
ALBERTA TAR SANDS CLIMATE FACTS AND CHARTS

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CONTENTS

1. Producing a barrel of tar sands oil creates three to four times more climate pollution than producing conventional crude oil in Canada or USA.	3
2. A full "wells-to-wheels" lifecycle analysis by the US Department of Energy shows tar sands oil creates 22% more climate pollution than conventional crude oil.	3
North American Impact examples	4
A. A Honda Accord burning tar sands gasoline has the same climate impact as a Chevy Suburban using conventional gasoline.	4
B. Over the lifetime of an average car, using tar sands gasoline will increase the climate impact by 19 tonnes of CO2 compared to using conventional gasoline.	4
C. Fuelling ten percent of USA transportation with tar sands oil increases the climate impact by nearly 40 MtCO2 -- equal to adding 8 million cars to US roads.	4
European Impact examples	5
A. UK Cars: A Honda Accord burning tar sands petrol has the same climate impact as a Ford Ranger XL pickup using conventional petrol.	5
B. Switching ten percent of the EU-27's oil to tar sands oil would increase the climate impact by 41 MtCO2 per year -- equal to adding 21 million new cars to EU roads.	5
3. Climate pollution per barrel has increased 21% in the last few years.	6
4. Tar sands are the fastest growing source of climate pollution in Canada	8
5. There are no effective limits on climate pollution from the tar sands	8
6. Climate pollution from the tar sands has doubled in the last decade -- and is predicted to more than double again in the coming decade.	9
7. Climate pollution from producing tar sands oil is projected to hit 104 MtCO2 by 2020. That is twice current emissions from Norway or Bangladesh -- and exceeds the combined emissions from 85 nations.	9
8. "Wells-to-wheels" climate pollution from the tar sands is projected to hit 730 MtCO2 by 2020. That would rank as the seventh worst climate polluting nation in the world today.	10
9. Alberta has already approved enough tar sands projects to produce "wells-to-wheels" climate pollution of 1,095 MtCO2 per year. That exceeds the current combined emissions from 150 nations.	10
Compared To Canadian Coal	11
10. Production of tar sands currently generates ten times more climate pollution than production of coal in Canada. This is expected to grow to 34 times more by 2020.	11
11. Burning tar sands oil currently produces two times more climate pollution than burning Canadian coal. This is set to grow to four times more by 2020.	11
12. Eliminating all coal mining in Canada would offset the climate impact of just four years of planned tar sands expansion.	11
Compared to USA coal	12
13. Climate pollution from Alberta tar sands production is on track to exceed that from all USA coal production within a decade.	12
14. The tar sands contain nearly four times more carbon than the Gillette Coalfield in the Powder River basin, one of the largest coal deposits in the world.	12
Petcoke: The hidden coal in the tar sands	13
15. Around 15% of bitumen gets turned into a dirtier-than-coal fuel called "petcoke", making coal plants that use it even dirtier.	13
16. The bitumen flowing through one large pipeline yields enough "petcoke" by-product to fuel five coal power plants.	13
17. Rapid expansion of tar sands pollution is the overwhelming reason why Canada is expected to break our nation's climate promise.	14
18. Canada would be on track to reduce climate pollution over the next decade if not for the planned expansion of the tar sands industry. Instead Canadian emissions are predicted to increase.	14
19. The tar sands projects already under construction will supply almost all the tar sands oil the world can use on a path that avoids dire climate changes.	15
20. The tar sands projects already approved by Alberta will supply far more tar sands oil than the world can use on a path to leads to a climate "catastrophe".	15

21. A moratorium on future project approvals will not affect the ability of the tar sands industry to supply all the tar sands oil humanity can safely burn.	16
22. Fully exploiting the tar sands could release more climate pollution than the USA and China combined -- or EU plus China combined -- have released in all their history. It could surpass all the oil ever burned by humanity.	17
23. NASA Climatologist James Hansen said that "if Canada proceeds [with its exploitation of the oil sands] it will be game over for the climate"	19
24. Climate pollution pricing adequate to prevent catastrophic climate change will make the majority of the proposed tar sands oil supply too expensive to sell.	20
25. Tar sands oil faces 22% more climate pollution fees than conventional oil.	21
26. The Alberta economy faces substantially higher climate pollution fees per capita than any nation except Qatar.	22
27. The Alberta economy creates three times less GDP per tCO2 than the rest of Canada.	22
28. To meet Canadian climate targets requires a continually rising climate pollution price reaching \$150 to \$200 per tonne of CO2 by 2020, and continuing upwards from there.	23
Impact examples using average climate pollution price of \$150/tCO2 over next 30 years	23
29. Annual climate pollution fees would cost Alberta 14% of current GDP; Ontario just 4%.	23
30. Adds \$86 per barrel to tar sands oil -- 22% more than for conventional oil.	23
31. Adds \$750 billion to cost of tar sands oil flowing through one pipeline over 30 years.	23
32. No new tar sands pipelines are needed on an energy path where humanity avoids the dire climate impacts beyond 2oC of warming.	25
33. Each major tar sands pipeline locks in a climate spill of five billion tonnes of CO2.	25
34. Tar sands oil flowing through a major new pipeline is exposed to half a trillion dollars in potential climate pollution fees. Or more.	25
35. Three proposed pipelines to BC's coast could require over 800 oil tankers per year.	26
Proposed pipelines data table	27

A :: Dirtier per gallon

Tar sands oil causes significantly more climate damage per barrel

1. Producing a barrel of tar sands oil creates **three to four times more climate pollution** than producing conventional crude oil in Canada or USA.

DETAILS: Average greenhouse gas emissions for bitumen extraction and upgrading are estimated to be 3.2 to 4.5 times as intensive per barrel as for conventional crude oil produced in Canada or the US.¹

2. A full “wells-to-wheels” lifecycle analysis by the US Department of Energy shows tar sands oil creates **22% more climate pollution** than conventional crude oil.²

DETAILS: “Wells-to-wheels” includes extraction of bitumen, upgrading, refining, transportation and combustion of oil products such as gasoline. Other studies show a range of 8% to 37% more climate damage from tar sands depending on what is included and compared.³ These studies do not yet include the extra emissions recently documented for a by-product fuel from tar sands refining/upgrading called “petcoke”.⁴ Petcoke has been shown to be on average 7.5% more carbon-intensive than coal.

