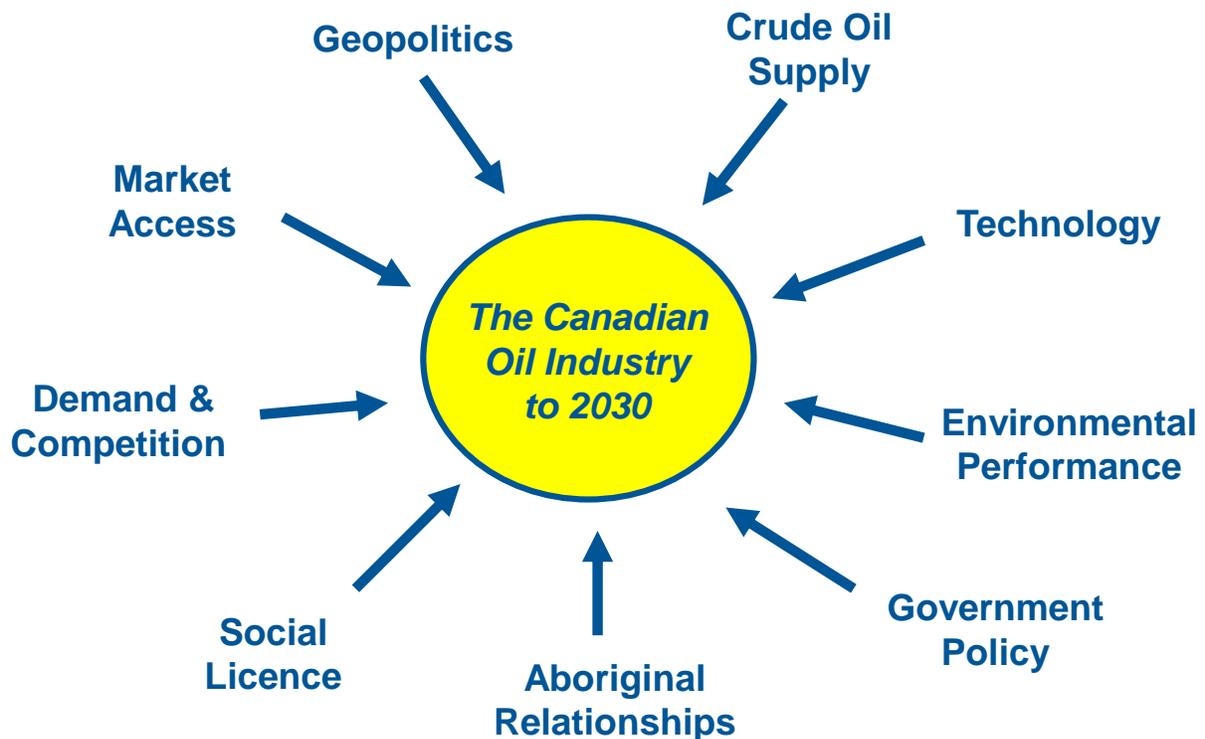


CANADIAN OIL PATHWAYS

Driving Forces



Executive Summary

Growth in several oil-bearing shales has been impressive, particularly in the Eagle Ford Shale in Texas and the Bakken Shale in North Dakota and Montana. The impact on US crude oil production is visible. Currently, US oil production, expected to exceed 8 million barrels per day (MMb/d) by end-2014, is scheduled to surpass crude oil imports for the first time in two decades.¹

The tight oil bonanza did not stop at the border. For the first time in many years, Canadian crude oil production (excluding oil sands) has reversed its downward trend due to technological advancements able to unlock these hard to produce resources. For the Canadian oil industry, 2013 was a year of growth for both oil sands and conventional oil producers. With continued innovation and technology, combined production of crude oil (including condensate and pentanes plus volumes) and oil sands for Canada averaged 3,510,643 barrels per day (b/d) in 2013. Oil sands production, both upgraded and non-upgraded bitumen, grew to the 1,981,000 b/d level. Conventional, tight and shale oil production for the same period averaged 1,146,000 b/d from western Canada and 236,000 b/d from eastern Canada.

