Canadian Oil and Gas Production

CANADA'S OIL & NATURAL GAS PRODUCERS

Canadian Oil and Gas Production Definitions

Oil Sands

About 65% of Canada's oil production is from oil sands. The extra heavy crude produced from the oil sands formation is called bitumen. Oil sands can be produced by mining or in-situ:

- **Mined**. 20% of the reserves are close enough to the surface for mining. Mined bitumen is either upgraded into a lighter crude oil, called Synthetic Crude Oil (SCO), or diluted with light liquids (often condensates) so that it can be thinned and transported by pipeline.
- **In-situ.** 80% of the reserves must be produced from wells since they are too deep for mining. Except for a small amount of primary/cold production, steam is used to mobilize the bitumen to flow to the surface. The most common method is steam-assisted gravity drainage (SAGD); the other is cyclic steam stimulation (CSS).

Conventional Oil and Gas

About 30% of Canada's oil and almost all of Canada's natural gas is called conventional production. Traditionally, oil and gas were produced from vertical wells, but today, horizontal wells and hydraulic fracturing are the dominant methods. While it is not always in shale formations, this new production technique is often applied in shale formations and is called shale gas or shale oil. The Montney and the Duvernay are two dominant Canadian shale plays. Condensates and pentanes plus are also categorized as conventional production in this chapter book:

- **Condensate and Pentanes Plus.** These light liquids are similar in quality to naphtha from a refinery. They are a byproduct of natural gas production, often from shale gas and oil wells. The light liquids are often used to dilute bitumen for pipeline transportation.

East Coast Production

About 5% of Canada's oil production comes from four offshore developments in Newfoundland and Labrador; Hibernia, Terra Nova, White Rose, and Hebron.

Source: Alberta Government ST98 2023 (Alberta Energy Outlook), S&P Global Oil Sands Dialogue, Canada Energy Regulator

Content Summary

Canada is a significant supplier of oil and gas. Canada is the fourth-largest producer of oil in the world and the fifth-largest producer of natural gas.

Natural Gas Highlights

- Competition from US shale gas starting in 2008 led to a decline in Canadian production. In 2012-13, the trend reversed with the discovery of shale gas in BC and Alberta. Canadian production has now recovered to a record high.
- Shale gas has also shifted the dominant location for natural gas production; from southern Alberta to NE British Columbia and northern Alberta.

Crude Oil Highlights

- Canadian oil production includes oil sands at 3.2 MMB/d (65%), conventional at 1.4 MMB/d (30%), and offshore east coast at 0.2 MMB/d (5%).
- Since 2005, oil sands production has tripled, but after 2018, production growth has moderated. Production has ranged between 3.1 and 3.2 MMB/d the last few years (2021, 2022, and 2023).
- Condensate and pentanes plus production has doubled since 2014 and is currently about 460,000 B/d. The growth of light liquids is a byproduct of the prolific shale gas and oil wells.

Canadian Oil and Gas Production (2022)