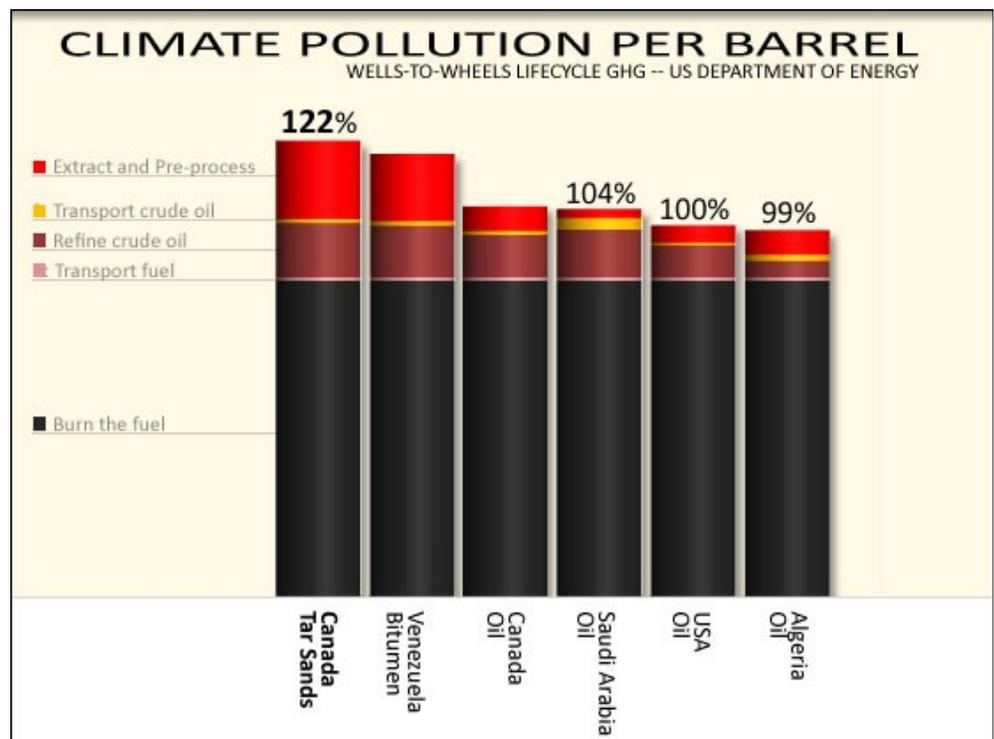


Chart by Barry Saxifrage at VisualCarbon.org and VancouverObserver.com. Source: US DOE National Energy Technology Laboratory "An Evaluation of the Extraction, Transport and Refining of Imported Crude Oils and the Impact on Life Cycle GHG Emissions"

¹ 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), Pembina's life cycle assessment checklist (Dan Woynillowicz, Jeremy Moorhouse and Danielle Droitsch, Life cycle assessments of oilsands greenhouse gas emissions (Pembina Institute, 2011)

² "Setting the Record Straight: Lifecycle Emissions of Tar Sands", Natural Resources Defense Council, http://docs.nrdc.org/energy/files/ene_10110501a.pdf

³ "Setting the Record Straight: Lifecycle Emissions of Tar Sands", Natural Resources Defense Council, http://docs.nrdc.org/energy/files/ene_10110501a.pdf

⁴ Oil Change International "Petroleum Coke" report at <http://priceofoil.org/2013/01/17/petroleum-coke-the-coal-hiding-in-the-tar-sands/>

North American Impact examples

- A. A Honda Accord burning tar sands gasoline has the **same climate impact as a Chevy Suburban** using conventional gasoline.
- B. Over the lifetime of an average car, using tar sands gasoline will **increase the climate impact by 19 tonnes** of CO₂ compared to using conventional gasoline.
- C. Fuelling ten percent of USA transportation with tar sands oil increases the climate impact by nearly 40 MtCO₂ -- **equal to adding 8 million cars to US roads**.

DETAILS: The average passenger vehicle in the USA got 21.6 miles per USGallon in 2010¹ and lasted for 212,000 miles². This requires burning 9,722 gallons of gasoline per vehicle which will produce 87 tonnes of CO₂ (tCO₂). Gasoline produces 8.92 kgCO₂/USGallon³. Using tar sands gasoline increases wells-to-wheels emissions by 22% leading to an extra 19 tCO₂ for an average vehicle.

US EPA lists 2012 Honda Accord Coupe at 21 mpg and 2012 Chevrolet Suburban 1500 2WD at 17 mpg⁴. The Accord will drive 2,100 miles on 100 gallons of gas. With tar sands gasoline the "wells-to-wheels" climate impact will be 22% more -- equal to burning 122 gallons. The Suburban needs 123 gallons to go the same distance.

Ten percent of USA transportation emissions in 2010 equalled 175 million tonnes of CO₂ (MtCO₂)⁵. Adding 22% to that adds 39 MtCO₂. The average car in USA emits 4.8 tCO₂ per year⁶. Eight million cars at 4.8 tCO₂ each yields 38.4 MtCO₂.

¹ US EPA at www.epa.gov/cleanenergy/energy-resources/refs.html

² California EPA <http://www.arb.ca.gov/regact/grnhsgas/vmt.pdf>

³ US EPA at www.epa.gov/cleanenergy/energy-resources/refs.html

⁴ US EPA at www.fueleconomy.gov

⁵ US EPA Emissions Trends 2012 at <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2012-Chapter-2-Trends.pdf>

⁶ US EPA Emissions Calculator at <http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>

- A. UK Cars: A Honda Accord burning tar sands petrol has the **same climate impact as a Ford Ranger XL pickup** using conventional petrol.
- B. Switching ten percent of the EU-27's oil to tar sands oil would increase the climate impact by 41 MtCO₂ per year -- **equal to adding 21 million new cars to EU roads.**

DETAILS: Honda UK lists four models of Honda Accord coupe (aka "Saloon"). The average of the four models is 156 gCO₂/km with the dirtiest being 168 gCO₂/km.¹ With tar sands gasoline the "wells-to-wheels" climate impact will be 22% more -- pushing the average for Accord Saloons over 190 gCO₂/km and the dirtiest over 205 gCO₂/km. Ford UK lists their Ford Ranger XL pickup truck at 192 gCO₂/km.²

US EIA lists EU-27 2010 CO₂ emissions from consumption of petroleum at 1877 million tonnes of CO₂ (MtCO₂).³ Ten percent equals 188 MtCO₂. Adding 22% to cover the extra CO₂ from tar sands oil adds 41 MtCO₂. The average new car in Europe in 2011 emits 135.7 gCO₂ per kilometer.⁴ The average annual distance travelled by a car in the EU is approximately 14000 km per year.⁵ Combined yields 1.9 tCO₂ per new car per year. It would take 21.5 million cars at 1.9 tCO₂ each to total 41 MtCO₂.

¹ <http://www.honda.co.uk/cars/accordsaloon/>

² <http://www.ford.co.uk/Cars/Ranger>

³ <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=5&aid=8&cid=CG1,&syid=2006&eyid=2010&unit=MMTCD>

⁴ http://ec.europa.eu/enterprise/newsroom/cf/itemdetail.cfm?item_id=6021&lang=en

⁵ http://www.acea.be/news/news_detail/vehicles_in_use/

B :: Getting dirtier

Tar sands oil is getting dirtier to produce in recent years.

3. Climate pollution per barrel has **increased 21%** in the last few years.

DETAILS: The Canadian Association of Petroleum Producers (CAPP) produces "Facts on Oil Sands" booklet ¹.

The 2010 edition states: "Since 1990, GHG emissions associated with every barrel of oil sands crude produced have been reduced by 39%."

The 2011 edition states: "Since 1990, GHG emissions associated with every barrel of oil sands crude produced have been reduced by 29%."

The 2012 edition states: "Since 1990, GHG emissions associated with every barrel of oil sands crude produced have been reduced by 26%."

A carbon-intensity drop from 39% better to just 26% better means climate pollution per barrel has increased by 21% in recent years. Pembina documents a similar increase ². A study by CanOils showed a similar increase ³.

Despite the fact that CAPP's own publication shows a significant increase in the emissions intensity per barrel recently, that same CAPP booklet opens their environmental section with a full page quote saying: "Canada's oil sands industry continues to reduce GHG emissions intensity".

