing the lowest greenhouse gas emitting oilsands project to the highest greenhouse gas emitting conventional crude is very different from comparing "average oilsands" to "average conventional" — terms for which the meanings also change over time. To be consistent, many studies refer comparisons to the 2005 U.S. baseline (the average of all fuels consumed in the U.S. that year, calculated by the Environmental Protection Agency).

Studies that indicate lower differences (e.g., around six per cent) in emissions levels when comparing oilsands with other crudes are not based on averages; instead they compare a select set of 'better performing' oilsands to a select set of crudes that have higher-than-average

[1] Pembina's life cycle assessment checklist (http://www.pembina.org/pub/2163) provides guidance on how to conduct a meaningful and robust greenhouse gas life cycle assessment for the oilsands industry.

emissions. For more information, see the Pembina Institute's *Oilsands, heavy crudes, and the EU fuel-quality directive* backgrounder.[2]

The scope of the study

Second, emission comparison results can vary significantly based on what aspects of crude production are being compared. The typical full life cycle of oilsands crude includes many major steps from the production to end use. These include: extraction (e.g. mining or in situ), upgrading, pipeline or tanker transport, refining, and use (e.g., combustion in a vehicle). The major differences between oilsands and conventional crudes all occur at the extraction/upgrading stage, which is often referred to generally as "production".

For the most part, the amount of emissions from refining, transport and use (combustion) of oilsands crude is essentially the same as for any fossil-based crude, and combustion accounts for a very large amount of emissions from all crudes, regardless of the source. Studies compare crudes on different scope levels for a variety of reasons, but comparisons of 'production' emissions will show the biggest difference between oilsands and conventional crudes because the scope is focusd on the processes where emissions rates differ. Since the rest of the processes are similar, the broader the scope of study, the smaller the difference appears to be between oilsands and conventional crudes, simply because the denominator in the calculation is growing.

In a comparison of production emissions only, the per-barrel greenhouse gas emissions associated with oilsands extraction and upgrading are estimated to be 220 to 350 per cent (3.2 to 4.5 times) higher than conventional crude oil produced in Canada or the United States.[3]

Full life cycle (well-to-wheels) calculations look at all processes, from extraction up to and including combustion (which accounts for around 80 per cent of total emissions). Looking at this scope, a comparison of oilsands emissions intensities from seven data sources to the EPA's 2005 U.S. baseline showed that average values for oilsands emissions range from eight to 37 per cent higher than the baseline.[4] In a peer-reviewed assessment completed for the European Fuel Quality Directive, the average oilsands greenhouse gas emissions were 23 per cent greater than the average crude processed in European refineries.[5]

Today, there are a number of life cycle studies comparing oilsands greenhouse gas emissions across a range of scopes and assumptions. While these studies add value, the value is undermined when the facts are misrepresented by selectively focusing on results between comparisons of 'better performing' oilsands projects with higher-than-average conventional crudes. This approach makes the difference in emissions between average oilsands and average crude look small, when in fact the difference is very significant.

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[2] P.J. Partington and Marc Huot, *Oilsands, heavy crudes and the EU fuel-quality directive* (Pembina Institute, 2012) http://www.pembina.org/pub/2325

[3] National Energy Technology Laboratory, *Development of Baseline Data and Analysis of Life Cycle Greenhouse Gas Emissions of Petroleum-Based Fuels*, DOE/NETL-2009/1346 (2008), 12.

[4] Natural Resources Defense Council, *Setting the Record Straight: Lifecycle Emissions of Tar Sands* (2010), 2.

[5] Adam Brandt, *Upstream greenhouse gas (GHG) emissions from Canadian oilsands as a feedstock for European refineries*, Executive summary. (Department of Energy Resources, Stanford University, 2011), 41–42.

THE FACTS

Oilsands are the fastest growing source of greenhouse gas emissions in Canada.

Between 1990 and 2010, production from Alberta's oilsands increased by 260 per cent and the corresponding greenhouse gas emissions have almost tripled from 17 megatonnes (Mt) in 1990 to 48 Mt in 2010 (a 180 per cent increase in emissions).[6] Based on recent projections from the Government of Canada, oilsands emissions growth will increase from 48 Mt in 2010 to 104 Mt in 2020 under existing federal and provincial climate policies.[7] Further, while per-barrel emissions have decreased since 1990, these improvements have since stalled and are unlikely to resume without substantial improvements in climate policy at both the federal and provincial levels.