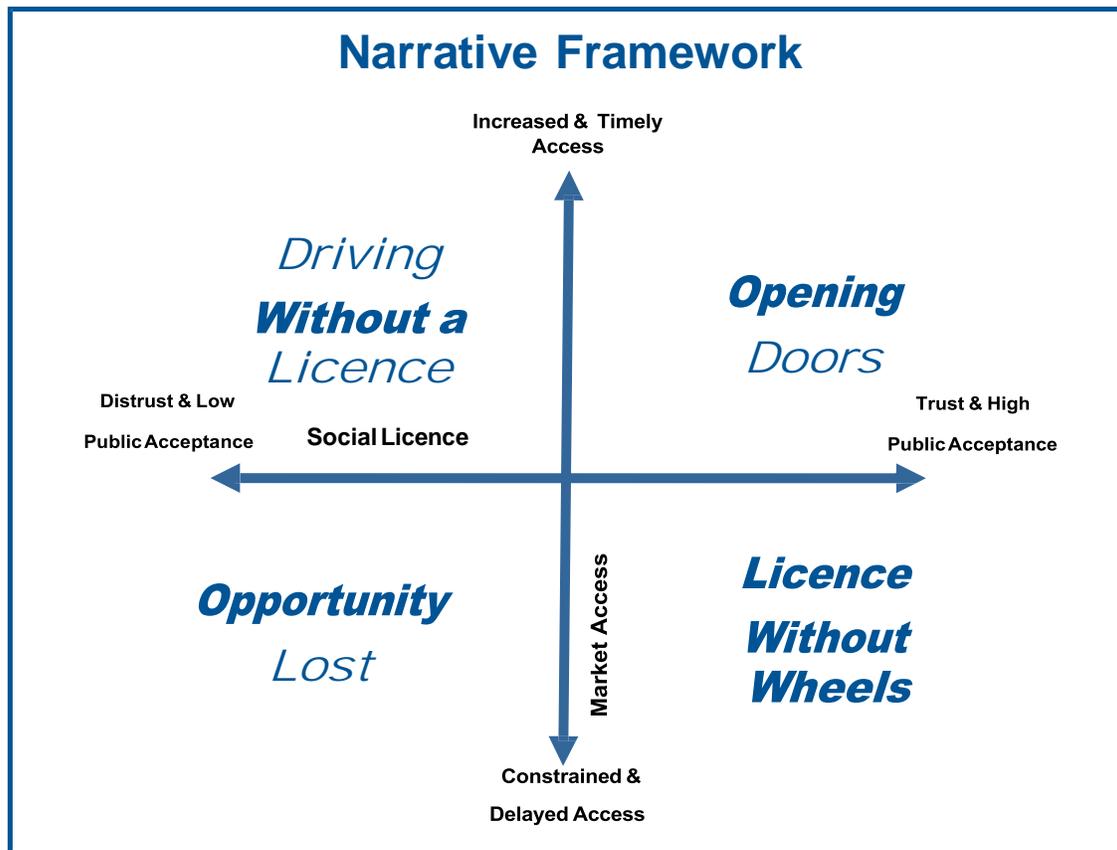
This growth was impressive given the lengthy list of issues facing the industry: rising project costs, skilled labour shortages, rising tight oil production in the US, offshore competition, shifting demand, transportation infrastructure constraints, pipeline approval delays, the lack of market diversification, widening basis differentials, and the challenges to development from environmental groups and the general public. Although the future for oil production growth in Canada still looks favourable, these and other issues could significantly impact the future of the Canadian oil industry.

