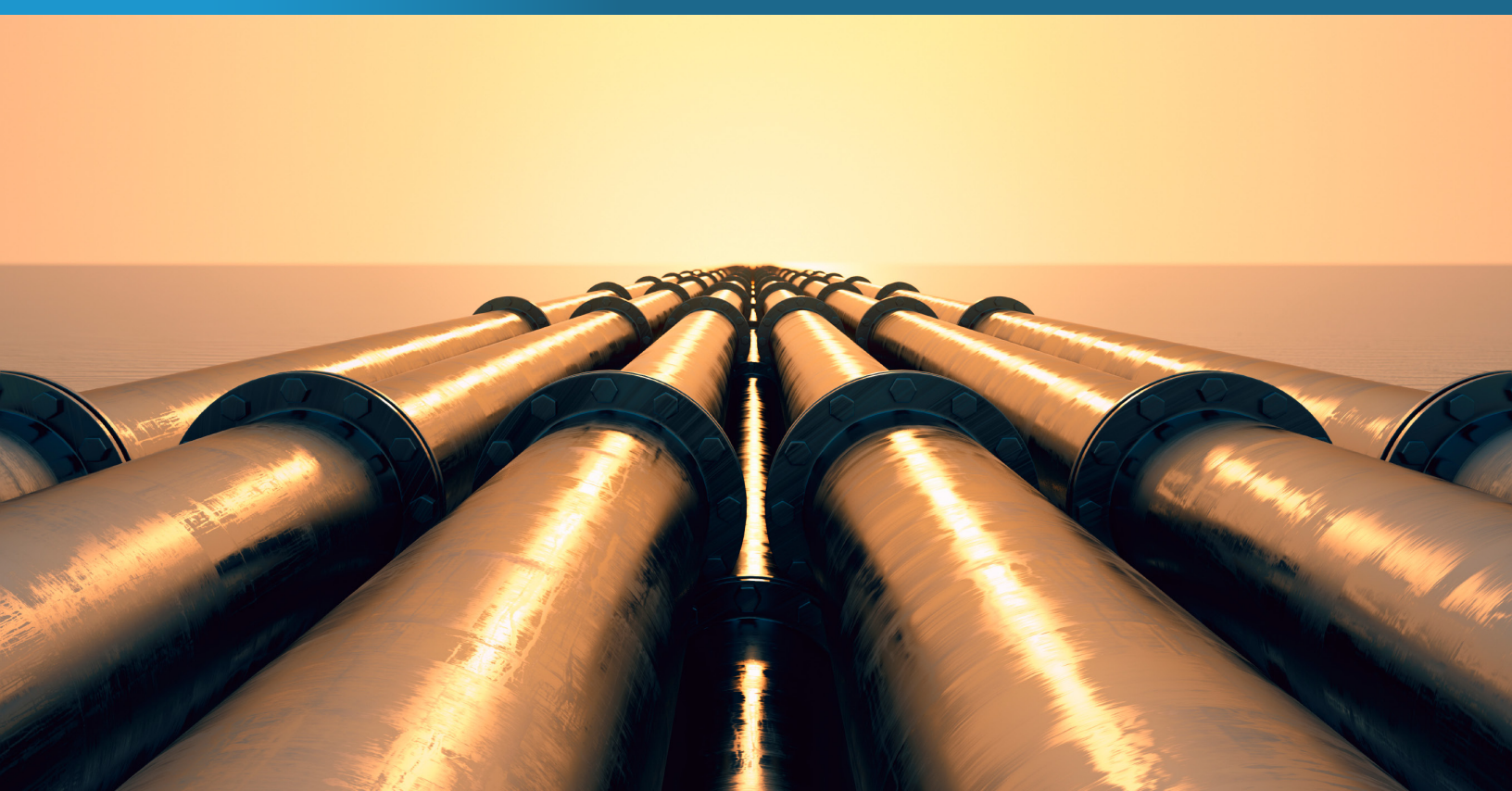


Keystone XL: The Climate Impact

AN EXPERT ELICITATION

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Oil sands production in Canada has been steadily increasing, and a pipeline connecting Alberta to US Gulf Coast oil refineries has been proposed. The pipeline, Keystone XL (KXL), has faced controversy over the climate effects of oil sands development.