The full story

As scientists are calling for a decrease in greenhouse gas emissions to mitigate the impacts of climate change, oilsands emissions are growing rapidly. Figure 1 below illustrates the growth in absolute oilsands emissions from 1990 to 2010 (extraction and upgrading in Canada) and includes recent government projections for oilsands emissions in 2020. As shown in the figure, from 1990 to 2010, the emissions from oilsands nearly tripled. This trend of rapid growth will continue well into the next decade, with oilsands emissions expected to more than double again between 2010 and 2020.

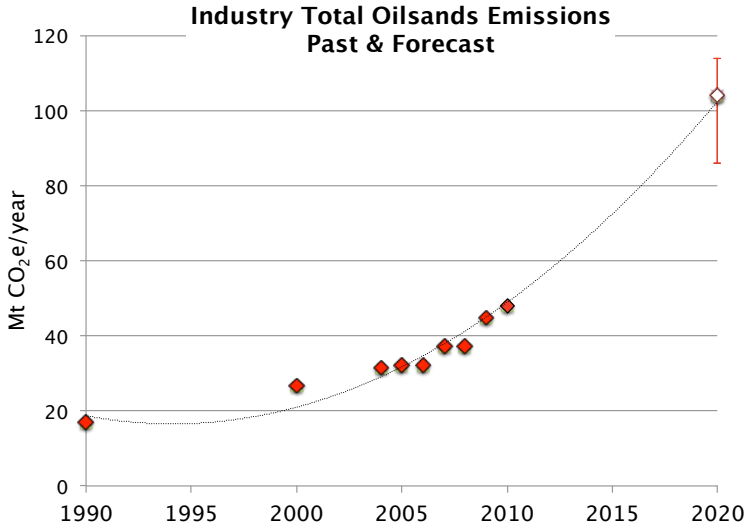

Figure 1: Actual and forecast emissions growth from oilsands extraction and upgrading in Canada.[8]

[6] See Figure 1

[7] See Figure 1

[8] Sources include: Environment Canada, National Inventory Report (1990-2008 & 1990-2010), and Environment Canada, *Canada's Emissions Trends*, (2012), 24. http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada's-Emissions-Trends-2012_e_01.pdf

The oilsands industry did reduce its overall greenhouse gas intensity (emissions per barrel produced) by 29 per cent from 1990 to 2009, as shown in Figure 2. More recently however, the trend for intensity reductions plateaued and then reversed. Between 2009 and 2010, the emissions intensity of the oilsands rose two per cent,[9] and this trend is likely to continue.

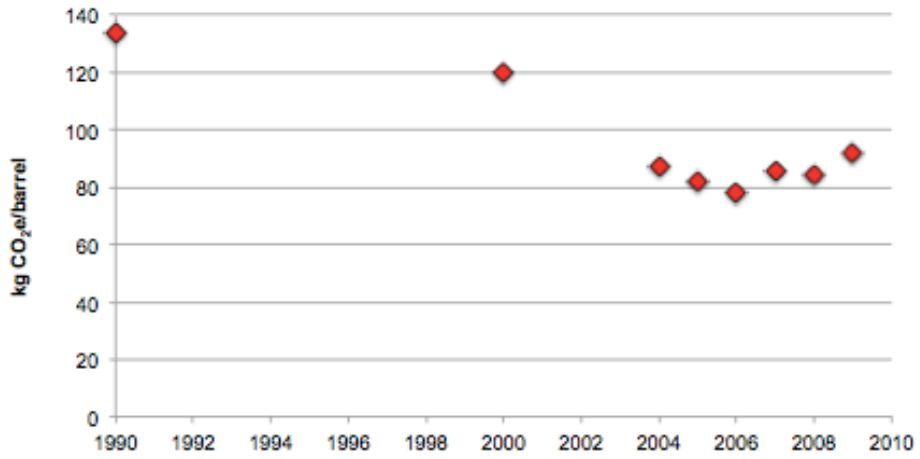

Figure 2: Past changes in industry-wide greenhouse gas intensity in the oilsands.[10]

For example, in order to maintain absolute greenhouse gas emissions across the industry at 2009 levels (45 Mt per year), the industry would need to reduce its emissions intensity by 53 per cent by 2020 and 72 per cent by 2030 based on the current production forecasts.[11] This would mean reducing emissions more than three times faster than the reductions the made by industry between 1990 and now.