17.3 Bcf/d

Natural Gas

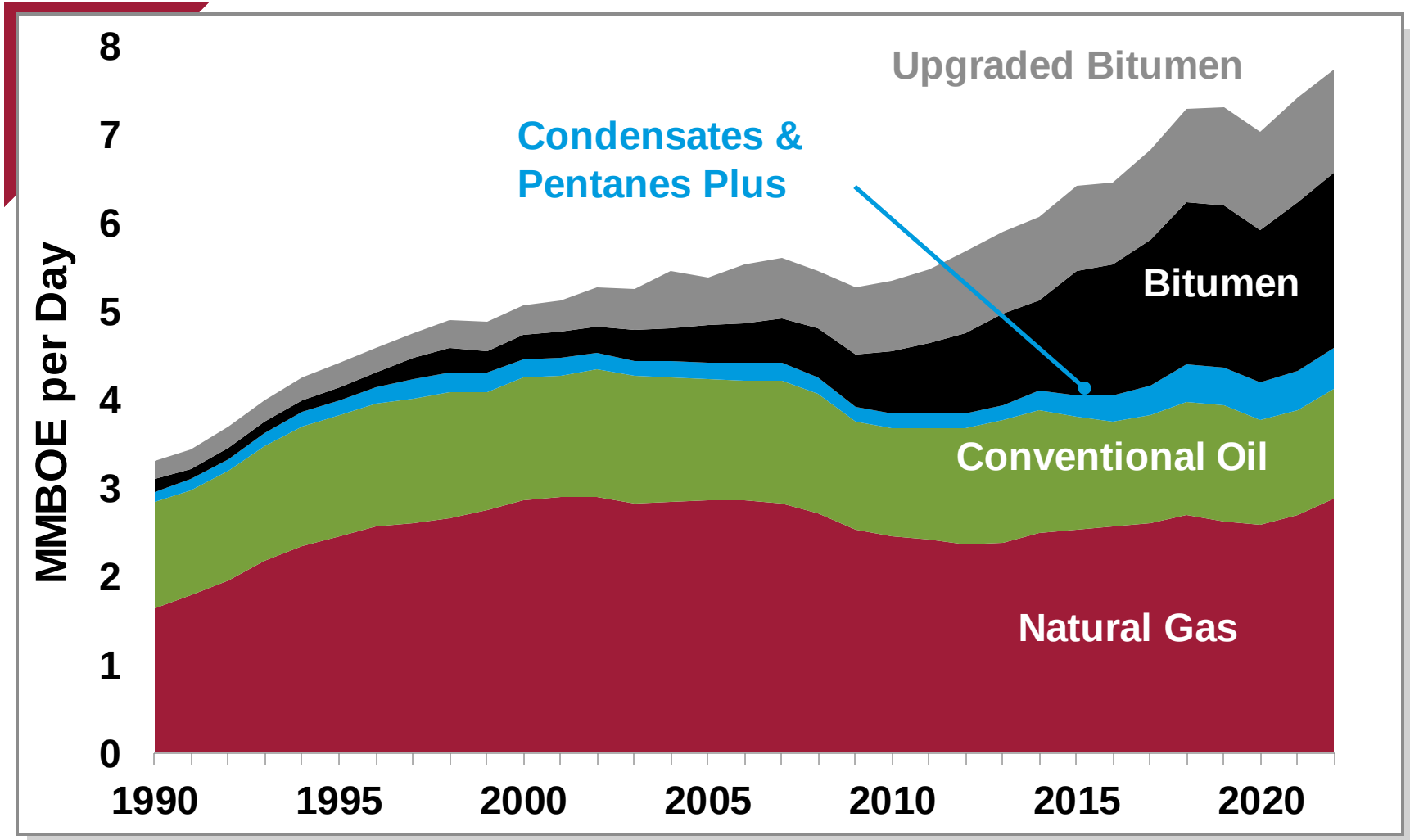
4.8 MMB/d

Crude Oil*

* Does not include NGLs.