The State Department must determine if the project is in the national interest. President Obama stated in 2013 that he will approve the pipeline “only if this project doesn’t significantly exacerbate the problem of carbon pollution.”

To help assess the effect of KXL on the climate, Near Zero surveyed a variety of oil sands experts about the impact of KXL on future oil sands production. The survey was completed by 26 people: 13 supported KXL, and 13 did not.

Most participants (nearly 70%) thought approval of KXL would increase oil sands production over the next 10 and 20 years, although they disagreed by how much. The average for all experts was a production increase of 220,000 barrels per day (b/d) by 2015, and over 900,000 b/d by 2035.

Respondents also disagreed about the effect KXL and oil sands production in general would have on net greenhouse gas (GHG) emissions.

Pipeline supporters argued oil sands would primarily displace heavy crudes currently processed at the US Gulf Coast with comparable life-cycle GHG emissions, while opponents largely see oil sands as

a new source of world oil production that will supply new markets and increase GHG emissions.

Drawing upon life-cycle GHG estimates from the US State Department report, we calculate that if the increase in oil sands production displaced heavy crude oils currently processed at the US Gulf Coast, the net increase in GHG emissions would be anywhere from >1 to 40 million metric tons (Mt) CO₂-eq per year, based on our expert production estimates. Yet if the oil sands added to rather than displaced oil supply, its full emissions may represent a net increase, up to 183 Mt CO₂-eq per year by 2035 for our expert averages, or nearly 3% of US annual GHG emissions in 2012.

The only scenario in which KXL would not lead to an increase in GHG emissions is if the same amount of oil sands were produced regardless and transported by rail, raising emissions by less than 1.2 Mt CO₂-eq per year for 830,000 b/d of production. Yet most of our experts did not think the same amount of oil sands would be produced in the absence of KXL approval, particularly over the next 10 to 20 years.

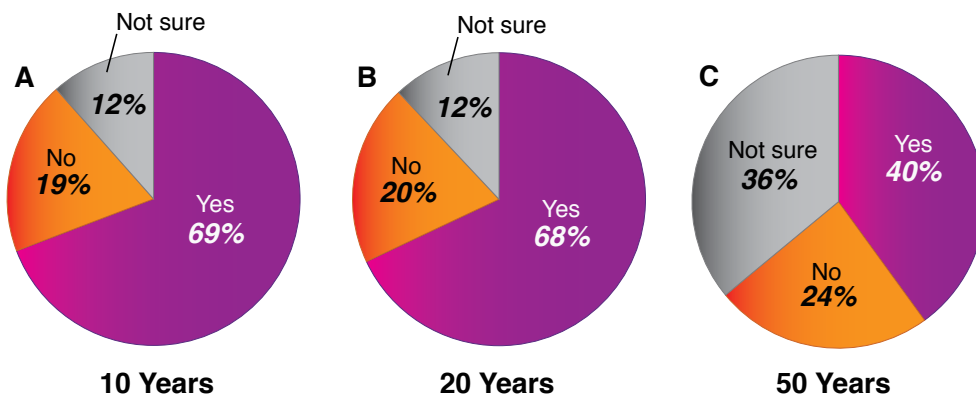


Figure 1 | Most participants said KXL would increase oil sands production. Percentage of participants who thought KXL would increase oil sands production in Alberta over the next 10, 20, and 50 years.

In short, our survey responses suggest KXL would likely raise global GHG emissions, even if equivalent amounts of other heavy crudes were produced instead, and particularly if oil sands production added to rather than displaced current global oil production.

Alberta Oil Sands >

Alberta's oil reserves are estimated at over 170 billion barrels, or about 11 percent of total global oil reserves. Almost all of Alberta's proven oil reserves are oil sands, which contain a dense form of petroleum known as bitumen.

Production of crude bitumen in the region has been growing, reaching over 1.8 million barrels a day (b/d) in 2013 and expected to more than double to 3.7 million b/d by 2021 and 5.2 million b/d by 2030 (CAPP 2013). The industry has ambitions to expand oil sands exports beyond the US to growing markets in India and China, according to the Canadian Association of Petroleum Producers (2013).