[9] Responsible Canadian Energy, *2010 Progress Report*. http://www.rce2010.ca/oil-sands/air/greenhouse-gases/

[10] The source for emissions data is *National Inventory Report 1990–2008: Greenhouse Gas Sources and Sinks in Canada, Part 1*, 86. Note: the value for 2009 was provided in an e-mail communication from Environment Canada officials. The source for production data is *Table 126-0001 — Supply and disposition of crude oil and equivalent, monthly (cubic meters),* (CANSIM database), Statistics Canada (accessed July 22, 2010). Retrieved from Matthew Bramley, Marc Huot, Simon Dyer and Matt Horne, *Responsible Action? An Assessment of Alberta's Greenhouse Gas Policies* (2011), 31. http://www.pembina.org/pub/2295.

[11] *Responsible Action?* 31.

Will technology solve the problem of oilsands emissions?

New technologies and improvements may be developed to help reduce the growing challenge of greenhouse gas emissions from oilsands production. However, some significant barriers will likely limit the role new technology will play in cutting emissions:

1. The pace of absolute emissions growth is too rapid. As illustrated above, with the pace of absolute emissions growth projected for the oilsands, very large emissions intensity reductions from oilsands would be needed curb the growth in emissions, let alone reduce absolute emissions over time.

2. "Low-hanging fruit" reductions have already been achieved. One of the barriers limiting further improvement in the emissions intensity of oilsands production is that many of the "low-hanging fruit" — the relatively easy and inexpensive — technologies to reduce emissions intensities have already been widely adopted. As a result, the majority of additional reductions will come with significant costs.[12]

3. The shift toward in situ oilsands extraction will increase overall oilsands emissions. With in situ oilsands extraction set to grow faster than open-pit mining, the generally higher emissions intensity associated with in situ extraction will have the net effect of increasing the industry-wide greenhouse gas emissions intensity.[13]

4. Lag time between innovation and widespread implementation. It can take years to move from the research and development phase to industry-wide implementation of new technologies in the oilsands. As such, the potential benefits of any revolutionary technologies are probably 15 to 20 years away,[14] at a time when science indicates that action is urgently needed to reduce greenhouse gas emissions.

5. Today's technology will be used for years to come. More than 5.2 million barrels per day of oilsands capacity has already been approved with today's technology or older. With some exceptions, the incentive to adopt new technologies is very low once design is complete and regulatory approvals have been granted. Given that projects operate for 20 to 50 years, the bulk of oilsands production will therefore be conducted using today's technology.

[12] Ibid., 32.

[13] Ibid.

[14] IHS CERA, "Summary of Key Insights of IHS CERA's Analysis," *Oil Sands Technology: Past, Present, and Future — Special Report* (2011). http://a1024.g.akamai.net/f/1024/13859/1d/ihsgroup.download.akamai.com/13859/ihs/cera/Oil-Sands-Technology-Past-Present-and-Future.pdf

THE FACTS

Alberta's greenhouse gas regulations do not result in meaningful reductions in emissions from oilsands development.

Alberta's carbon price on heavy emitters is too weak to provide an incentive for oilsands operators to meaningfully reduce greenhouse gas emissions. As a consequence, the oilsands industry will continue to be the fastest growing source of greenhouse gas emissions in Canada.[15]

The full story

Alberta's Specified Gas Emitters Regulation (SGER) is one of the province's key tools to meet its greenhouse gas emission reduction targets for 2020 and 2050 (Alberta also had a 2010 target to reduce emissions by 20 Mt below the business-as-usual level — a target the province failed to even come close to meeting in 2011[16]). This regulation requires all facilities emitting more than 100,000 tonnes of CO_2 equivalent per year to reduce their emissions intensities by up to[17] 12 percent relative to a three-year facility baseline.[18] Currently, the SGER is the main greenhouse gas reduction policy that is imposed on the oilsands industry.

Oilsands operators can achieve compliance with this target by: reducing emissions on site; purchasing Alberta-based offset credits; purchasing or using Emissions Performance Credits; or paying into a climate change fund at a rate of $15 per tonne.

While the SGER was the first carbon price in North America, it falls short of providing an incentive to industry to adopt progressive carbon mitigation strategies. By allowing large emitters to fully comply by paying into a fund at $15 per tonne, this policy essentially places a carbon price maximum of $15 per tonne in Alberta. In effect, any emissions reductions that cost more than this ceiling price make less economic sense than paying into the fund. Since emitters are allowed to comply by using any of the four options (including paying into the climate fund) for 100 per cent of their emissions, at the price of $15 per tonne, the SGER sends only a weak price signal to oilsands operators to reduce their emissions.

