

CANADIAN
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CANADIAN CRUDE OIL AND NATURAL GAS PRODUCTION, SUPPLY COSTS, ECONOMIC IMPACTS AND EMISSIONS OUTLOOK (2018-2038)

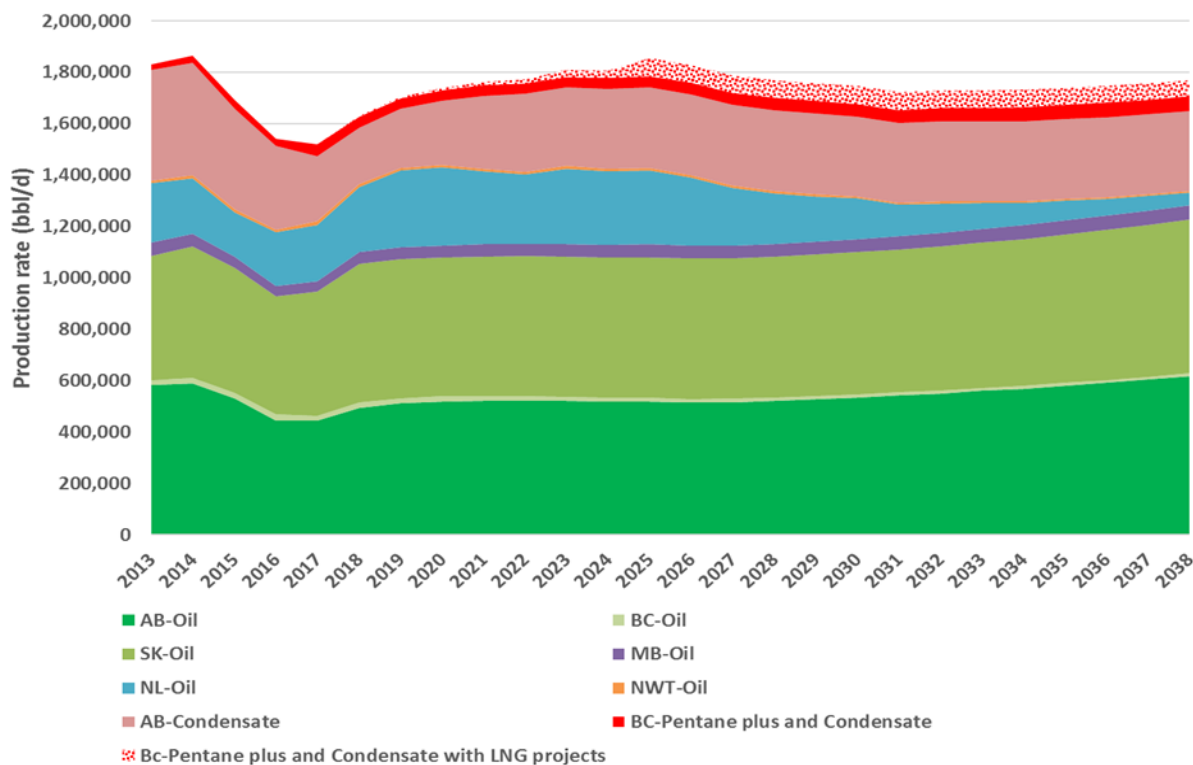


Executive Summary

This study examines Canada’s conventional crude oil and natural gas industries, including production forecasts and supply costs, over the next 20 years. The study covers onshore and offshore conventional oil, including shale and tight oil activity, conventional natural gas, coalbed methane, tight and shale gas, and the associated natural gas liquids (pentanes plus and condensate only). It does not include oil sands.

For crude oil, after a sharp decline in output from 2014 to 2016 (by 8.4%),¹ conventional oil production started to rise in 2017 in response to increasing oil prices. Conventional oil production including pentanes plus in Canada in 2017 was 1.52 million barrels per day (MMbpd), led by Alberta at 0.69 MMbpd, 0.49 MMbpd from Saskatchewan and 0.22 MMbpd from Newfoundland and Labrador (offshore).² Figure E.1 shows total conventional crude oil produced in Canada between 2013-2017, and forecast out to 2038. It does not include production out of the territories, Ontario, New Brunswick, or Nova Scotia as these volumes are negligible.