Taken together, an array of national, continental and global challenges could limit the growth, profitability and competitiveness of the Canadian oil industry. Looking out to 2030, a key question is: ***“How can industry, government and others work to understand and address an array of supply, demand, transportation, environmental and social issues with a view to improving the societal value of oil development, which itself provides a significant contribution to the Canadian economy?”***

The Canadian Energy Research Institute (CERI), in collaboration with ICF International, and Scenarios to Strategy Inc. (S2S) developed four plausible pathways, or narratives, of the future of the Canadian oil industry. These are shown in Figure E.1.

¹ Reuters website, U.S. oil output to surpass imports for 1st time since 1995 –EIA, March 20, 2013, <http://www.reuters.com/article/2013/03/20/usa-oil-imports-eia-idUSL1N0CC2VA20130320>

Figure E.1: Four Narratives



Narratives are stories about the future designed to gain insight into the forces driving change and the major uncertainties shaping the future. Narratives do not try to predict the most likely future; rather they describe a range of different, plausible and important futures. Narratives are intended to challenge assumptions, explore issues and broaden understanding of the range of future paths for the Canadian oil industry. In this way, narratives become a vehicle for learning, building shared understanding, strategic conversation and planning.

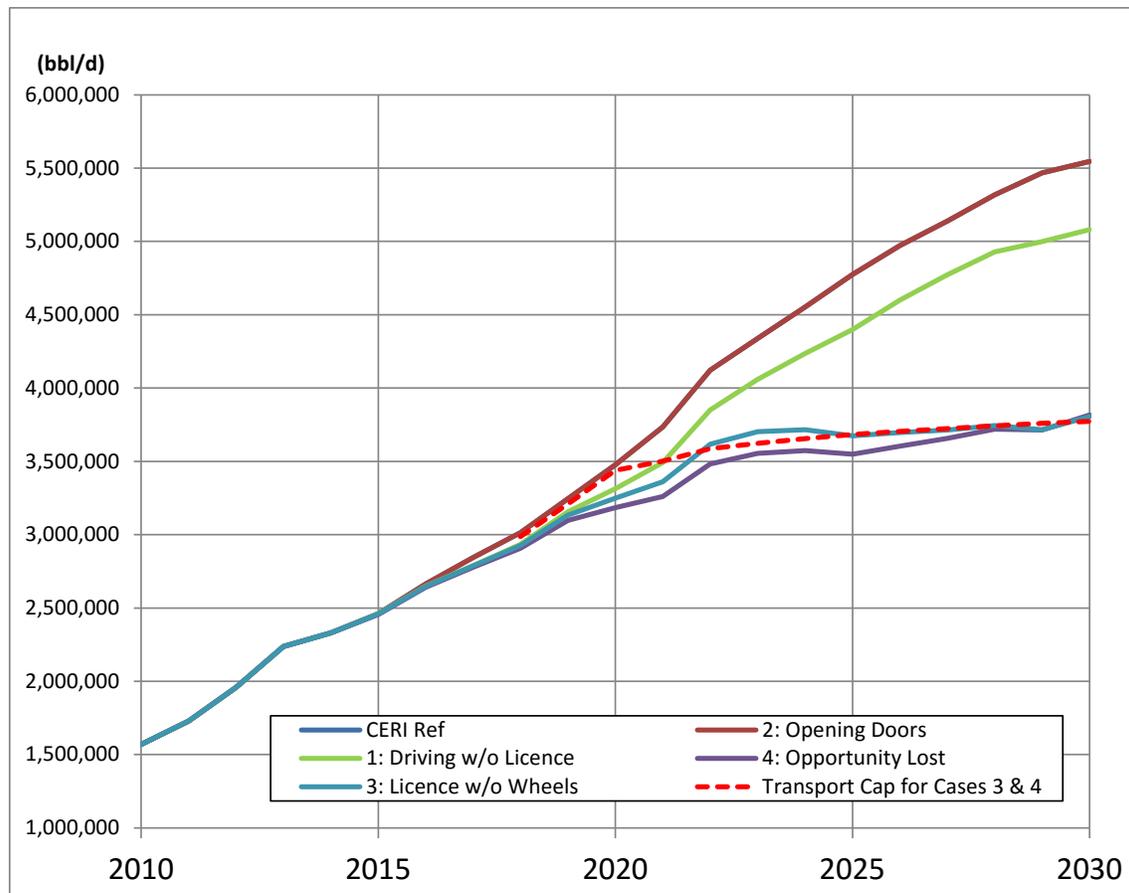
Future Oil Supply