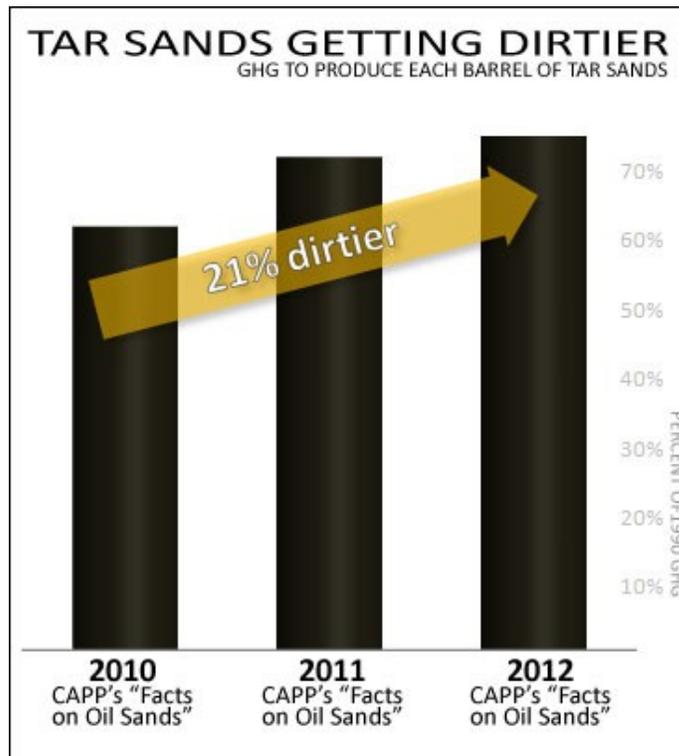


Chart by Barry Saxifrage at VisualCarbon.org and VancouverObserver.com.
Source: CAPP's annual "Facts on Oil Sands" report at www.capp.ca

¹ CAPP at www.capp.ca/UpstreamDialogue/OilSands/Pages/default.aspx

² Pembina: "Responsible Action? An Assessment of Alberta's Greenhouse Gas Policies (2011)"

³ www.oil-blog.com/operating-sector/oil-sands-producers-cut-co2-emissions-2/

C :: Rapid and unchecked surge in climate damage

Industry rapidly increasing climate pollution without any effective limits

4. Tar sands are the **fastest growing source** of climate pollution in Canada

DETAILS: From 1990 to 2010, annual GHG emissions from production of tar sands increased by 33 million tonnes of CO₂ (MtCO₂) -- a 220% increase. The next fastest growing GHG sector in Canada was Freight Transport which increased 21 MtCO₂ -- a 54% increase.¹

Similarly from 2000 to 2010, annual GHG emissions from production of tar sands increased by 25 MtCO₂ -- a 109% increase in one decade. The next fastest growing GHG sector in Canada was again Freight Transport which increased 12 MtCO₂ -- a 25% increase.²

5. There are **no effective limits** on climate pollution from the tar sands

DETAILS: **The federal government** has no policies or limits on climate pollution from the tar sands. An NRDC report states³: "There are no effective limits on greenhouse gas, air or water pollution from the tar sands: A recent expert science panel report on tar sands⁴ found that the Canadian federal government has authority to regulate tar sands, but that they have not been doing so⁵."

The Alberta government introduced their Specified Gas Emitters Regulation (SGER) policy for climate pollution from the tar sands in 2007. In just the few years since this policy has been in place both the carbon-intensity⁶ and the total emissions⁷ from the tar sands have increased by more than 20%. A Pembina report⁸ says "*Alberta's carbon price on heavy emitters is too weak to provide an incentive for oilsands operators to meaningfully reduce greenhouse gas emissions ... compliance with Alberta's climate policies costs a typical oilsands operator an equivalent of between 18 and 22 cents per barrel of oil produced.*" That adds less than half a penny per gallon; **a tenth of a penny per litre.**

¹ Canada—National Inventory Report 1990-2010 part 1, Table 2-13 Details of Trends in GHG Emissions by Sector at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

² Canada—National Inventory Report 1990-2010 part 1, Table 2-13 Details of Trends in GHG Emissions by Sector at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

³ NRDC report: Canada Climate and Energy Myths vs. Facts at <http://www.nrdc.org/energy/files/EnergyMythsVsFacts.pdf>

⁴ Royal Society of Canada. Environmental and Health Impacts of Canada's Oil Sands Industry. December 2010. www.rsc-src.ca/expertpanels_reports.php

⁵ Josh Wingrove, "Oil Sands Report Criticizes All Stakeholders", *Globe and Mail*, December 15, 2010. www.theglobeandmail.com/news/politics/oil-sands-report-criticizes-all-stakeholders/article1838315/page2/

⁶ See "Getting Dirtier" section above.

⁷ Canada—National Inventory Report 1990-2010 part 1, Table 2-13 Details of Trends in GHG Emissions by Sector at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

⁸ Pembina Institute: "Beneath the Surface"

6. Climate pollution from the tar sands *has doubled in the last decade -- and is predicted to more than double again in the coming decade.*

DETAILS: **Production emissions.** In 2000, tar sands production generated 23 MtCO₂. By 2010 that had more than doubled to 48 MtCO₂.¹ Environment Canada expects production emissions will more than double again to hit 104 MtCO₂ by 2020 under current expansion plans.²

Wells-to-wheels emissions. The "wells-to-wheels" emissions (wtwe) from tar sands oil has been calculated at 0.572 tCO₂/barrel.³

In 2000, the tar sands produced 220 million barrels of oil⁴ with wtwe of 126 MtCO₂. By 2010 that had more than doubled to 590 million barrels⁵ with wtwe of 337 MtCO₂. By 2020 it is predicted to more than double again to 1,280 million barrels⁶ with wtwe of 731 MtCO₂.

7. Climate pollution from producing tar *sands oil is projected to hit 104 MtCO₂ by 2020. That is twice current emissions from Norway or Bangladesh -- and exceeds the combined emissions from 85 nations.*

DETAILS: Environment Canada expects production emissions to hit 104 million tonnes of CO₂ (MtCO₂) by 2020 under current expansion plans⁷. US EIA lists Norway emissions at 51MtCO₂; Bangladesh emissions at 50 MtCO₂; and 85 nations with combined emissions of 103 MtCO₂⁸.

¹ Canada—National Inventory Report 1990-2010 part 1, Table 2-13 Details of Trends in GHG Emissions by Sector at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

² Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

³ Swart & Weaver: "Alberta oil-sands and climate" at http://climate.uvic.ca/people/nswart/original_images/Alberta_oil_sands_well_to_wheel_warming.pdf

⁴ IHS CERA at http://press.ihs.com/sites/ihs.newshq.businesswire.com/files/image/image/Oil_Sands_chart_hi-res.JPG

⁵ Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

⁶ Alberta Energy stats at <http://www.energy.alberta.ca/OilSands/791.asp>

⁷ Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

⁸ US EIA 2010 International Energy Statistics at <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=regions&syid=2010&eyid=2010&unit=MMTCD>

8. *"Wells-to-wheels" climate pollution from the tar sands is projected to hit 730 MtCO2 by 2020. That would rank as the seventh worst climate polluting nation in the world today.*

DETAILS FOR 2011: Canada produced 585 million barrels of tar sands oil in 2011.¹ The "wells-to-wheels" emissions from a barrel of tar sands oil is 0.572 tCO2.² That yields around 330 MtCO2. This is more than the 19th largest climate pollution nation (Spain) emits today.³

DETAILS FOR 2020: Tar sands production is expected to be 1,278 million barrels a year in 2020.⁴ The "wells-to-wheels" impact of this is 730 MtCO2. US EIA lists South Korea as the 7th biggest GHG nation at 579 MtCO2 and Germany as the 6th biggest GHG nation at 794 MtCO2.⁵ Other top 20 emitters include Canada at 549 MtCO2, UK at 532 MtCO2, Brazil at 454 MtCO2 and France at 395 MtCO2.