Bitumen can either be upgraded to synthetic crude oil or diluted (known as dilbit) before shipment to refineries for processing. Dilbit requires more heavy oil conversion capacity than conventional crudes. Currently, western Canada has an estimated 260,000 b/d of heavy oil refining capacity, much less than it produces.

Transport Capacity >

In 2013 Goldman Sachs estimated the effective total take-away capacity for western Canadian oil at about 2.9 million b/d, of which 1.5 million b/d was dedicated for heavy oil. Most is from four existing pipelines transporting western Canadian crude, as rail accounts for only 150,000 b/d of the total capac-

ity. With heavy oil supply of 1.8 million b/d, CAPP has said "current capacity is tight" (2013), particularly given the region's future production goals.

To increase transport options, pipelines with a combined capacity of 2,000 to 3,000 million b/d have been proposed out of western Canada. This includes the Keystone XL (KXL) pipeline, which would extend from Alberta to Nebraska, transporting an estimated 830,000 b/d to US refineries in the Gulf Coast (730,000 b/d of oil sands and 100,000 b/d of US tight oil).

Obama's Climate Test >

The project has faced opposition in the US on the basis of its environmental and climate effects: oil sands life cycle emissions (from drilling to use, known as "well to wheel") are 14% to 20% higher than those of a weighted average of transportation fuels used in the US, and 2% to 10% higher than the heavy crudes currently processed in the US Gulf Coast (Lattanzio, 2013).

The State Department must determine if the project is in the "national interest" since it crosses international borders. In 2011 twenty climate scientists sent a letter to President Obama urging him not to approve the pipeline, followed by large public protests over the project in front of the White House.

President Obama has stated a goal of reducing greenhouse gas emissions 80% by 2050, relative to 2005 levels. In June 2013, President Obama declared that his administration would approve the proposed Keystone XL oil pipeline "only if this project doesn't significantly exacerbate the problem of carbon pollution."

Key to Obama’s test is the effect KXL would have on future Alberta oil sands production and, in turn, net GHG emissions.

Expert Survey >

To help assess the climate effects of KXL, Near Zero surveyed a variety of experts who work in or research oil sands. The survey was completed by 26 people: a full list of participants and their affiliations is available in Table 1. Thirteen said they supported approval of KXL, and 13 said they did not.

The survey was sent in 2013, after the State Department issued its draft Supplemental Environmental Impact Statement (SEIS) and before release of the Final SEIS. Echoing the draft, the final SEIS

concluded that KXL “is unlikely to significantly affect the rate of extraction in the oil sands areas (based on expected oil prices, oil-sands supply costs, transport costs, and supply-demand scenarios)” (ES-9). The State Department concluded that, unless oil prices drop and transport costs make a large impact on future production decisions, then KXL will not significantly impact oil sands production.

In our survey, most participants thought approval of KXL would increase future oil sands production (Fig. 1). Nearly 70% said it would increase production over the next 10 and 20 years, and 40% over 50 years (36% were not sure over 50 years). The key was by how much (Fig. 2).

Most participants who supported the pipeline thought it would only lead to a slight increase in