Source: Canada Energy Regulator

Annual Canadian Total Hydrocarbon Production by Type | 1990 to 2022



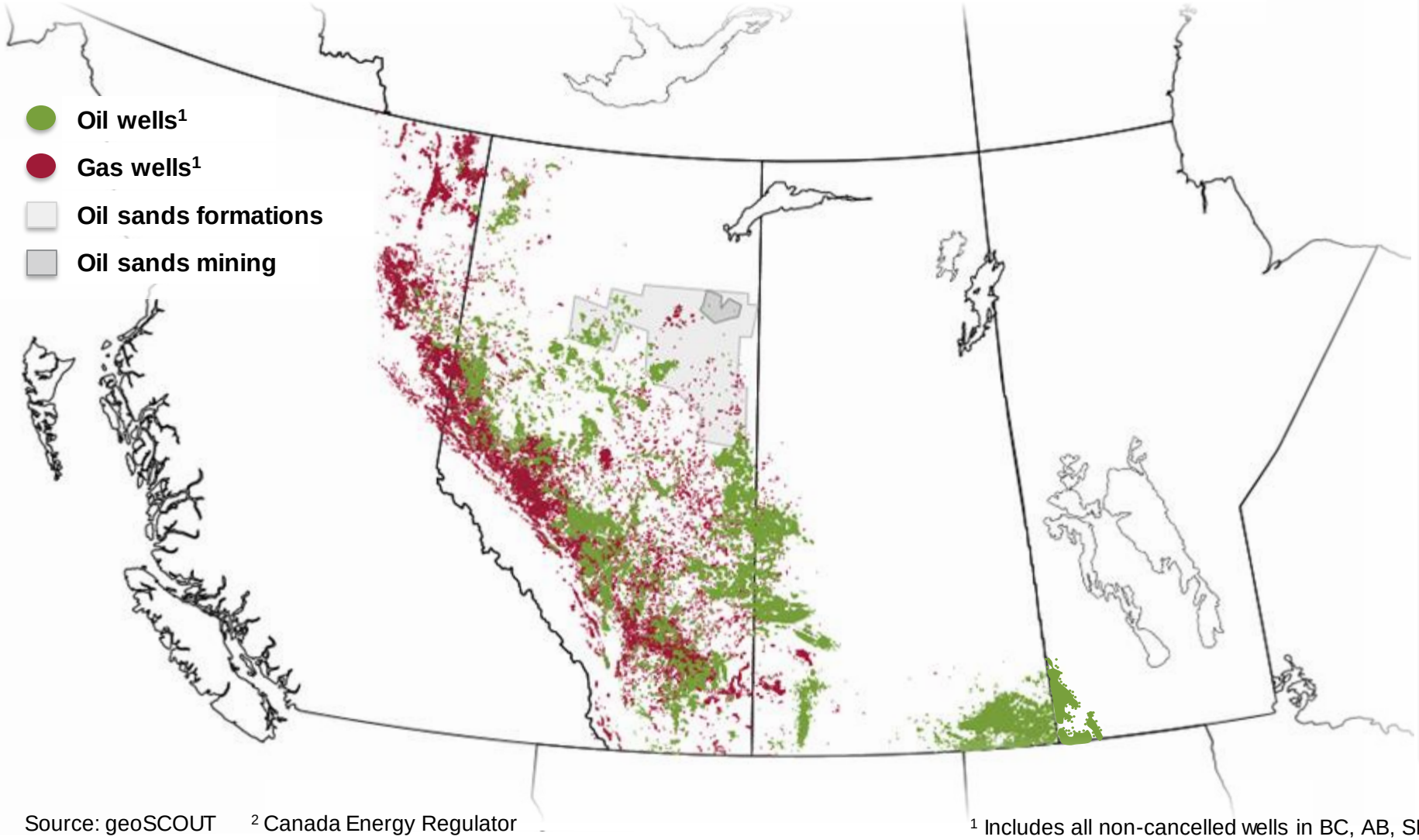
- In 2022, Canada's total oil and gas production reached an all-time high of 7.7 MMBOE/d.
- Note: The graph excludes NGLs (butane, propane, and ethane).

Source: CAPP (1990-2017), Canada Energy Regulator (2018-2022)

Western Canadian Sedimentary Basin (WCSB)

CANADA'S OIL & NATURAL GAS PRODUCERS

The Western Canadian Sedimentary Basin (WCSB)