9. *Alberta has already approved enough tar sands projects to produce "wells-to-wheels" climate pollution of 1,095 MtCO2 per year. That exceeds the current combined emissions from 150 nations.*

DETAILS: Alberta has approved enough tar sands projects to produce 5.25 million barrels a day, or 1,916 million barrels a year.⁶ The "wells-to-wheels" emissions from a barrel of tar sands oil is calculated at 0.572 tCO2 when burned.⁷ That yields around 1,095 MtCO2. US EIA lists 150 nations with combined emissions of 1,025 MtCO2.⁸

¹ CAPP at www.capp.ca/UpstreamDialogue/OilSands/Pages/default.aspx

² Swart & Weaver: "Alberta oil-sands and climate" at http://climate.uvic.ca/people/nswart/original_images/Alberta_oil_sands_well_to_wheel_warming.pdf

³ US EIA 2010 International Energy Statistics at <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=regions&syid=2010&eyid=2010&unit=MMTCD>

⁴ CAPP at www.capp.ca/UpstreamDialogue/OilSands/Pages/default.aspx

⁵ US EIA 2010 International Energy Statistics at <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=regions&syid=2010&eyid=2010&unit=MMTCD>

⁶ Oil Sands Developers Group. Oil sands Project List. Updated as of October 2012 at

<http://www.oilsandsdevelopers.ca/wp-content/uploads/2012/01/Oil-Sands-Project-List-January-2012.pdf>

⁷ Swart & Weaver: "Alberta oil-sands and climate" at http://climate.uvic.ca/people/nswart/original_images/Alberta_oil_sands_well_to_wheel_warming.pdf

⁸ US EIA 2010 International Energy Statistics at <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=regions&syid=2010&eyid=2010&unit=MMTCD>

⁸ US EIA 2010 International Energy Statistics at <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=44&aid=8&cid=regions&syid=2010&eyid=2010&unit=MMTCD>

D :: Worse than coal

Tar sands climate damages have surged far beyond Canadian coal

Compared To Canadian Coal

10. Production of tar sands currently generates **ten times more climate pollution** than production of coal in Canada. This is expected to grow to **34 times more** by 2020.

DETAILS: Canada produces ~70 Mt of coal each year.¹ The GHGenius software used by the Canadian government estimates 66 kgCO₂ in production emissions for each tonne of Canadian coal.² That yields around 4.6 million tonnes of CO₂ (MtCO₂). This matches the "coal mining" value of 4.7 MtCO₂ for 2010 from Environment Canada.³ Production of tar sands in 2010 released 48 MtCO₂.⁴ Environment Canada expects emissions from "coal mining" to fall to 3 MtCO₂ by 2020 while emissions from tar sands production will grow to 104 MtCO₂ under current expansion plans.⁵

11. Burning tar sands oil currently produces **two times more climate pollution** than burning Canadian coal. This is set to grow to four times more by 2020.

DETAILS: Canada produces ~70 Mt of coal each year.⁶ Burning that releases around 140 MtCO₂. Canada produced 1.6 million barrels of tar sands per day in 2011, or 585 million barrels a year.⁷ Each barrel of bitumen produces 0.521 tCO₂ when burned.⁸ That yields around 300 MtCO₂ -- double the emissions from burning all Canadian-mined coal. Tar sands production is expected to more than double by 2020⁹ yielding over 650 MtCO₂ when burned.

12. Eliminating all coal mining in Canada would offset the climate impact of **just four years** of planned tar sands expansion.

DETAILS: Canada produces around 70 million tonnes of coal each year.¹⁰ Burning that releases around 140 MtCO₂. Canada produced 1.6 million barrels of tar sands per day in 2011.¹¹ Tar sands production is expected to more than double by 2020 to 3.5 million barrels a day.¹² This is an increase of 1.9 million barrels per day -- 694 million barrels a year. Each barrel produces 0.521 tCO₂ when burned.¹³ Within nine years the annual climate pollution from burning tar sands oil will increase by more than 360 million tonnes of CO₂ (MtCO₂). The average works out to a 40 MtCO₂ increase each year for nine years. Shutting down coal mining in Canada would eliminate 140 MtCO₂ from Canadian-sourced coal. That equals four years of planned increases in Canadian-sourced tar sands oil (4 x 40MtCO₂ = 160 MtCO₂).

¹ National Resources Canada at <http://www.nrcan.gc.ca/energy/sources/1205#production>

² <http://www.ghgenius.ca/reports/FinalGHGeniusPathways.pdf>

³ Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

⁴ Canada's 2012 UNFCCC Submission at http://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/6598.php

⁵ Environment Canada "Canada's Emissions Trends 2012"

⁶ National Resources Canada at <http://www.nrcan.gc.ca/energy/sources/1205#production>

⁷ CAPP at www.capp.ca/UpstreamDialogue/OilSands/Pages/default.aspx

⁸ Oil Change International "Petroleum Coke" report at <http://priceofoil.org/2013/01/17/petroleum-coke-the-coal-hiding-in-the-tar-sands/>

⁹ Environment Canada "Canada's Emissions Trends 2012"

¹⁰ National Resources Canada at <http://www.nrcan.gc.ca/energy/sources/1205#production>

¹¹ CAPP at www.capp.ca/UpstreamDialogue/OilSands/Pages/default.aspx

¹² Alberta Energy stats at <http://www.energy.alberta.ca/OilSands/791.asp>

¹³ Oil Change International "Petroleum Coke" report at <http://priceofoil.org/2013/01/17/petroleum-coke-the-coal-hiding-in-the-tar-sands/>

13. Climate pollution from Alberta tar sands production is on track to **exceed that from all USA coal production** within a decade.

DETAILS: Environment Canada expects from tar sands production will grow to 104 MtCO₂ by 2020 under current expansion plans.¹ CAPP expects tar sands production to grow another 50% from there by 2030² pushing emissions to around 150 MtCO₂. Emissions from USA coal production were estimated at 117 MtCO₂ for 2008.³ USA coal production is expected to fall to 87% of 2008 level by 2020.⁴ A similar decrease in coal production emissions yields 101 MtCO₂ per year. USA coal industry has been the single largest source of climate pollution in history.

14. The tar sands contain nearly **four times more carbon** than the Gillette Coalfield in the Powder River basin, one of the largest coal deposits in the world.

DETAILS: Gillette Coalfield has been called "one of the largest coal deposits in the world" and is estimated to contain 67.5 Gt of carbon.⁵ The tar sands deposit is estimated at 1,800 Gbbls with each barrel having 142 kg of carbon in it.⁶ That yields over 250 Gt of carbon -- nearly four times larger. Note that values in this paragraph are for pure carbon. To get CO₂ values multiply by 3.6667.