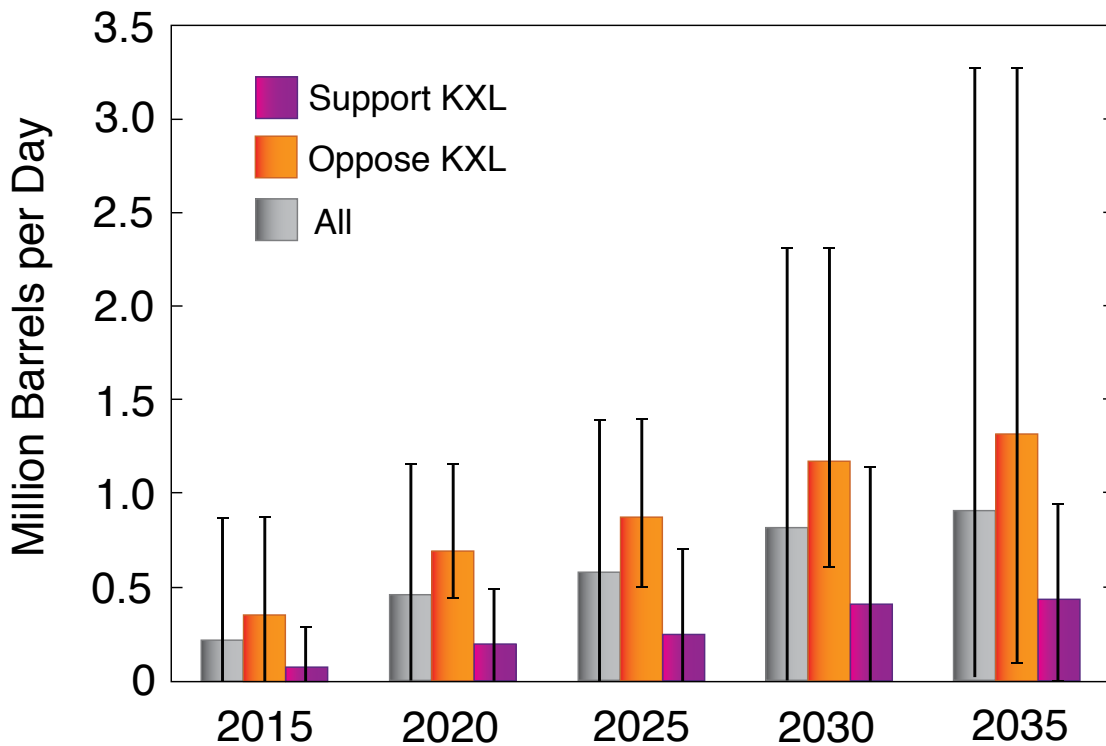


Figure 2 | **How much KXL would increase oil sands production.** Participants estimated all future oil sands production with and without KXL. The increase in production with KXL are shown above. The ranges show the highest and lowest responses for each group.

production, if any at all, while a small group thought it would lead to an increase of over 800,000 b/d by 2030. The average for all KXL supporters was a 71,000 b/d increase by 2015 and 435,000 by 2035.

Nearly everyone who opposed the pipeline thought it would lead to a large increase in production, averaging 350,000 b/d by 2015 and over one million b/d by 2030. They argued KXL approval would represent a favorable market signal to oil sands, increasing overall production beyond KXL.

The mean for all experts was a 220,000 b/d increase by 2015 and 908,000 b/d by 2035.

Effect of KXL on Production >

When asked about their projections, many supporters of the pipeline essentially agreed with the State Department analysis, arguing the pipeline would have little effect on oil sands production in the region, which would be produced as long as market conditions remained favorable:

As long as oil prices stay high, the oil sands will be produced regardless of KXL.

– Dvid Hackett, Stillwater Associates

The alternative transport, according to the State Department, would be rail: “Rail and supporting non-pipeline modes should be capable... of providing the capacity needed to transport all incremental Western Canadian and Bakken crude oil production to markets if there were no additional pipeline projects approved” (Draft SEIS, 1.4-1).

Many experts who supported the pipeline agreed with this view:

Alternative delivery systems and delivery points (consumers) are or will become available. – Chris Powter, Oil Sands Research and Information Network

The new rail terminal capacity that is coming online will help to move stranded bitumen. It is estimated that by 2015 the on-loading rail capacity will be north of 700,000 bpd, which almost replaces the total KXL capacity. – Dinara Millington, Canadian Energy Research Institute

Those who opposed the pipeline argued KXL would markedly decrease transport costs over rail, increasing the profitability of oil sands and encouraging heightened production.