This is problematic because many of the opportunities for the oilsands industry to make significant greenhouse gas reductions cost higher than $15 per tonne. For example, in the case of carbon capture and storage (CCS), applying CCS to an oilsands project costs an order of

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[15] As shown in Figure 1, accounting for federal and provincial policies (which includes Alberta's SGER) oilsands emissions are projected to more than double between now and 2020.

[16] *Responsible Action?*, 10.

[17] For new facilities or facilities that began operation after the year 2000 with less than eight years of commercial operations starts, the intensity targets start in their fourth year of operation and gradually increase to 12 per cent (increasing two per cent each year).

[18] Government of Alberta, Specified Gas Emitters Regulation, http://www.qp.alberta.ca/574.cfm?page=2007_139.cfm&leg_type=Regs&isbncln=9780779758791&display=html

magnitude higher than $15 per tonne. While the price varies between mining, in situ and upgrading projects, CCS in the oilsands industry costs between $95 and $255 per tonne.[19] It is clear that the current SGER policy is not strong enough to create an incentive for CCS. As such, the primary policy that serves to address oilsands emissions is not effective at driving real reductions.

> Considering that a facility must only reduce emissions by a maximum of 12 per cent at a maximum cost of $15 per tonne, this works out to a net compliance cost of $1.80 per tonne. In other words, compliance with Alberta's climate policies costs oilsands operators an equivalent of between 18 and 22 cents per barrel.

THE FACTS

Large-scale carbon capture and storage for oilsands emissions is unlikely due to high capital cost and lack of regulatory driver.

For CCS to be implemented on a large scale in the oilsands, regulators would have to either make the technology mandatory for oilsands projects, scale up incentives, or put a price on emissions approximately five times higher than they have proposed to date. Current government approaches are not close to making this happen. Technology cost improvements on the necessary scale are similarly unlikely.

The full story

CCS is an expensive technology, both because it is new and because it carries major energy and infrastructure costs. It is particularly expensive when applied to some aspects of oilsands production, where costs can range from $95 per tonne for some upgraders to $255 per tonne for in situ oilsands facilities.[20] In comparison, Alberta's SGER imposes a maximum levy of $15 per tonne of carbon dioxide emissions.

To make up the funding shortfall, over $2.5 billion has been committed to funding CCS projects by both the provincial and federal governments; despite this influx of government subsidies, the low cost of carbon and the high cost of development are hurting the financial viability of CSS projects.

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[19] Capture costs from The Delphi Group, *ICO_2N GHG Alternatives Report* (2009), 79, http://delphi.ca/images/uploads/IC02N_GHG_Alternatives_Report.pdf.

Cost totals (including capture, transport, sequestration) from *Responsible Action?*, 30.

[20] Capture costs from *ICO_2N GHG Alternatives Report*, 79. Cost totals (including capture, transport, sequestration) from *Responsible Action?*, 30.

In April 2009, eight oilsands companies abandoned their bids for a share of $2 billion in provincial government subsidization of CCS projects for financial reasons.[21] In April 2012, TransAlta abandoned its CCS project because the potential revenue from selling carbon offsets did not justify the project's costs. TransAlta said the capital costs were in line with their expectations but the price of CO_2 sales and the price of emissions reductions were not sufficient to proceed with the project.[22] This follows a similar trend around the world, where projects have been cancelled or put on hold in the United Kingdom, Italy, Germany and the United States.[23]

To date, only two CCS projects are approved in Alberta:[24] Shell's Quest CCS project,[25] which will capture and store up to 1.2 Mt of CO_2 per year, and Enhance Energy Inc.'s Alberta Carbon Trunkline, which will initially transport and store between 1.6 and 1.8 Mt of CO_2 per year from a variety of emissions sources.[26]

However, for the Government of Alberta to achieve its 2020 target of 50 Mt of emissions reduction (70 per cent or 35 Mt of which to be completed through CCS), they would have to approve and commence 29 other CO_2 capture projects in similar scale to the Shell Quest project.