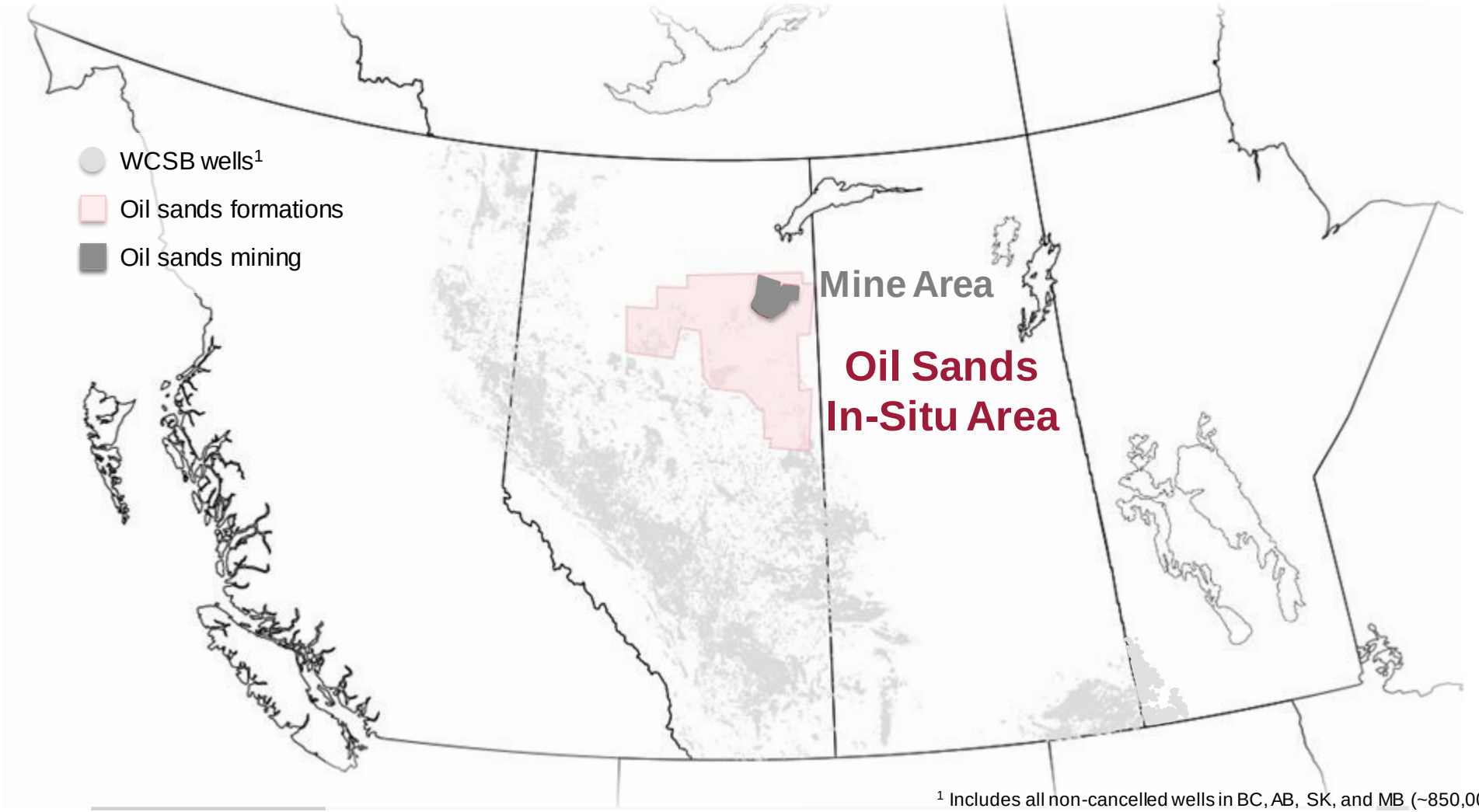


- 95% of Canada's oil production and all its marketable gas is produced in the WCSB.
- The WCSB is a large, well-explored basin with 100+ years of history, spanning four provinces.
- The WCSB has 850,000 wells drilled (oil and gas) since 1901, creating a wealth of data on the basin.
- The total area is ~1.4 million km^2, about two times larger than the state of Texas[2].

Source: geoSCOUT [2] Canada Energy Regulator

[1] Includes all non-cancelled wells in BC, AB, SK, and MB (~850,000 wells)