Without the sunk cost of a pipeline (i.e. with ongoing operating costs of rail transport) the economics of tar sands production will be less attractive, so alternative sources of energy will be more viable and less oil sand will be produced. – Alice Chapple, Impact Value

Others argued that all currently proposed transport capacity was needed for the region to meet its production goals:

Tars sands operations cannot be increased much beyond present without new capacity to transport its product. Current expansion plans exceed the sum of all proposed capacity additions, so each pipeline not approved will eventually subtract from future expansions. – Danny Harvey, University of Toronto

Some were skeptical that rail could substitute for pipeline, and argued that the State Department decision will represent a market signal on the future of oil sands production:

If this pipeline is not approved it represents a definite business constraint, the exaggerated claims

of rail as a possible substitute notwithstanding, and refusing to approve Keystone XL also sends a serious message to oil sands producers that environmental concerns are real and government means to internalize more of these increasing costs to corporations. – Robyn Allan, robynallan.com

The State Department’s draft assessment predicted that rail shipments of Canadian heavy crude down to refiners in the Gulf Coast would reach 200,000 b/d by the end of 2013 (it did not offer projections in the final analysis). Yet a Reuters analysis of EIA data for that year found oil arrivals were often below 30,000 b/d (Rucker 2014).

Greenhouse Gas Emissions >

We now consider how oil sands production would affect global oil supply and demand, and net greenhouse gas emissions.

Many who supported the pipeline argued it would primarily be displacing heavy crudes currently being processed at US Gulf Coast refineries. Therefore any

reduction in oil sands production should be compared against the same amount of heavy crude production. In this view, oil demand is largely independent of supply, and if not met by one source of oil will be met by another, likely with comparable life-cycle GHG emissions to meet demand at heavy oil refineries.

It is US oil consumption that is the principal source of carbon emissions, and the source of those barrels is of little consequence. - Paul Precht, Paul Precht Energy Economics

[T]he proposed pipeline will have no lasting impact on aggregate GHG emissions, as they seem to be more demand-side driven as opposed to created from incremental supply. - Todd Crawford, Conference Board of Canada

KXL would not increase global carbon emissions by any significant amount unless one thinks the absence of that pipeline would trigger a US (or world) reduction in oil consumption. - Pierre-Olivier Pineau, HeC Montreal Business School

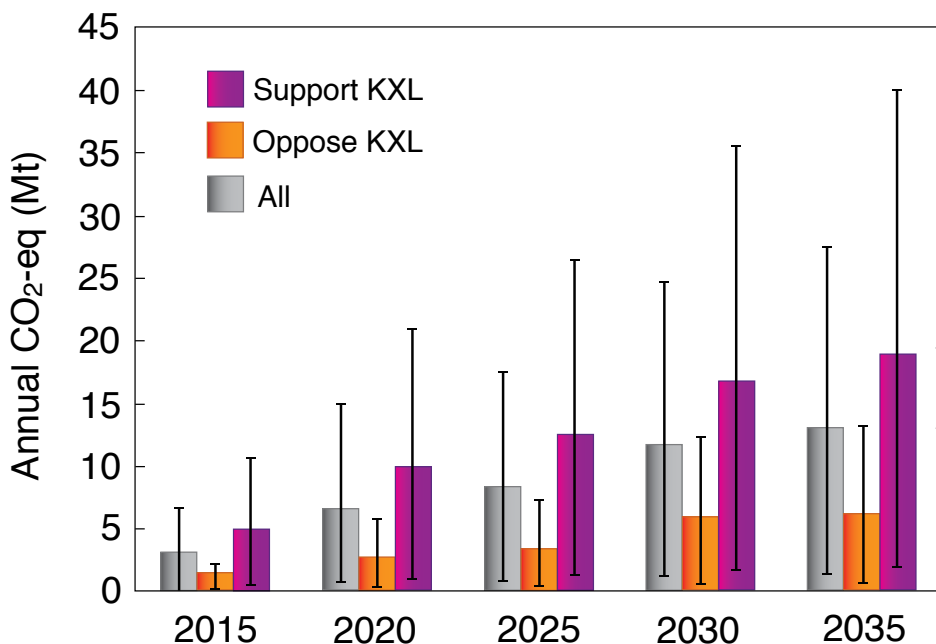
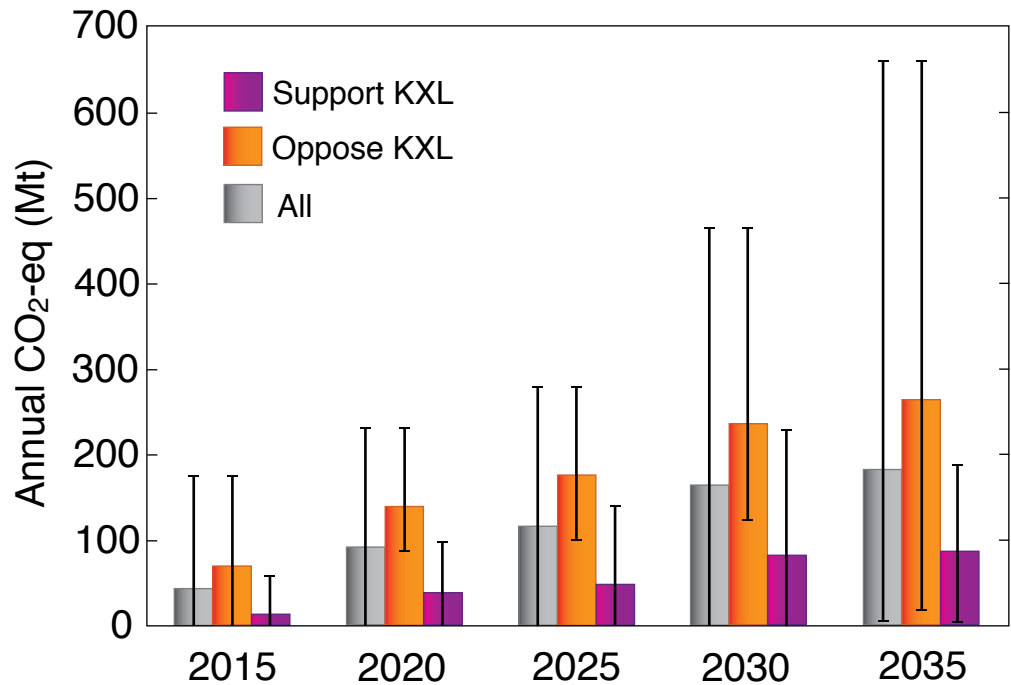