In the oilsands, it is unclear how CCS will be used, since oilsands' CO_2 streams are relatively small and diluted.[27] Oilsands facilities are also scattered over thousands of square kilometres and would require additional infrastructure and operating costs to implement CCS. Given the current challenges faced by CCS projects that are sequestering CO_2 from concentrated sources, CCS is unlikely to mitigate any substantial amount of oilsands emissions in the near future — particularly if the price of carbon remains low.

[21] Kelly Cryderman, "Oilsands Opts out of Carbon Capture," *Calgary Herald*, April 2, 2009. http://www.edmontonjournal.com/Business/Oilsands+opts+carbon+capture/1455181/story.html

[22] Project Pioneer, "Project Pioneer Partners Conclude Front-End Study; Will Not Proceed with CCS Demonstration Project," April 26, 2012. http://www.projectpioneer.ca/

[23] Sally Bakewell, "TransAlta Abandoning Canada Carbon Capture Project," *Bloomberg,* April 27, 2012. http://www.bloomberg.com/news/2012-04-27/transalta-abandoning-canada-carbon-capture-project.html

[24] A third project, Swan Hills Synfuel, has received provincial funding to date. See Government of Alberta, "Carbon Capture and Storage: Solutions Start Here." http://www.solutionsstarthere.ca/24.asp.

[25] ERCB, Shell Canada Limited: Application for the Quest Carbon Capture and Storage Project. Radway Field, (2012), 10. http://www.ercb.ca/decisions/2012/2012-ABERCB-008.pdf

[26] Enhance Energy Inc., "The ACTL Pipeline Project," http://www.enhanceenergy.com/actl. Note: The ACTL has a design capacity for 14.6 Mt but the initial throughput will be between 1.6 and 1.8 Mt.

[27] ecoENERGY Carbon Capture and Storage Task Force, *Canada's Fossil Energy Future: The Way Forward on Carbon Capture and Storage*, report to the Minister of Alberta Energy and the Minister of Natural Resources Canada (2008), 8–9. http://www.energy.gov.ab.ca/Org/pdfs/Fossil_energy_e.pdf

THE FACTS

Oilsands expansion is a significant barrier to Canada meeting its 2020 climate commitment.

Canada will not reach its greenhouse gas reduction target of 17 per cent below the 2005 base level by 2020 without a significant increase in effort. Increased emissions in the oilsands will undo much of the progress made by other sectors to reduce Canada's emissions.

The full story

Canada has a list of failed greenhouse gas emissions commitments dating back to 1988. However, since that time Canada's emissions have continued to grow steadily. Canada's current climate commitment is to reduce emissions to 17 per cent below 2005 levels by 2020. Numerous recent studies confirm that existing provincial and federal policies are grossly insufficient to achieve this commitment. Canada is set to fail to meet this target unless further substantive action is taken at all levels of government.

In 2011, Environment Canada's *Emissions Trends* report projected that Canada would achieve a dismal one-quarter of its commitments by 2020.[28] As a result of new accounting rules for forestry and land-use change and some economic factors, the 2012 version of the same report showed Canada projecting to achieve 50 per cent of its commitments by 2020.[29] This large jump in "progress" did not occur because of any new federal government efforts between 2011 and 2012.[30] As such, while Canada may have shrunk the gap down to 50 per cent, the challenge of achieving 100 per cent of Canada's target has not changed. In fact, Canada is likely to continue failing to meet climate change commitments unless the government makes a serious effort to address oilsands emissions.

Between 2010 and 2020, Canada's greenhouse gas emissions are projected to increase by 28 Mt.[31] In that same time period, the oilsands, including in situ, mining and upgrading, are expected to grow by 56 Mt.[32] Under these projections, many reductions made in other economic sectors are neutralized and reversed by the growth in oilsands emissions. In situ emissions are expected to grow from 18 Mt in 2010 to 55 Mt in 2020, a net increase of 37 Mt. By 2020,

[28] Environment Canada, *Canada's Emissions Trends* (2011). Figure 6.

[29] Environment Canada, *Canada's Emissions Trends* (2012). Figure ES.1. http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada's-Emissions-Trends-2012_e_01.pdf

[30] See: P.J. Partington, "Are we there yet? Closing the gap on Canada's climate commitments," *Pembina Institute*, August 9, 2012. http://www.pembina.org/blog/643

[31] *Canada's Emissions Trends* (2012), 19. Note: This decrease includes the 25 Mt reduction contributed by the reporting of the Land Use, Land-Use-Change and Forestry sector (LULUCF).