The Western Canadian Sedimentary Basin (WCSB) | Oil Sands

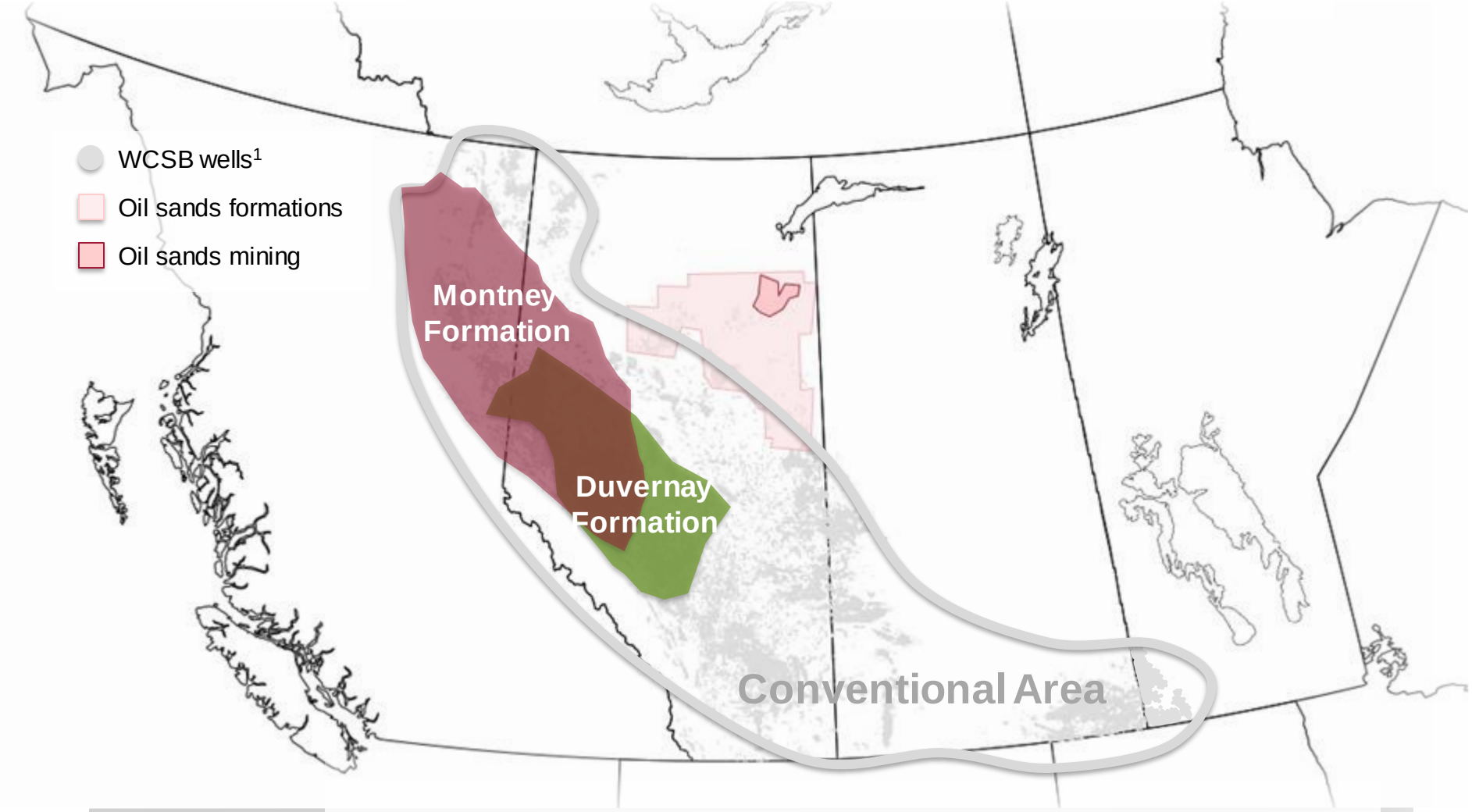


- Oil sands reserves are estimated at 168 billion barrels, ranking 4th largest after Venezuela, Saudi Arabia, and Iran[2].
- The oil sands region covers 142,000 km^2 a smaller area than the Permian Basin[3].
- Oil sands are mined and produced by wells (in-situ). The minable area is a relatively small part.
- The active mined area is about 1,264 km^2; a footprint that is 1.5X larger than the city of Calgary[4].

Source: geoSCOUT; Natural Resources Canada for oil sands areas

[1] Includes all non-cancelled wells in BC, AB, SK, and MB (~850,000 wells)
[2] Oil and Gas Journal estimate as of January 2022
[3] Alberta Government [4]ABMI (2018 estimate)