Figure 3 | If KXL oil sands replaced other heavy crudes, it would increase emissions. GHG emission increase from oil sands carried by KXL compared with an equivalent amount of heavy crudes, using the participants’ average responses for how much KXL would increase oil sands production. Emissions estimates based on an average of life-cycle assessments considered in the final State Department KXL report (2014), with ranges reflecting the highest and lowest LCA estimates.

Figure 4 | If KXL oil sands added to world oil supply, it would increase emissions much more.

GHG emissions for the increase in production from KXL, assuming oil sands carried by KXL would add to world oil production, rather than displacing other oil. Emissions estimates based on an average of life-cycle assessments considered in the final State Department KXL report (2014).



Opponents of the pipeline primarily see it as increasing world oil supply and therefore demand, as new markets might be bolstered by oil sands production.

[A]ccess to additional markets means increased production and increased production means increased emissions. - Spencer Veale, International Forum on Globalization

KXL provides access to the largest refining hub in the world and major new international markets. – Kate Colarulli, Sierra Club

Goldman Sachs stated heavy crude exports from Venezuela and Mexico to Gulf Coast refineries are going down for primarily domestic reasons (2013), suggesting oil sands might not be displacing but rather replacing some of these crude supplies. In addition, some argued that if heavy crude production falls, US refineries may move toward processing light oil instead:

The U.S. Gulf Coast and Great Lakes region... are also evaluating the economic advantage of refining light crude oils from a resurgent Permian Basin and unconventional shale formations. The economics could squeeze out Syncrude. – Anthony Andrews, Congressional Research Service

Based on our expert averages of oil sands production, Figure 3 shows the net GHG emissions (in carbon dioxide equivalent [CO₂-eq]) attributed to oil sands from KXL compared to an equivalent amount of Mexican Maya and Venezuelan, two of the heavy crudes that KXL supporters say oil sands would displace.

For the experts' estimated average increase in oil sands production from KXL, the mean increase in annual GHG emissions from oil sands over heavy crudes would be 3 million metric tons (Mt) CO₂-eq by 2015 and 13 Mt CO₂-eq by 2035.