All stories show a different picture for Canadian oil sands production development and corresponding prices and the value of this resource. Figure E.2 illustrates bitumen production for the four narratives as well as CERI's Reference Case oil sands production, which happens to be the Opening Doors forecast.

Production growth is the highest for the Opening Doors pathway, followed by the Driving Without a Licence forecast. The two narratives that describe constrained market access, Licence Without Wheels and Opportunity Lost, exhibit the least growth in oil sands production as limited transportation capacity (represented by the red dashed line in the Figure) prohibits the development and puts a ceiling on how large production could grow. The difference between the highest growth case, Opening Doors, and the two with the least production growth is 1.7-1.8

MMb/d, a production capacity that was never realized due to market access and social licence limitations.

Figure E.2: Bitumen Production Forecast by Case



Source: ICF International, CERI

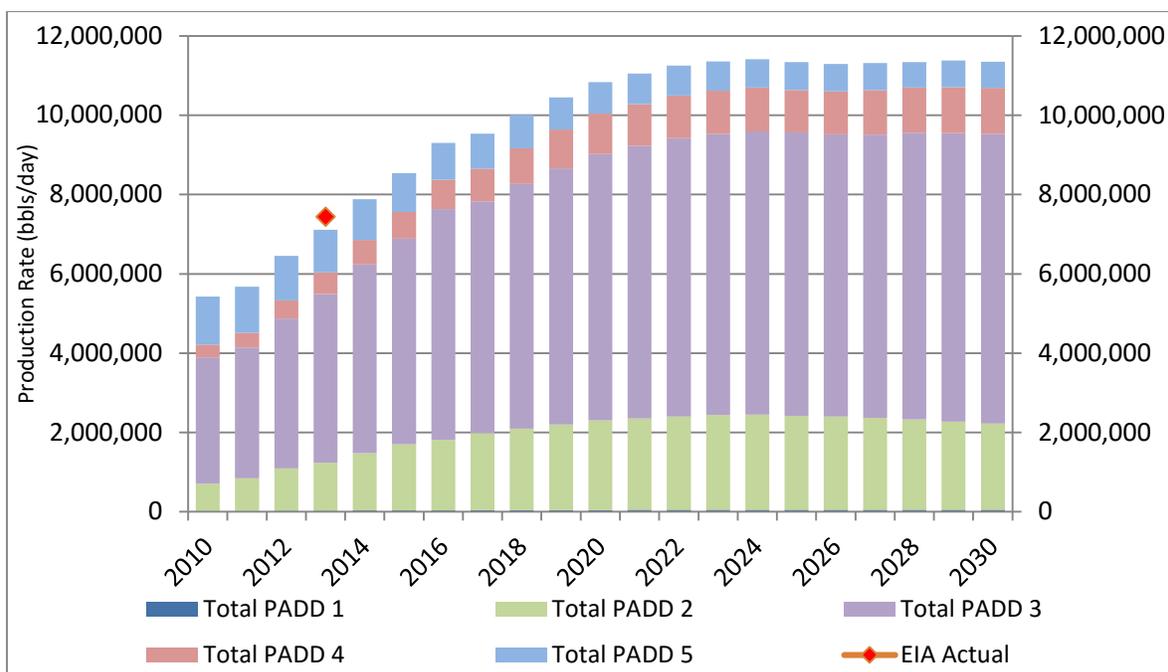
With the potential of additional crude oil supplies coming from western Canada, expansion and diversification to all potential markets is vital to the Canadian oil industry. The US Gulf Coast is a major target market due to the large heavy oil processing capability in the region. As well, western Canadian crude could expand its share in PADD I, eastern Canada, and PADD V markets. Also, beyond North America, global markets in Asia and even Europe represent a potential opportunity.