Figure E.1: Total Canadian Conventional Crude Oil Production



Source: CERI, BCOGC, AER, Government of SK, Government of Manitoba, CNLOPB, PSAC, CAPP

¹ NEB, Estimated production, NEB Data-hub

² Totals may not add due to rounding. NEB, Estimated Production of Canadian Crude Oil and Equivalent, <https://www.neb-one.gc.ca/nrg/sttstc/crdlndprtrlmrdct/stt/stmtdprctn-eng.html>

This report examines conventional crude oil production from each province individually. Total production will increase from 2017 to 2025 where it will remain stable through the remainder of the study period. Growth in western Canada will be offset by the declines seen in offshore Newfoundland and Labrador. Over the study period, production levels are not expected to reach the highs seen in 2014 before the decline in oil price.

The growth in crude oil production will be led by Alberta (25% increase from 2018 levels), followed by Saskatchewan (11% growth) as it is expected the province will be focusing on drilling their tight oil formations. In 2038, total conventional crude oil production will be just above 1.3 MMbpd. Pentane plus and condensate production for the two scenarios of no LNG plants versus LNG plants are 0.37 and 0.43 MMbpd, respectively. Thus, total conventional oil production with pentanes plus and condensate in Canada will increase to 1.67 MMbpd (9.8% growth from 2017) or 1.76 (15.7% growth from 2017) for the scenario with LNG.

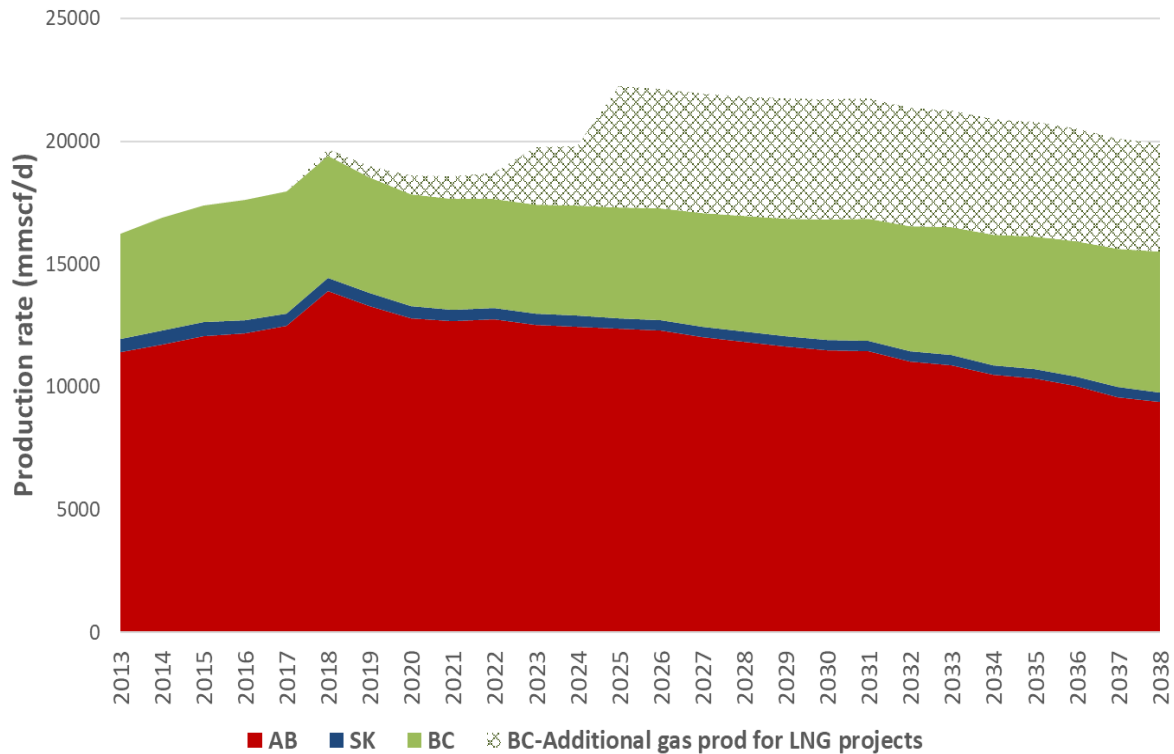
Canadian natural gas producers are facing challenges with the “shale revolution” that has occurred in the United States. The shale revolution and LNG exports have transformed the US from a net importer to a net exporter of natural gas in 2017. With Canada being the main natural gas exporter to the US, it is no surprise that there are negative consequences for Canadian gas producers. In 2017, Canada was the fifth largest producer of natural gas globally³ with production of 18.1 bcf/d.⁴ In Canada, Alberta represented approximately three-quarters of the country’s production. Total natural gas production in Canada from 2013-2017 and the forecast through 2038 is shown in Figure E.2.