[32] Ibid. 24.

oilsands extraction and upgrading will make up 14 per cent of Canada's greenhouse gas emissions.[33]

As Figure 3 shows, between 2010 and 2020 the oilsands stand out as both the fastest growing source of emissions and the most significant across Canadian economic subsectors.

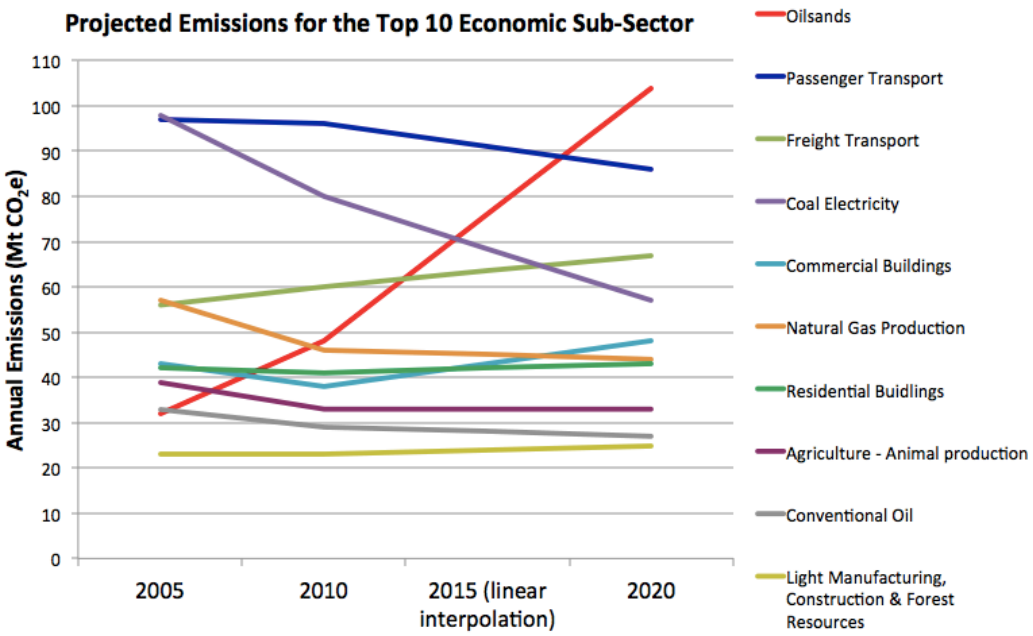

Figure 3: Oilsands greenhouse gas emissions (past and forecast) under existing policies[34]

If Canada is to meet its 2020 climate change targets, it will have to address the growing challenge of oilsands emissions or rely on other sectors making even steeper reductions in their emissions. There are a variety of tools and approaches Canada can take to make progress on its climate commitments, but the first step is to acknowledge the actual gravity of the challenges ahead.

[33] Ibid. 20, 24.

[34] Ibid., 24.

THE FACTS

Rising greenhouse gas pollution from the oilsands is at odds with Canada's international climate change commitments and the global need to make deep reductions to emissions.

Canada is a significant contributor to greenhouse gas pollution globally, ranking in the top 10 list of countries for absolute and per capita emissions. The projected rate of oilsands expansion and the corresponding rise in emissions from this sector represent a serious challenge for Canada to reduce its greenhouse gas pollution overall.

Further, if the global community successfully implements policies to avoid dangerous levels of climate change, demand for fossil fuels — and in particular carbon-intensive fuels like the oilsands — will not grow to levels consistent with planned oilsands development. It is very likely that Alberta's rapid pace of oilsands approvals and planned expansions have outpaced global demand for emission-intensive fossil fuels in an increasingly carbon-constrained world.

The full story

Climate change is a global challenge that will require a serious effort from all countries, especially major emitters like Canada. Limiting global temperature rise below the internationally-agreed threshold of two degrees Celsius will require a complete transformation of the global energy system, taking decades of unprecedented and sustained effort.

The success of this global, collaborative approach to fighting climate change depends on individual actions. The challenge of this approach is that, when viewed in isolation, individual actions seem insignificant relative to the scale of the problem. On the global scale, emissions from the oilsands — or any other single economic sector, for that matter — may appear insignificant, but it's their relative contribution to Canada's emissions as a whole that matters.