Canadian total refinery capacity currently sits at 1.9 MMb/d; however, only 60 percent of crude processed in Canada is domestically sourced, since eastern Canadian refineries have limited access to western Canadian crude production. In 2013, Canadian refineries processed 905,000 b/d of western Canadian crude oil. The remaining 2.6 million b/d (or 74 percent) of available supply was exported. PADD II (US Midwest) is the largest regional market for western Canadian crude oil. In two cases where market access is unconstrained and pipeline connectivity exists between western and eastern Canada, the domestic demand for crude oil in Canada is satisfied

with domestic production, as well Canada is able to export available crudes to other markets in the US, in particular pipelines and rail will provide access to the US Gulf Coast and eastern PADD II. Eastern Canada and refineries on the West Coast (PADD V) could potentially process close to double the volume of their current intake of Canadian crude oil. However, in two cases where this connectivity is not present, it is evident that eastern Canadian refineries will need to rely on imported foreign crudes to meet their demand and the markets in the Gulf or abroad will never be reached.

Taking production forecasts from all PADDs and combining them together will produce a total crude oil supply forecast for the US. It is estimated that the production of crude oil in the US will increase substantially in the next decade and the trend will continue for the remainder of the forecast period. Growth in several oil-bearing shales has been impressive, particularly in the Eagle Ford Shale in Texas and the Bakken Shale in North Dakota and Montana. The impact on US crude oil production is visible. At year-end 2013, US oil production averaged 7.4 MMb/d and is expected to exceed 8 MMb/d by end-2014, is scheduled to surpass crude oil imports for the first time in two decades.² Production is forecasted to reach 11.3 MMb/d in 2030, growing by 32 percent from the 2012 level (see Figure E.3). Most of the growth will come from the shale and tight oil plays in PADD III, in particular Permian and Eagle Ford, and PADD II, the Bakken and Three Forks plays.

Figure E.3: United States Crude Oil Supply (Reference Case)