As shown in Figure E.2, total Canadian production is expected to decrease out to 2038 because of the declining trend of Canadian natural gas exports to the US and increased imports from the US. Alberta will see declining production from 2018 through 2038, while British Columbia is expected to have a slight increase for the same period. British Columbia will also see two increases in production if Liquefied Natural Gas (LNG) projects are approved. In this study, the Canadian Energy Research Institute (CERI) assumes liquefaction capacity is coming online in 2023 and 2025. Total natural gas production for LNG projects is forecasted to be slightly over 5 Bcf/d. This amount could be perceived as optimistic, but still feasible if projects on the west coast take FID in 2018-2020. Once production has risen to accommodate the increase in demand that the LNG projects will cause, production will remain stable with marginal decreases through the remainder of the study period. In 2038, the production of natural gas will be 15.4 Bcf/d for the scenario with no new LNG plants, whereas it is approximately 20 Bcf/d with new LNG plants.

³ BP website, BP Statistical Review of World Energy June 2017, <https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review-2017/bp-statistical-review-of-world-energy-2017-full-report.pdf>, pp. 30. (Accessed on May 18, 2018)

⁴ CAPP Statistical Handbook, October 2017, Table 3.9.

Figure E.2: Total Canadian Natural Gas Production



Source: CERl, Government of SK, BCOGC, AER, PSAC, CAPP

This study also examines the economic impacts of the Canadian conventional oil and natural gas industry on the Canadian economy, at the provincial level, utilizing CERl’s proprietary Canada Multi-Regional Input-Output (CMRIO) model. The impacts analysis is done for the period 2018-2028.

The Canadian oil and gas industry is a significant contributor to the provincial and national economies in Canada. In the foreseeable future, natural gas and crude oil will be important elements in many economic sectors in Canadian and North American economies. Total GDP impacts from investment and revenues throughout the forecast period of 2018-2028 for crude oil is CAD\$833.9 billion and CAD\$299.7 billion for natural gas. Similarly, with government tax revenues, those collected and received from crude oil are higher in magnitude than for natural gas. Federal taxes from crude oil projects are approximately three times higher than those collected from natural gas projects (CAD\$68.7 billion vs. CAD\$27.9 billion). Provincial tax revenues follow the same pattern – crude oil related provincial taxes are higher than those for natural gas (CAD\$50.3 billion vs. CAD\$17.5 billion).

Total employment impacts from all Canadian oil and gas development will materialize in every province and territory (1,836 thousand person-years for oil and 820 thousand person-years for natural gas). The largest labour impact will be felt in Alberta with 46 and 60 percent for crude oil and natural gas projects, respectively, of total labour impacts. However, companies that are

suppliers of goods and services, such as machinery, manufacturing, trade, legal, environmental, financial services, often located outside of Alberta, will also benefit.

Because of the impacts of carbon emission intensities on market outlook of industrial operations, the third part of this study estimated the annual average emissions from oil and gas production during the forecast period. CERI's emission forecasts include upstream production of conventional oil and conventional and unconventional gas in Canada. More specifically, upstream emissions encompass emissions from the following activities: drilling, production and extraction, processing in the field, and venting, flaring, and fugitive emissions.

For conventional crude oil, we used data from CERI Study 167: "An Economic and Environmental Assessment of Eastern Canada Crude Oil Imports." In particular, emission intensity for light crude volumes for this study is calculated as a weighted average of two emission intensity figures – mixed sweet blend and mixed sour blend. The estimated intensity is then 41.12 kg CO₂ eq/bbl, which is used to calculate total upstream emissions for light, medium and condensate production. For heavy oil production, an intensity of 72.4 CO₂ kg eq/bbl is used for calculating upstream emissions.