¹ Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

² CAPP at www.capp.ca/UpstreamDialogue/OilSands/Pages/default.aspx

³ http://www.worldwatch.org/system/files/pdf/Natural_Gas_LCA_Update_082511.pdf

⁴ http://www.eia.gov/forecasts/aeo/source_coal.cfm

⁵ <http://www.realclimate.org/index.php/archives/2011/11/keystone-xl-game-over/>

⁶ Oil Change International "Petroleum Coke" report at <http://priceofoil.org/2013/01/17/petroleum-coke-the-coal-hiding-in-the-tar-sands/>

15. Around 15% of bitumen gets turned into a **dirtier-than-coal** fuel called "petcoke", making coal plants that use it even dirtier.

DETAILS: An 2013 Oil Change International report titled "Petroleum Coke: The Coal Hiding in the Tar Sands"¹ documents that "15 to 30 percent of a barrel of tar sands bitumen can end up as petcoke, depending on the upgrading and refining process used ... On a per-unit of energy basis petcoke emits 5 to 10 percent more carbon dioxide than coal." Because this is a by-product of tar sands upgrading and refining petcoke fuel sells at an average 25% discount to coal. Tar sands petcoke is "helping to make coal fired power generation dirtier and cheaper – globally ... at exactly the time that we urgently need low carbon solutions to energy production." So far the extra climate impact from this "hidden coal" in the tar sands has not been included in life-cycle studies of the tar sands.

16. The bitumen flowing through one large pipeline yields enough "petcoke" by-product to **fuel five coal power plants**.

DETAILS: An 2013 Oil Change International report titled "Petroleum Coke: The Coal Hiding in the Tar Sands"² documents the " petcoke produced from the Keystone XL pipeline would fuel 5 coal plants and produce 16.6 million metric tons of CO2 each year." This is based on a flow of 830,000 barrels a day. The proposed Enbridge Northern Gateway pipeline through British Columbia is designed to handle up to 800,000 barrels a day³ and so could have a similar petcoke impact. The proposed Kinder Morgan Transmountain pipeline expansion across BC has a proposed capacity even higher at 890,000 barrels a day.

¹ Oil Change International "Petroleum Coke" report at <http://priceofoil.org/2013/01/17/petroleum-coke-the-coal-hiding-in-the-tar-sands/>

² Oil Change International "Petroleum Coke" report at <http://priceofoil.org/2013/01/17/petroleum-coke-the-coal-hiding-in-the-tar-sands/>

³ US State Department KeytstoneXL review: <http://keystonepipeline-xl.state.gov/documents/organization/182421.pdf>

E :: Forcing climate failure on Canada

Tar sands' pollution is forcing Canada to break our climate promises.

17. Rapid expansion of tar sands pollution is the overwhelming reason why Canada is expected to **break our nation's climate promise**.

DETAILS: Prime Minister Stephen Harper formally committed Canada -- via the Copenhagen Accord in 2009 -- to cut climate pollution to 17 per cent below 2005 levels by 2020. Canada's climate emissions were 740 million tonnes of CO₂ (MtCO₂) in 2005. Canada's commitment is to reduce climate pollution to 607 MtCO₂ in 2020.¹

Environment Canada projects that current climate policies are inadequate to meet this goal. Instead Canada is on track for emissions of 720 MtCO₂ in 2020. That is **106 MtCO₂ too high**.²

Environment Canada also predicts that proposed growth plans for the tar sands will see the climate pollution from producing tar sands oil grow to 104 MtCO₂ per year by 2020. That is an **increase of 72 MtCO₂ (a 225% increase)** between 2005 and 2020.³ This tripling of tar sands climate pollution represents **68% of the overshoot on Canada's climate promise**.

The next fastest growing GHG sector in Canada from 2005 to 2020 is projected to be Freight Transport with an 11 MtCO₂ increase (a 20% increase). After that are all the buildings in Canada with 6 MtCO₂ increase (a 7% increase).⁴

18. Canada would be on track to **reduce** climate pollution over the next decade if not for the planned expansion of the tar sands industry. **Instead Canadian emissions are predicted to increase**.

DETAILS: Environment Canada predicts that between 2010 and 2020, climate pollution from all of Canada except the tar sands is set to decline between by 28 million tonnes of CO₂ (MtCO₂).⁵

However climate pollution from the planned expansion of tar sands is predicted to increase by 56 MtCO₂ over that same period.⁶ This will wipe out the climate progress from the rest of Canada and force the nation to increase, rather than decrease, climate pollution for at least another decade.

If regulations were put in place that capped the amount of climate pollution from the tar sands then Canada as a nation would be on track to reduce climate emissions.

Pembina report⁷: "...it is clear that oilsands expansion and the corresponding rise in emissions from this sector represent a serious barrier to Canada playing a constructive role in the global fight to reduce greenhouse gas emissions."

¹ Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

² Environment Canada "Canada's Emissions Trends 2012"

³ Environment Canada "Canada's Emissions Trends 2012"

⁴ Environment Canada "Canada's Emissions Trends 2012"

⁵ Environment Canada "Canada's Emissions Trends 2012"

⁶ Environment Canada "Canada's Emissions Trends 2012"

⁷ Pembina Institute: "Beneath the Surface"

F :: Enough already

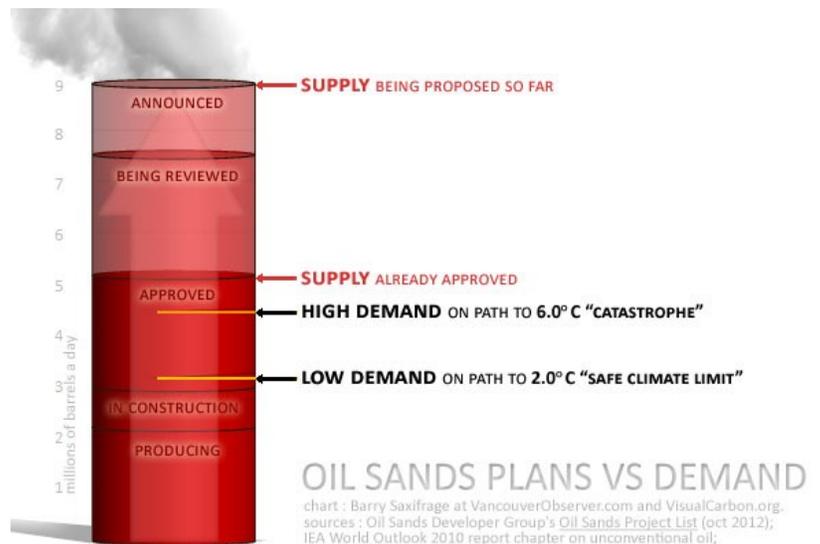
Already more tar sands projects are approved than the world needs.

19. The tar sands projects **already under construction** will supply almost all the tar sands oil the world can use on a path that avoids dire climate changes.

DETAILS: The International Energy Agency's global energy models predict that the world will only want to buy **3.3 million barrels of tar sands oil per day** on an energy path that give humanity a 50/50 chance to limit global warming to an increase of 2C.¹ Both the climate science -- and all the nations of the world -- have agreed that beyond 2C of warming the climate impacts become dire for human civilization. Operating tar sands projects plus those currently under construction are sufficient to **supply 92%** of this.²

20. The tar sands projects **already approved by Alberta** will supply far more tar sands oil than the world can use on a path to leads to a **climate "catastrophe"**.

DETAILS: The International Energy Agency's global energy models predict that the world will only want to buy **4.6 million barrels of tar sands oil per day** on an energy path that leads to disastrous global warming of 6C.³ The chief economist at the IEA said bluntly: *"The world is perfectly on track for a six-degree Celsius increase in temperature. Everybody, even the schoolchildren, knows this is a catastrophe for all of us."*⁴ Already approved tar sands projects are sufficient to **supply 5.25 million barrels a day**⁵ -- significantly more than needed even in a Mad Max world heading for catastrophic climate damage.