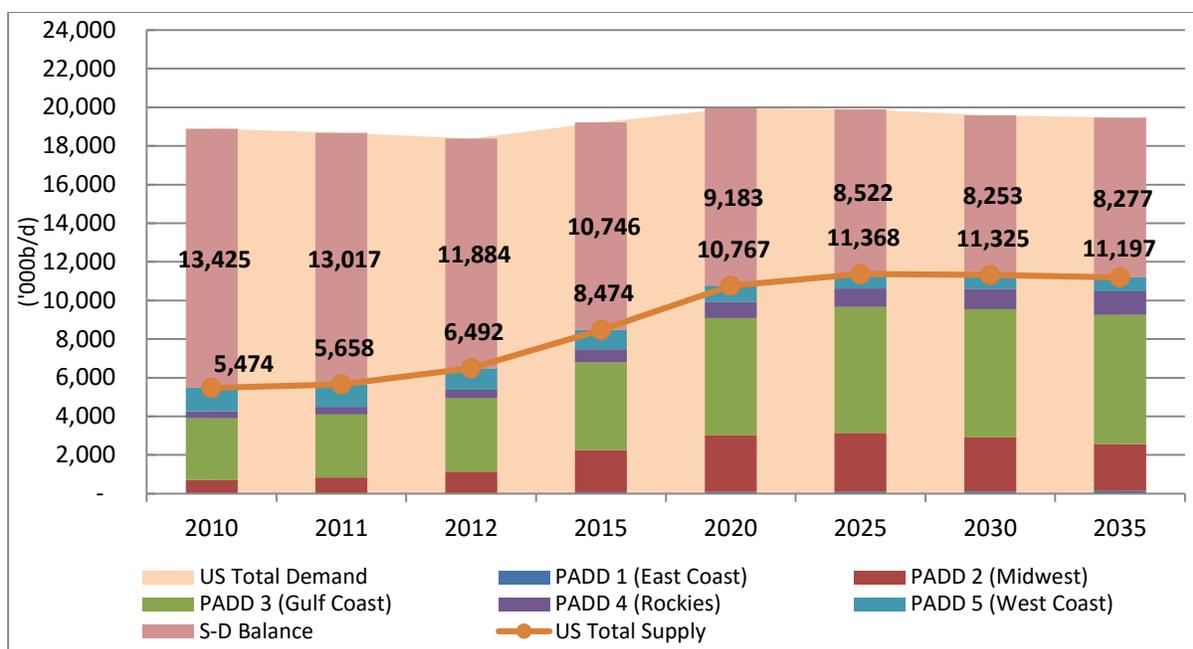


Source: ICF International

² Reuters website, U.S. oil output to surpass imports for 1st time since 1995 –EIA, March 20, 2013, <http://www.reuters.com/article/2013/03/20/usa-oil-imports-eia-idUSL1N0CC2VA20130320>

Looking out to 2030, it is projected that the US demand for crude oil and refined products will gradually be evolving, in particular, oil demand for the transportation sector. In their latest energy outlooks, both the Energy Information Administration (EIA) and the International Energy Agency (IEA) forecast that the demand will be stagnant or even declining, mainly due to vehicle fuel efficiency improvements and stricter Corporate Average Fuel Economy (CAFE) standards. However, even with a stagnant demand growth, it is estimated that the US will continue to import crude oil to meet its domestic demand, albeit the gap between domestic production and demand is narrowing over time (Figure E.4). The supply-demand balance, which does not include imports or exports of crude and products, declines from 11.9 MMb/d in 2012 to 8.3 MMb/d in 2030, a 30 percent drop from current levels. Hence, it is safe to say that the US will continue to rely on Canadian and other foreign sources of crude into the future.³