For our analysis, CERI is using the emissions intensity of the natural gas industry derived from data published by Environment and Climate Change Canada (ECCC 2018). According to the publication, as of April 2018, total natural gas emissions were 48.6 megatonnes of carbon dioxide equivalent. Using 17.91 Bcf/d as raw natural gas production for 2016 (CanSim 2017), the resulting intensity is 7.44 tonnes CO₂ eq/mmscf.

It is important to note that according to historical intensity values, which have been decreasing for natural gas and crude oil, CERI considered two scenarios for emissions:

- The reference case: 2016 emission intensities were considered to be the same over the study period (no further improvement in emission intensities was assumed in the forecast).
- The lower intensity case: CERI assumed that the 2016 intensities drop by 1.1% for oil production and 4.6% for natural gas production based on recent historical trends. Note that the decreasing trend of intensities continues until it reaches 70 percent of the 2016 intensity rates at which it is assumed to remain constant.

In the reference case, total emissions associated with oil production will amount to 635.7 million tonnes over the 2018-2038 period (Figure E.3). On average, annual emissions from oil production will be 30.3 million tonnes/year. The provinces of Alberta and Saskatchewan will generate the highest emissions at 45 and 40 percent, respectively. With the improved emission intensities, total annual emissions drop from 28.13 million tonnes/year in 2018 to 23.9 million tonnes/year in 2038 (on average 26.4 million tonnes/year).

Figure E.3: Crude Oil Production Emissions

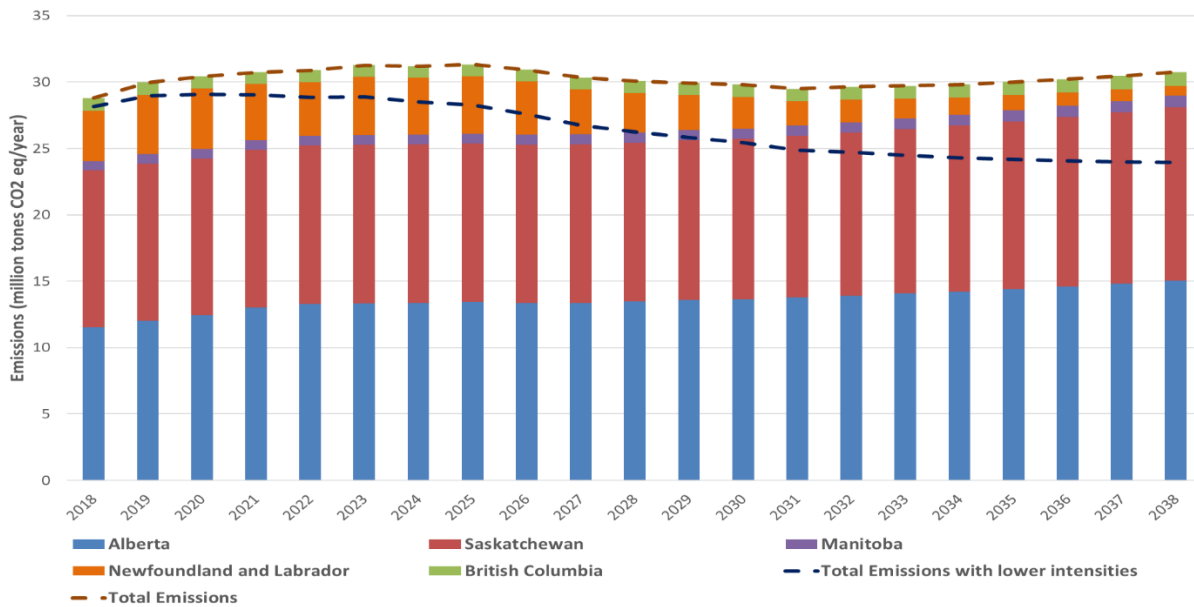


Figure E.4 shows total emissions associated with natural gas production for the reference case, which is 970.4 million tonnes over the 2018-2038 period (Figure 3.14). On average, annual emissions from natural gas production will be 46.2 million tonnes/year during the study period. The provinces of Alberta and British Columbia will generate the highest emissions at 70 and 28 percent, respectively (Figure E.4). With the improved emission intensities, total annual emissions drop from 47.9 million tonnes/year in 2018 to 29.4 million tonnes/year in 2038 (on average 33.0 million tonnes/year).

Figure E.4: Natural Gas Production Emissions