The Western Canadian Sedimentary Basin (WCSB) | Conventional

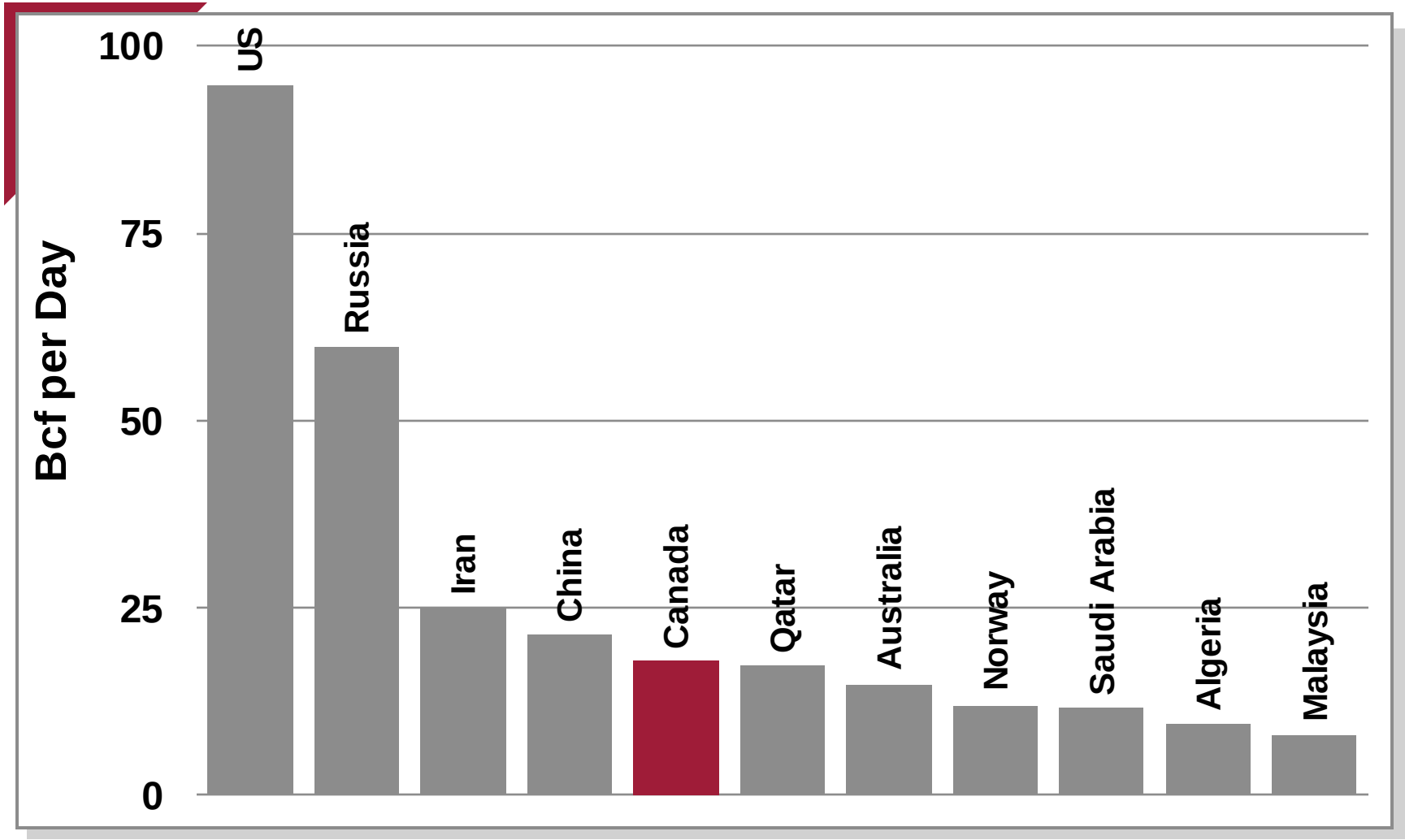


- Conventional WCSB production makes up 30% of Canada's total oil production and all of its natural gas production.
- Conventional oil and gas is produced from a large area, spanning four provinces.
- Since the early 2010s, the Montney and Duvernay have become important plays that are attracting new investment. They are shale plays that use horizontal wells and hydraulic fracturing to liberate the gas and light oil.