Figure E.4: US Crude Oil and Liquids Supply-Demand Balance



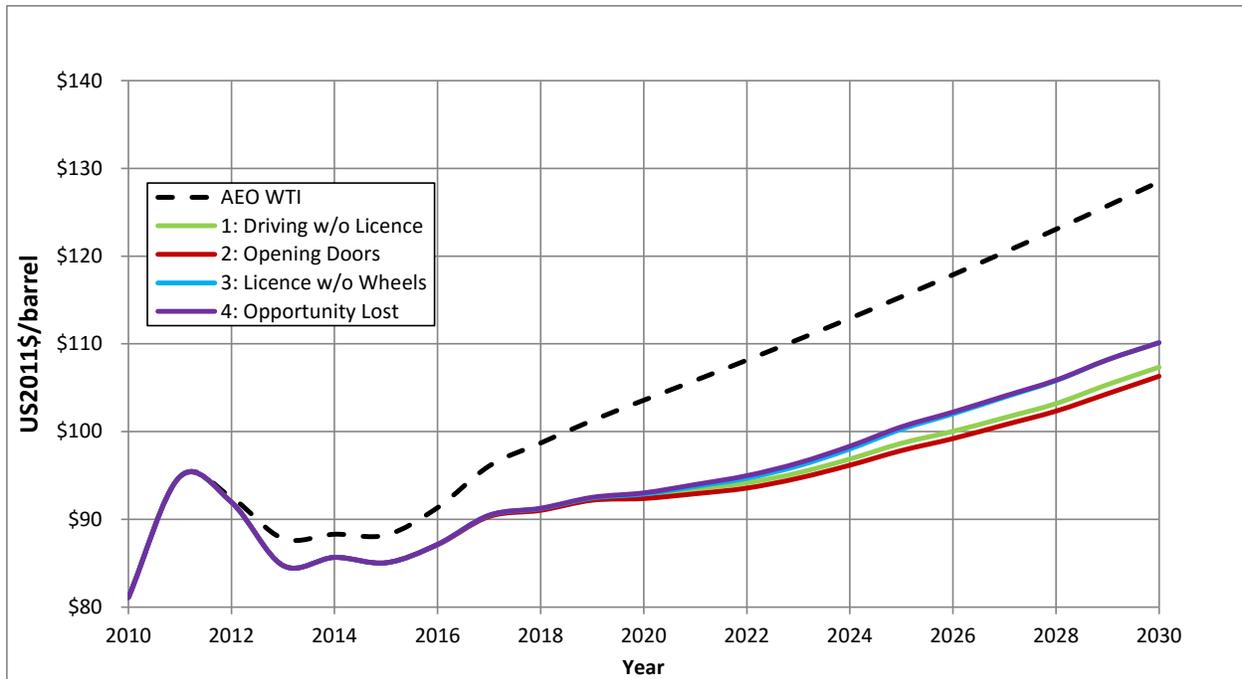
Source: ICF International

Figures E.5 and E.6 show corresponding WTI and WCS prices, respectively. WTI prices are higher in two cases where market access is constrained. This is understandably so, as the global supply of crude is declining due to lower bitumen production, the prices increase, all things being equal. However, the WCS prices show the opposite – in two pathways where market access is limited, bitumen cannot reach the desirable new markets and producers are forced to continue to sell their existing production to the US Midwest refineries at a heavy discount (as shown in Figure E.7), hence the realized WCS prices are the lowest in the *Licence Without Wheels and Opportunity*

³ The increase in the US light tight oil production might dampen or constrain imports of crude oil, especially those of similar specifications/types. It could also spur refinery reconfiguration to handle locally sourced crudes.

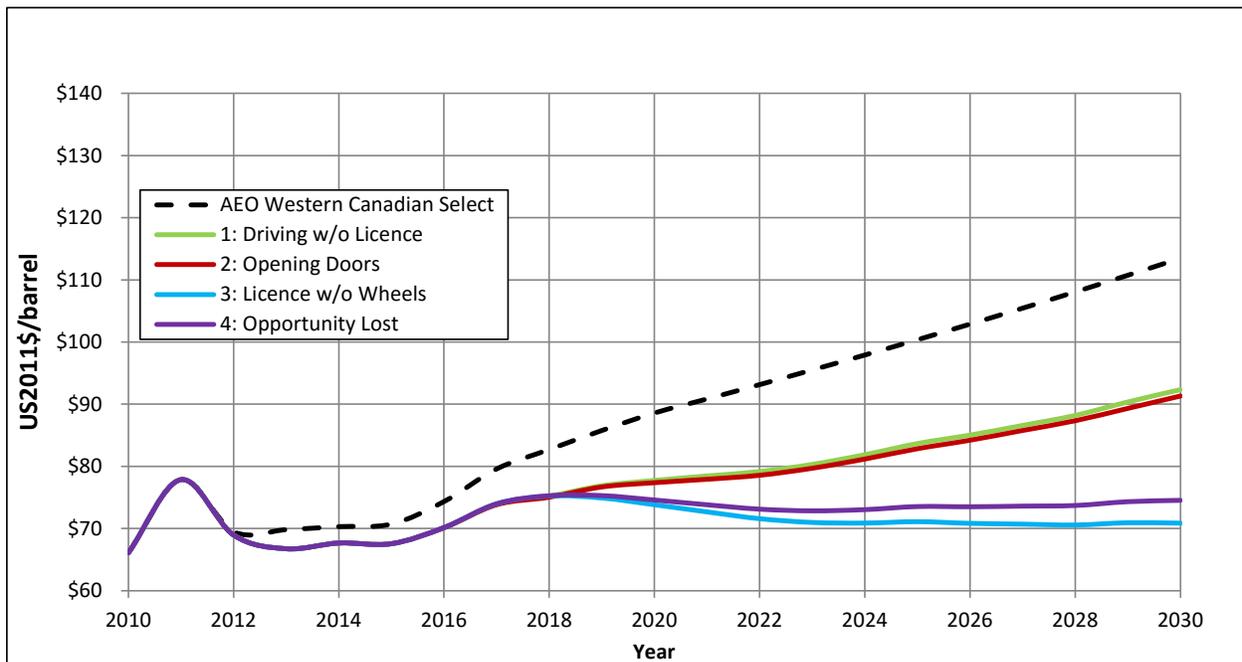
Lost cases. It's the opposite situation for the two narratives where market access is not constrained.