For those opposed to the pipeline, the GHG emissions attributed to KXL should largely be seen as a net increase, as it would primarily be adding to rather

than displacing world oil supply and use. Based on our expert averages, the emissions from the increase in oil sands production would be about 44 Mt CO₂-eq in 2015 and over 180 Mt CO₂-eq by 2035 (Fig. 4).

The only scenario in which KXL would not lead to an increase in GHG emissions is if the same amount of oil sands were produced regardless and transported by rail. The Final SEIS does not offer an analysis of how much rail would add to transport emissions over pipeline. According to Stanford's Oil Production Greenhouse gas Emissions Estimator, use of rail over pipeline to transport oil sands from Alberta to the Gulf Coast would add about 0.0039 Mt CO₂-eq per barrel.

Averaging across the life-cycle GHG estimates for oil sands in the final State Department report, rail would add less than 1.2 Mt CO₂-eq annually for 830,000 b/d of production. It has also been argued that pipeline would result in more transport emissions, as the infrastructure for rail but not pipeline is already in place (Tarnoczi 2013).

Conclusions >

Based on our small and diverse sample, most of our participants said Keystone XL would raise oil sands production over the next 10-20 years. Yet they disagreed by how much. The average across experts was a 225,000 b/d increase by 2015 and 908,000 b/d by 2035, although estimates varied from no increase in production up to over two millions b/d annually.

If all of the production displaced crude oils like Mexican Maya and Venezuelan crude, the net increase in GHG emissions would be anywhere from >1 to 40 Mt CO₂-eq annually, based on our expert estimates. Yet if the oil sands added to rather than displaced oil supply, its full emissions may represent a net increase,

up to 183 Mt CO₂-eq by 2035 for our expert averages, nearly 3% of US annual GHG emissions in 2012.

The only scenario in which KXL would not lead to an increase in GHG emissions is if the same amount of oil sands were produced regardless and transported by rail, raising emissions by less than 1.2 Mt CO₂-eq annually for 830,000 b/d of production. Yet most of our experts did not think the same amount of oil sands would be produced in the absence of KXL approval, particularly over the next 10 to 20 years.

In short, KXL would likely raise global GHG emissions, even if equivalent amounts of other heavy crudes were produced instead. As many experts noted, a main driver of GHG emissions from oil is global demand. Policies are therefore needed to improve efficiencies and curb demand, if the world is to begin meeting carbon targets of 80% GHG reductions by 2050.

Acknowledgments

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◦ Table 1

◦ Alice Chapple	<i>Impact Value</i>	◦ Kate Colarulli	<i>Sierra Club</i>
◦ Anthony Andrews	<i>Congressional Research Service</i>	◦ Keith Stewart	<i>Greenpeace</i>
◦ Bill McKibben	<i>350.org</i>	◦ Lorne Stockman	<i>Oil Change International</i>
◦ Bob Dunbar	<i>Strategy West Inc.</i>	◦ Mark Jaccard	<i>Simon Fraser University</i>
◦ Bruce Baizel	<i>Earthworks</i>	◦ Michael Moore	<i>University of Calgary</i>
◦ Cary Krosinsky	<i>CarbonTracker</i>	◦ Nathan Lemphers	<i>University of Toronto</i>
◦ Chris Powter	<i>University of Alberta</i>	◦ Noël Perry	<i>Transportation Economics Co</i>
◦ Danny Harvey	<i>University of Toronto</i>	◦ Paul Precht	<i>Energy economist</i>
◦ David Hackett	<i>Stillwater Associates LLC</i>	◦ Pierre Olivier Pineau	<i>HeC Montreal Business School</i>
◦ Dinara Millington	<i>Canadian Energy Research Institute</i>	◦ Robert Schulz	<i>University of Calgary</i>
◦ Greg Stringham	<i>Canadian Association of Petroleum Producers</i>	◦ Robyn Allan	<i>Economist, Robynallan.com</i>
◦ Jalal Abedi	<i>University of Calgary</i>	◦ Spencer Veale	<i>International Forum on Globalization</i>
◦ James Leaton	<i>Carbon Tracker</i>	◦ Todd Crawford	<i>The Conference Board of Canada</i>