21. A **moratorium on future project approvals** will not affect the ability of the tar sands industry to supply all the tar sands oil humanity can safely burn.

¹ IEA "World Energy Outlook 2010"-- 450 Scenario at <http://www.worldenergyoutlook.org/media/weo2010.pdf>

² Oil Sands Developers Group. Oil sands Project List. Updated as of October 2012 at <http://www.oilsandsdevelopers.ca/wp-content/uploads/2012/01/Oil-Sands-Project-List-January-2012.pdf>

³ IEA "World Energy Outlook 2010"-- Current Policy Scenario at <http://www.worldenergyoutlook.org/media/weo2010.pdf>

⁴ <http://www.iea.org/newsroomandevents/ieainthenews/2012/may/>

⁵ Oil Sands Developers Group. Oil sands Project List. Updated as of October 2012 at <http://www.oilsandsdevelopers.ca/wp-content/uploads/2012/01/Oil-Sands-Project-List-January-2012.pdf>

G :: Game over

We cannot fully exploit the tar sands and stabilize the climate

22. Fully exploiting the tar sands could release more climate pollution than the USA and China combined -- or EU plus China combined -- have **released in all their history**. It could surpass all the oil ever burned by humanity.

DETAILS: If all the carbon in the tar sands deposit (aka "oil in place") were extracted and burned it would release between 1,000¹ and 1,200² billion tonnes of CO₂ (GtCO₂). However much of the carbon is unlikely to be economically viable to extract.

NASA climatologist James Hansen said a "conservative" estimate would be that around half of carbon deposits are eventually extracted, leading him to estimate around 160 billion tonnes of carbon which would release **587 GtCO₂** when used.³ The Energy Resources Conservation Board (ERCB) currently estimates just 17% would be ultimately recoverable although they say they haven't completely surveyed the resource.⁴ This lower estimate would result in wells-to-wheels emissions of 180 GtCO₂. An average recovery figure for oil industry currently is listed at around 35%.⁵ This would result in wells-to-wheels emissions of 361 GtCO₂.

The World Resources Institute's Climate Analysis Indicators Tool (CAIT)⁶ lists cumulative CO₂ emissions from 1850-2008 by nation in billions of tonnes of CO₂ (GtCO₂) including: USA = 345; EU = 314; China = 113; Germany = 82; UK = 69; Japan = 47; France = 33; India = 30 and Canada = 26. Either USA+China or EU+China total less than Hansen's 50% estimate. The US Department of Energy estimates global coal, oil and natural gas burning from 1752 through 2008: Coal: 616 GtCO₂; Oil: 450 GtCO₂; Gas: 165 GtCO₂.⁷

¹ Wells-to-wheels of oil in place. Swart & Weaver "The Alberta Oil Sands and Climate" at http://climate.uvic.ca/people/nswart/Alberta_Oil_Sands_climate.html

² IPCC estimate for Alberta tar sands as referenced by James Hansen at http://www.columbia.edu/~jeh1/mailings/2011/20110902_WhiteHouseAndTarSands.pdf

³ James Hansen at http://www.columbia.edu/~jeh1/mailings/2011/20110902_WhiteHouseAndTarSands.pdf

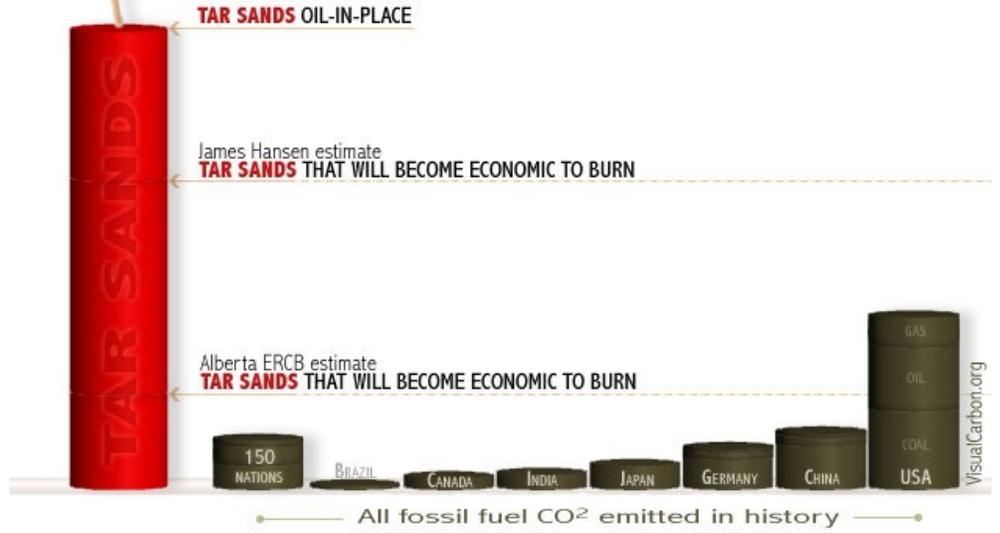
⁴ Alberta ERCB estimate from <http://www.ercb.ca/sts/ST98/st98-2011.pdf>

⁵ Leonardo Maugeri, June 2012, *Oil: The Next Revolution: The unprecedented upsurge of oil production capacity and what it means for the world.*

⁶ <http://www.wri.org/tools/cait/>

⁷ http://cdiac.ornl.gov/trends/emis/tre_glob.html

CARBON BOMB?



23. NASA Climatologist James Hansen said that “if Canada proceeds [with its exploitation of the oil sands] it will be **game over** for the climate”¹

DETAILS: He states that we cannot simply stabilize the climate and exploit the oil sands or other unconventional fossil fuels. “If the tar sands are thrown into the mix, it is essentially game over.”² He also says that to preserve a stable climate: “The principal requirement is that coal emissions must be phased out by 2030 and unconventional fossil fuels, such as tar sands, must be left in the ground.”³ In his book “Storms of My Grandchildren” Hansen discusses the climate impact of burning all the tar sands in addition to all the other reserves of carbon: “would Earth proceed to the Venus syndrome, a runaway greenhouse effect that would destroy all life on the planet, perhaps permanently? While that is difficult to say based on present information, I’ve come to conclude that if we burn all reserves of oil, gas, and coal, there is a substantial chance we will initiate the runaway greenhouse. If we also burn the tar sands and tar shale, I believe the Venus syndrome is a dead certainty.”⁴

¹ <http://www.nytimes.com/2012/05/10/opinion/game-over-for-the-climate.html>

² “Silence is Deadly” by James Hansen http://www.columbia.edu/~jeh1/mailings/2011/20110603_SilenceIsDeadly.pdf

³ <http://www.reuters.com/article/2011/06/27/idUS323166223820110627>

⁴ Hansen, James (2009-12-10). *Storms of My Grandchildren: The Truth About the Coming Climate Catastrophe and Our Last Chance to Save Humanity*

H :: Carbon bubbles and stranded assets

Low-carbon policies capable of stopping dire climate change will strand many tar sands assets.

24. Climate pollution pricing adequate to prevent catastrophic climate change will make the **majority** of the proposed tar sands oil supply **too expensive to sell**.