Figure E.5: WTI Prices by Case



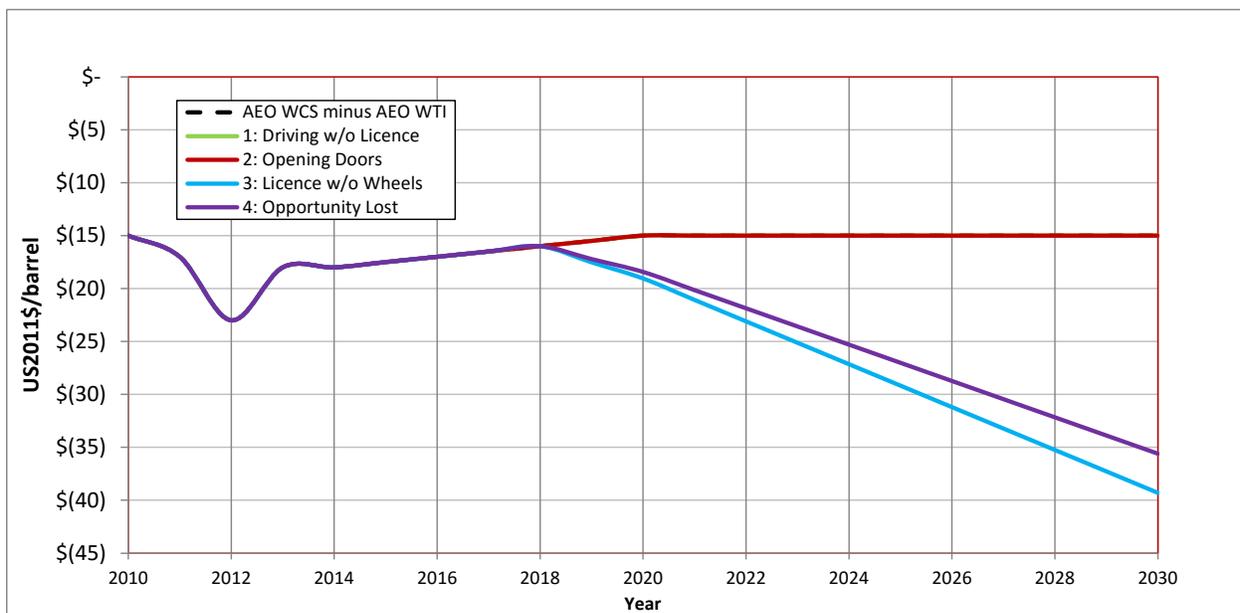
Source: ICF International, CERl

Figure E.6: WCS Prices by Case



Source: ICF International, CERl

Figure E.7: WTI-WCS Differential by Case



Source: ICF International, CERI

In summary:

- The modelling results indicate that the growth in oil sands production is more dependent on the development of infrastructure, such as pipelines and rail and less dependent on obtaining and maintaining social licence to operate.
- Conventional and shale/tight oil production in Canada is significant, but the long term growth potential lies within the oil sands areas.
- Without social licence and/or achieving adequate export pipeline and/or rail capacity, the losses to the companies and resource owners are considerable, as reflected in the discount (\$/bbl) displayed in Figure E.7.
- The demand for crude oil within Canada could be all domestically-sourced, but this is highly dependent on the infrastructure.
- The US tight oil boom will increase the US total crude and liquids supply, but not to the extent where the US becomes completely crude oil independent.
- The gap between US supply and demand is most likely to be met through imports, from both Canada and water-borne imports.