Within Canada, it is clear that all provinces and sectors will need to reduce greenhouse gas pollution. Therefore, when assessing the emissions from economic sub-sectors, such as the oilsands, it is far more relevant to consider them in relation to other sectors and in a provincial and national context than on a global scale. As illustrated in the sections above, it is clear that the oilsands represent a significant portion of Canada's emissions. The oilsands accounted for approximately seven per cent of Canada's emissions in 2010 and are forecast to grow to over 14 per cent by 2020.[35] In fact, Environment Canada projections shown in Figure 4, below, identify the oilsands stands as the largest source of emissions among economic subsectors in Canada, with oilsands emissions moving sharply in the opposite direction of what is required to meet Canada's national climate target. By 2020, oilsands emissions are projected to exceed those of all

[35] Ibid., 19 & 24.

passenger transportation in Canada, all electricity generation in Canada and the total emissions of every province except Alberta and Ontario.

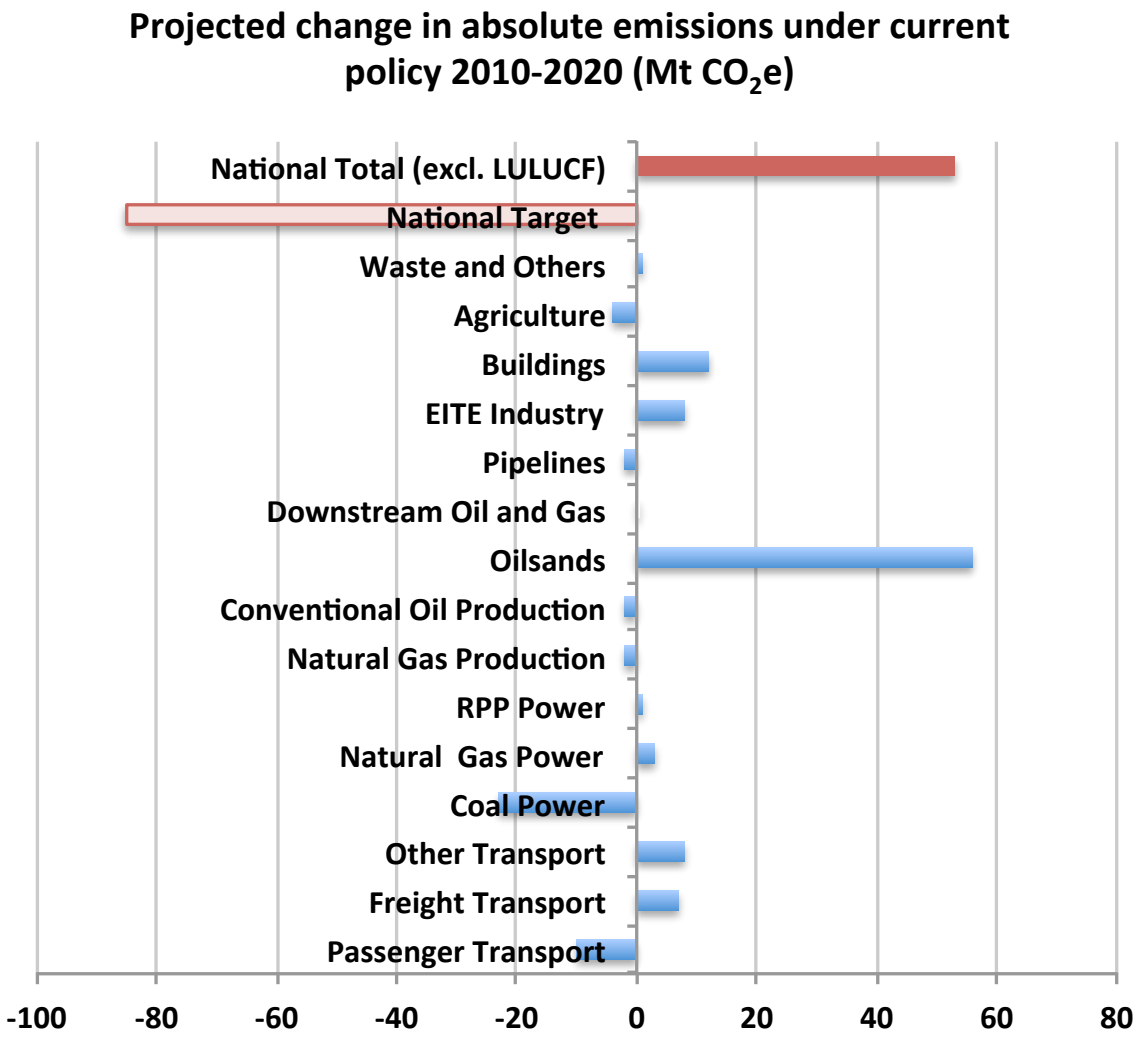

Figure 4: Canada's emissions projections (2010-2020) in context of National commitment.