International Energy Agency (IEA): The IEA's 2010 World Energy Outlook report specifically analyzed future oil sands demand under several possible energy scenarios. In every scenario, global demand for oil sands in 2035 was well below what has now already been approved. The IEA scenario that gives humanity a 50/50 chance of limiting global warming to 2C predicts that the world will only want to buy **3.3 million barrels of tar sands oil per day**.¹ Both the climate science -- and all the nations of the world -- have agreed that beyond 2C of warming the climate impacts become dire for human civilization. The IEA scenario leading to catastrophic global warming of 6C predicted only **4.6 million barrels of tar sands oil per day** will be economically viable.² Compare that to the currently proposed tar sands projects which are sufficient to **supply 9 million barrels a day**.³

Massachusetts Institute of Technology (MIT): The MIT study titled "Canada's Bitumen Industry Under CO2 Constraints" states: "The niche for the oil sands industry seems fairly narrow and mostly involves hoping that climate policy will fail...". It goes on to say that a under a global treaty to prevent dire climate changes above 2C that oil prices decline as demand is curtailed. In that scenario: "the Canadian bitumen production becomes essentially non-viable even with CCS technology." This is because the tar sands are 22% more carbon intensive to produce.

The Harper Government, the Alberta government and the oil sands industry are all pushing a rapid expansion of tar sands capital projects far beyond what these studies predict will be economically viable in a climate safe world. The threat is significant that that this push is over-capitalizing the industry and will lead to many billions in stranded assets and punishing debt burdens.

25. Tar sands oil faces **22% more climate pollution fees** than conventional oil.

DETAILS: A full "wells-to-wheels" lifecycle analysis by the US Department of Energy shows tar sands oil creates **22% more climate pollution** than conventional crude oil.⁴ So tar sands oil faces a future in which climate pollution fees (aka "carbon price" or "carbon tax") will be 22% more. As climate pollution fees rise they threaten to make tar sands oil uneconomic.

¹ IEA "World Energy Outlook 2010"-- 450 Scenario at <http://www.worldenergyoutlook.org/media/weo2010.pdf>

² IEA "World Energy Outlook 2010"-- Current Policy Scenario at <http://www.worldenergyoutlook.org/media/weo2010.pdf>

³ Oil Sands Developers Group. Oil sands Project List. Updated as of October 2012 at <http://www.oilsandsdevelopers.ca/wp-content/uploads/2012/01/Oil-Sands-Project-List-January-2012.pdf>

⁴ "Setting the Record Straight: Lifecycle Emissions of Tar Sands", Natural Resources Defense Council, http://docs.nrdc.org/energy/files/ene_10110501a.pdf

26. The Alberta economy faces substantially **higher climate pollution fees per capita** than any nation except Qatar.

DETAILS: Official emissions for Alberta are **63 tonnes of CO₂ (tCO₂) per capita**.¹ The Canadian government expects this to rise to 64 tCO₂ by 2020. Compare that to the top 10 dirtiest CO₂ per-capita nations (values in tCO₂/person)²: Qatar = 77; Bahrain = 42; Trinidad and Tobago = 41; UAE = 40; Netherlands Antilles = 39; Singapore = 37; Kuwait = 29; Montserrat = 29; Cook Islands = 26; Saint Pierre and Miquelon = 26. Regional averages include: Europe = 7; World = 5; Africa = 1. Other national examples: USA = 18; Canada = 16; Germany = 10; Norway = 9; UK = 9. The Alberta economy is 50% more exposed than the second dirtiest per-capita nation Bahrain. The Alberta economy faces four times more climate pollution costs per-capita than the USA and six times more than nations like Germany, Norway and the UK and nearly nine times more than Europe. It will be increasingly hard to maintain a 64 tCO₂ per-capita economy into the future, especially as studies show the tar sands becoming increasingly too expensive to sell under the carbon pricing levels needed to prevent catastrophic climate impacts.

27. The Alberta economy creates **three times less GDP per tCO₂** than the rest of Canada.

DETAILS: The Alberta economy is so inefficient at creating wealth per tonne of climate pollution that it faces a difficult future in a required lower-carbon economy. Canada's National Inventory Report to UN 1990-2008³ lists the carbon intensity of each province. Alberta generates just \$740/tCO₂. The rest of Canada averages \$2,320/tCO₂. The other large economy provinces are even better. BC creates \$2,500/tCO₂ and now has an economy wide carbon tax to spur future carbon-efficiencies. Ontario generates \$2,800/tCO₂ while Quebec generates \$3,300/tCO₂.

¹ Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

² US EIA data at <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=90&pid=45&aid=8&cid=regions&syid=2010&eyid=2010&unit=MMTCD>

³ Canada's National Inventory Report to UN 1990-2008 part 3.

<http://www.ec.gc.ca/publications/492D914C-2EAB-47AB-A045-C62B2CDACC29/NationalInventoryReport19902008GreenhouseGasSourcesAndSinksInCanadaPart3.pdf>

28. To meet Canadian climate targets requires a continually rising climate pollution price reaching **\$150 to \$200 per tonne** of CO₂ by 2020, and continuing upwards from there.

DETAILS: A Pembina Institute review¹ of carbon pricing says "Recent economic modelling indicates that carbon prices will need to be between \$100 and \$200 per tonne by 2020 for B.C. and Canada to meet the emissions reduction targets they have set". It lists as references: BC's Climate Action Plan figure of \$100/tCO₂ for BC by 2020; The federal government's National Roundtable on the Environment and the Economy 2012 report "Reality Check" figure of \$150/tCO₂ for Canada; A Pembina 2010 "Climate Leadership, Economic Prosperity" figure of \$150 to \$200/tCO₂ for Canada.

Recent polling² shows growing support for climate pollution pricing in Canada. A record-high majority of Canadians (59%) now support a carbon tax. Meanwhile after living with the BC Carbon Tax for many years the support for it continues to grow and has reached record levels with 64% now in favour of it. The number of British Columbians strongly opposed has declined by more than half to just 17%.

Impact examples using average climate pollution price of **\$150/tCO₂** over next 30 years

29. Annual climate pollution fees would cost Alberta **14% of current GDP**; Ontario just 4%.

DETAILS: Per-capita emissions Alberta = 63.4 tCO₂; Ontario = 13.0 tCO₂. For 2020 these are projected to rise slightly to 63.6 tCO₂ for Alberta and fall slightly to 11.7 tCO₂ in Ontario.³ In 2020 at \$150/tCO₂, climate pollution fees for Alberta would be \$9,540 per capita which is 14% of their current per-capita GDP of \$67,756⁴. For Ontario the 2020 climate pollution fee per capita would be \$1,755 which is 4% of their current per-capita GDP of \$45,196.

30. Adds **\$86 per barrel** to tar sands oil -- 22% more than for conventional oil.

DETAILS: The wells-to-wheels carbon emissions from a barrel of tar sands oil is calculated at .572 tCO₂.⁵ At \$150/tCO₂ the fee is \$86 per barrel. Tar sands oil causes 22% more carbon emissions⁶ than conventional oil meaning the carbon pricing would be 22% higher. It is the extra cost compared to conventional oil that causes global energy modelling from IEA, MIT and others to show greatly reduced economic viability for tar sands at carbon pricing levels needed to prevent more than 2C global warming.