Source: geoSCOUT; Natural Resources Canada for oil sands areas
The Duvernay and Montney formation locations are approximate

[1] Includes all non-cancelled wells in BC, AB, SK, and MB (~850,000 wells)

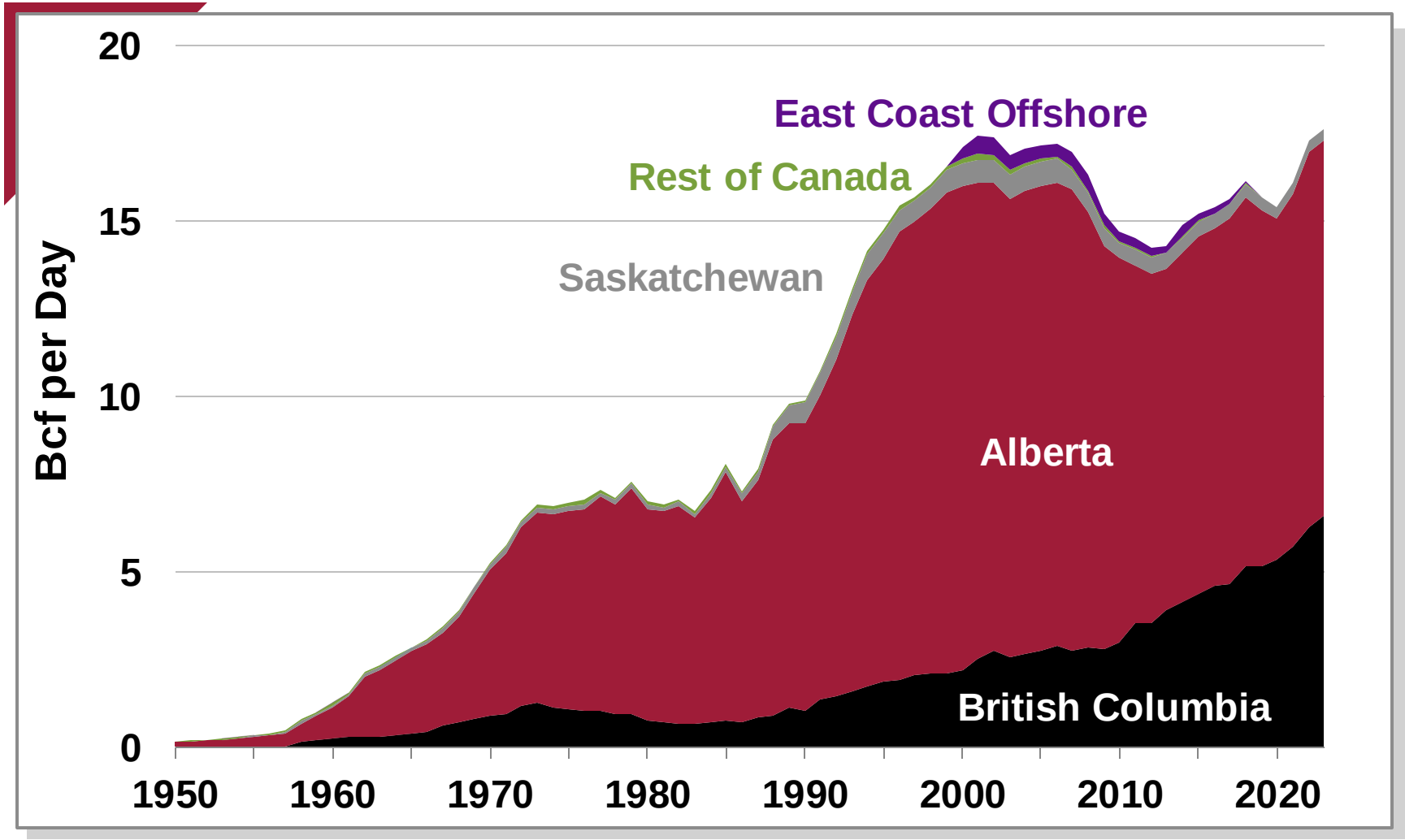
Canada is the World's Fifth Largest Natural Gas Producer | 2022



- The US and Russia together make up 40% of world natural gas production.
- In 2022, Canada accounted for 4.6% of world natural gas production.