On the global stage, Canada produces more than its share of greenhouse gas pollution and is also criticized for its lack of leadership in international efforts to address climate change.

Canada has taken on an obstructionist role in international climate talks, providing little leadership and attracting international criticism. Canada has actively lobbied against initiatives to reduce greenhouse gas emissions in other countries, including the European fuel quality directive,[36] California's low-carbon fuel standard,[37] and the European Union's inclusion of international aviation in their emissions trading system.[38]

[36] Max Paris, "EU delays 'anti-oilsands' fuel quality directive decision", *CBC News,* April 20, 2012. http://www.cbc.ca/news/politics/story/2012/04/20/pol-fuel-directive-europe-canada.html

As mentioned previously, Canada ranks among the top 10 greenhouse gas emitters globally, despite its relatively small population. According to International Energy Agency (IEA) data on energy-related CO_2 emissions, Canada ranks as the eighth largest absolute emitter. [39] On a per capita basis (excluding countries with populations below 1 million),[40] Canada is the ninth largest greenhouse gas polluter.

Further, while emissions from the production and upgrading of Canada's oilsands may look small relative to the global total, oilsands emissions alone are actually larger than the emissions from many countries as a whole. If Canada's oilsands emissions are compared against other countries' emissions, they would rank as the 56th largest emitter out of a total of 142 countries, ranking similar to Portugal.[41]

Whether a national or global perspective is taken, it is clear that the oilsands represent a significant source of greenhouse gas emissions that must be addressed in order to meet climate commitments and to avoid dangerous levels of climate change.

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[37] Climate Action Network Canada, *The Tar Sands' Long Shadow: Canada's Campaign to Kill Climate Policies Outside our Borders* (2010). http://climateactionnetwork.ca/issues/getting-off-fossil-fuels/tar-sands/report/

[38] James Kanter, "U.S. steps up its effort against a European system of fees on airline emissions," *New York Times,* September 9, 2010. http://www.nytimes.com/2010/09/10/business/energy-environment/10emit.html?_r=1

[39] International Energy Agency, *CO_2 Emissions from Fuel Combustion* (2012). http://www.iea.org/media/statistics/CO2Highlights2012.XLS

[40] Luxembourg, Brunei Darussalam, Netherlands Antilles, and Gibraltar also have higher per capita emissions than Canada due to their very low populations.

[41] Assuming oilsands emissions of 48 Mt in 2010 and 104 Mt in 2020.

Oilsands expansion plans are out of step with global efforts to address climate change

Economic and greenhouse gas emissions models have been developed to understand the actions necessary to meet various global targets for climate change. For example, in 2010 the IEA World Energy Outlook's "450 scenario" examined the conditions that would result from policies that aim to constrain the world to global warming impacts consistent with a temperature rise of two degree Celsius.[42]

Under the policies required to achieve the 450 scenario, demand for unconventional crude (which includes oilsands) declines. This disproportionately affects the oilsands, which are generally more costly and more emissions intensive. The IEA forecasts that oilsands production under this scenario will be limited to just over three million barrels per day.[43]

Similarly, a study conducted by the Massachusetts Institute of Technology indicates that oilsands production substantially decreases from planned levels as various policy scenarios are implemented to reduce global greenhouse gas emissions.[44]

Oilsands production is currently 1.7 million barrels per day, but production is expected to grow to 5.2 million barrels per day if all of the projects that have already been approved are built. Given the projected impact that global action to address climate change would have on oilsands production and demand, it is clear that the planned growth rates for oilsands and oilsands approvals are out of touch with market forces in a world that avoids disastrous levels of climate change impacts.

[42] International Energy Agency (2010), *World Energy Outlook 2010*, 62.

[43] Ibid., 450.

[44] G. Chan, J.M. Reilly, S. Paltsev, and Y.H. Chen, *Canada's Bitumen Industry Under CO_2 Constraints* (MIT Joint Program on the Science and Policy of Global Change Constraints, 2010) 11-12. http://globalchange.mit.edu/research/publications/2021