31. Adds **\$750 billion** to cost of tar sands oil flowing through one pipeline over 30 years.

DETAILS: Several proposed tar sands pipeline (KeystoneXL, Enbridge Northern Gateway, Kinder Morgan Transmountain expansion) each have capacities at or above 800,000 barrels per day. 800,000 barrels a day for thirty years equals 8.76 billion barrels per pipeline. At an average of \$86 in climate pollution fees per barrel the total is over \$750 billion.

¹ <http://www.pembina.org/pub/2370>

² <http://www.enviroinstitute.org/uploads/news/enviroinstitute%20institute%20-%20focus%20canada%202012%20-%20public%20opinion%20on%20climate%20change%20-%20december%2014-2012.pdf>

³ Environment Canada "Canada's Emissions Trends 2012" at http://www.ec.gc.ca/Publications/253AE6E6-5E73-4AFC-81B7-9CF440D5D2C5/793-Canada%27s-Emissions-Trends-2012_e_01.pdf

⁴ StatCan at <http://www.statcan.gc.ca/pub/81-595-m/2011095/tbl/tbla.34-eng.htm>

⁵ Swart & Weaver: " Alberta oil-sands and climate" at http://climate.uvic.ca/people/nswart/original_images/Alberta_oil_sands_well_to_wheel_warming.pdf

⁶ Setting the Record Straight: Lifecycle Emissions of Tar Sands", Natural Resources Defense Council, http://docs.nrdc.org/energy/files/ene_10110501a.pdf

Proposed Export Pipelines

Locking in long-term climate damage

32. **No new tar sands pipelines are needed on an energy path where humanity avoids the dire climate impacts beyond 2°C of warming.**

DETAILS: The International Energy Agency's global energy models predict that the world will only want to buy **3.3 million barrels of tar sands oil per day** on an energy path that give humanity a 50/50 chance to limit global warming to an increase of 2°C.¹ Both the climate science -- and all the nations of the world -- have agreed that beyond 2C of warming the climate impacts become dire for human civilization.

Proposed tar sands production levels for 2020 is **3.5 million barrels per day**². This is more than IEA says will be needed if we want to stay under 2°C.

A review by the US State Department found that existing pipelines have enough spare capacity to handle planned tar sands oil production beyond 2020.³ The report says that proposals to ship by rail could increase this spare capacity significantly.

Any new tar sands pipeline risks becoming a stranded asset when the world acts to prevent dire climate impacts.

33. **Each major tar sands pipeline locks in a climate spill of five billion tonnes of CO2.**

DETAILS: Several major proposed tar sands export pipelines (ex: KinderMorgan Transmountain expansion, Enbridge Northern Gateway, TransCanada KeystoneXL) have capacities of 800,000 bbl per day = 8,760,000,000 barrels over a typical 30 year lifespan. The wells-to-wheels climate impact of each barrel of tar sands oil is 0.572 tonnes of CO2.⁴ The 30 year climate pollution spill is therefore around 5,000,000,000 tCO2.

Five billion tonnes of CO2 (GtCO2) is nearly a century of BC's current fossil fuel emissions (currently 54 MtCO2/year). It is like burning a third of Canada's recoverable coal reserves.⁵

34. **Tar sands oil flowing through a major new pipeline is exposed to half a trillion dollars in potential climate pollution fees. Or more.**

DETAILS: Nearly nine billion barrels could flow through a major new tar sands pipeline over a 30 year lifespan (see table below). At the calculated wells-to-wheels climate impact of 0.572 tCO2⁶ per barrel of tar sands, the total climate pollution over 30 years would be around five billion tonnes of CO2. At an average carbon price of \$100/tCO2 over those 30 years, the carbon fees would be around \$500 billion dollars.

35. **Three proposed pipelines to BC's coast could require over 800 oil tankers per year.**

DETAILS: An Aframax oil tanker can hold up to 800,000 barrels of oil.⁷ The proposed KinderMorgan Transmountain expansion, KinderMorgan Northern Leg and Enbridge

¹ IEA "World Energy Outlook 2010"-- 450 Scenario at <http://www.worldenergyoutlook.org/media/weo2010.pdf>

² <http://www.energy.alberta.ca/OilSands/791.asp>

³ Page 30 of <http://keystonepipeline-xl.state.gov/documents/organization/182421.pdf>

⁴ Wells-to-wheels of oil in place. Swart & Weaver "The Alberta Oil Sands and Climate" at http://climate.uvic.ca/people/nswart/Alberta_Oil_Sands_climate.html

⁵ <http://www.nrcan.gc.ca/energy/sources/1205#resource>

⁶ Wells-to-wheels of oil in place. Swart & Weaver "The Alberta Oil Sands and Climate" at http://climate.uvic.ca/people/nswart/Alberta_Oil_Sands_climate.html

⁷ <http://www.osg.com/index.cfm?pageid=32>

Northern Gateway combined would deliver up to 653 million barrels of oil per year to the BC coast (see table below). It would require 817 Aframax oil tankers to ship it all.

Proposed pipelines data table

	Kinder Morgan Transmountain			Kinder Morgan Northern Leg	Enbridge N. Gateway	TransCanada Keystone XL	total increase by 4 proposals
	To Vancouver BC			To Kitimat BC	To Kitimat BC	To Texas USA	
	<i>Existing</i>	<i>Proposed expansion</i>	<i>Total if expanded</i>	<i>Proposed pipeline</i>	<i>Proposed pipeline</i>	<i>Proposed pipeline</i>	
Capacity (barrels)							
day	300,000	590,000	890,000 ¹	400,000 ²	800,000 ³	830,000 ⁴	+2,260,000
year	110 m	215 m	325 m	146 m	292 m	303 m	+956 m
30 years	3,285 m	6,461 m	9,746 m	4,380 m	8,760 m	9,089 m	+28,689 m
GHG (tonnes of CO2, m=millions) based on wells-to-wheels emissions of 0.572 tonnes of CO2 per barrel⁵							
year	63 m	123 m	186 m	84 m	167 m	173 m	+547 m
<i>vs BC's annual 54m</i>		227%		154%	307%		
30 years	1,879 m	3,695 m	5,574 m	2,505 m	5,011 m	5,199 m	+16,410 m
Carbon pricing exposure (based on average carbon price over next 30 years, b=billions)							
30 years @ \$100/tCO2	\$185 b	\$370 b	\$550 b	\$250 b	\$500 b	\$520 b	+\$1,600 b
30 years @ \$150/tCO2	\$280 b	\$550 b	\$840 b	\$375 b	\$750 b	\$780 b	+\$2,500 b
30 years @ \$200/tCO2	\$380 b	\$740 b	\$1,110 b	\$500 b	\$1,000 b	\$1,040 b	+\$3,200 b
Tankers per year (if all oil shipped out on Aframax-sized oil tankers at 800,000 bbls each⁶)							
	?	269		183	365	379	+817 off BC

¹ KM announced in Jan 2013 an expansion of their proposal to a total of 890,000 bbl/day. <http://www.transmountain.com/project-plan>

² <http://keystonepipeline-xl.state.gov/documents/organization/182421.pdf>

³ <http://keystonepipeline-xl.state.gov/documents/organization/182421.pdf>

⁴ TransCanada announced a capacity of 830,000 in May 2012. <http://www.transcanada.com/6040.html>

⁵ Wells-to-wheels of oil in place. Swart & Weaver "The Alberta Oil Sands and Climate" at http://climate.uvic.ca/people/nswart/Alberta_Oil_Sands_climate.html

⁶ <http://www.osg.com/index.cfm?pageid=32>