Source: Energy Institute Statistical Review of World Energy

Annual Marketable Natural Gas Production | 1950 to Q2/2023*

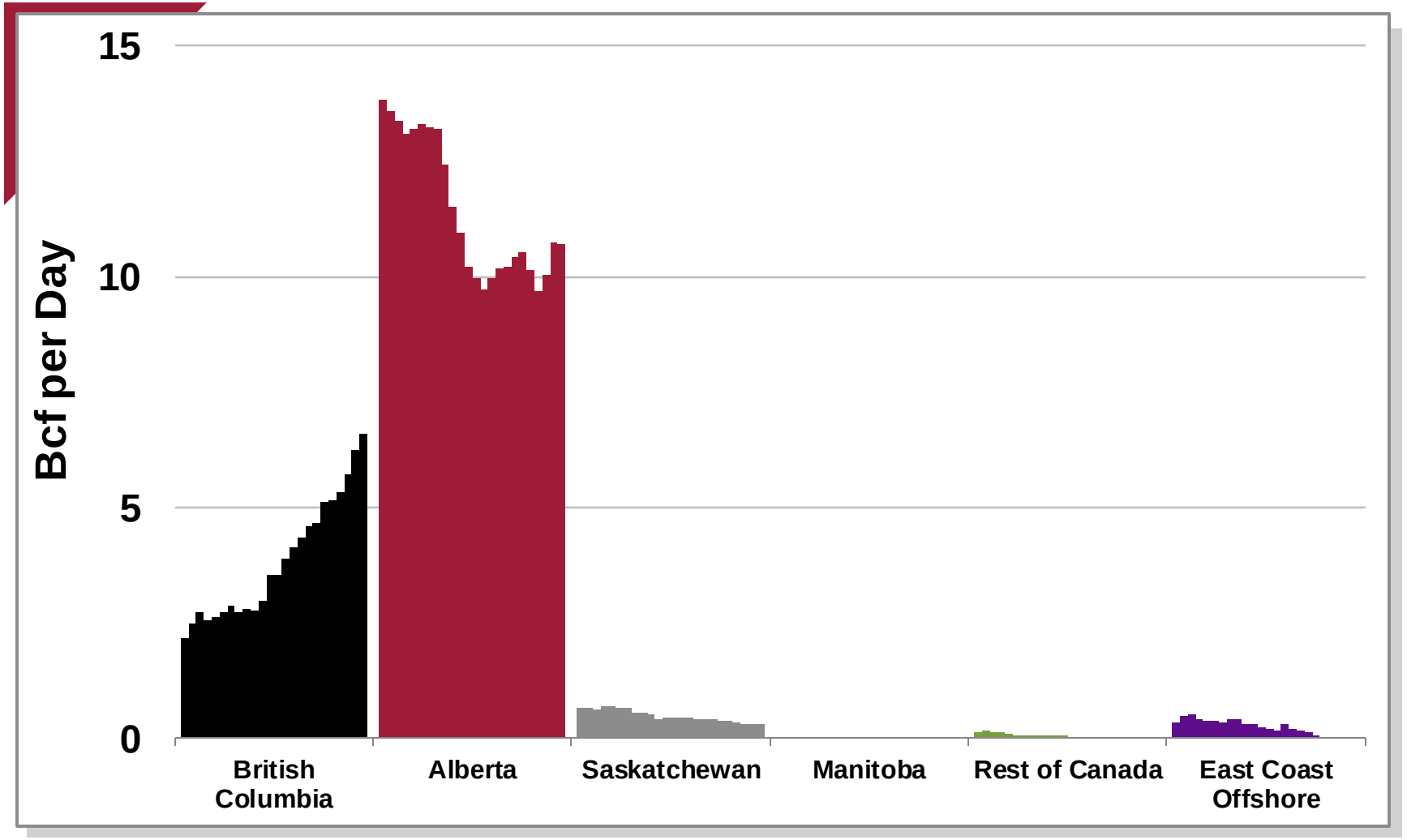


- The surge of US shale gas starting in 2008 led to a collapse in Canadian natural gas prices and a decline in production and exports. Alberta and British Columbia regained competitiveness when shale gas was discovered in these provinces. Canadian production reached a record high in 2023.
- Production from Rest of Canada is too small to see on this graph, at less than 10 MMcf/d.

Source: CAPP (1950-2017), Canada Energy Regulator (2018 to Current)

*2023 data is YTD average up to June 2023

Annual Marketable Natural Gas Production by Province | 2000 to Q2/2023*

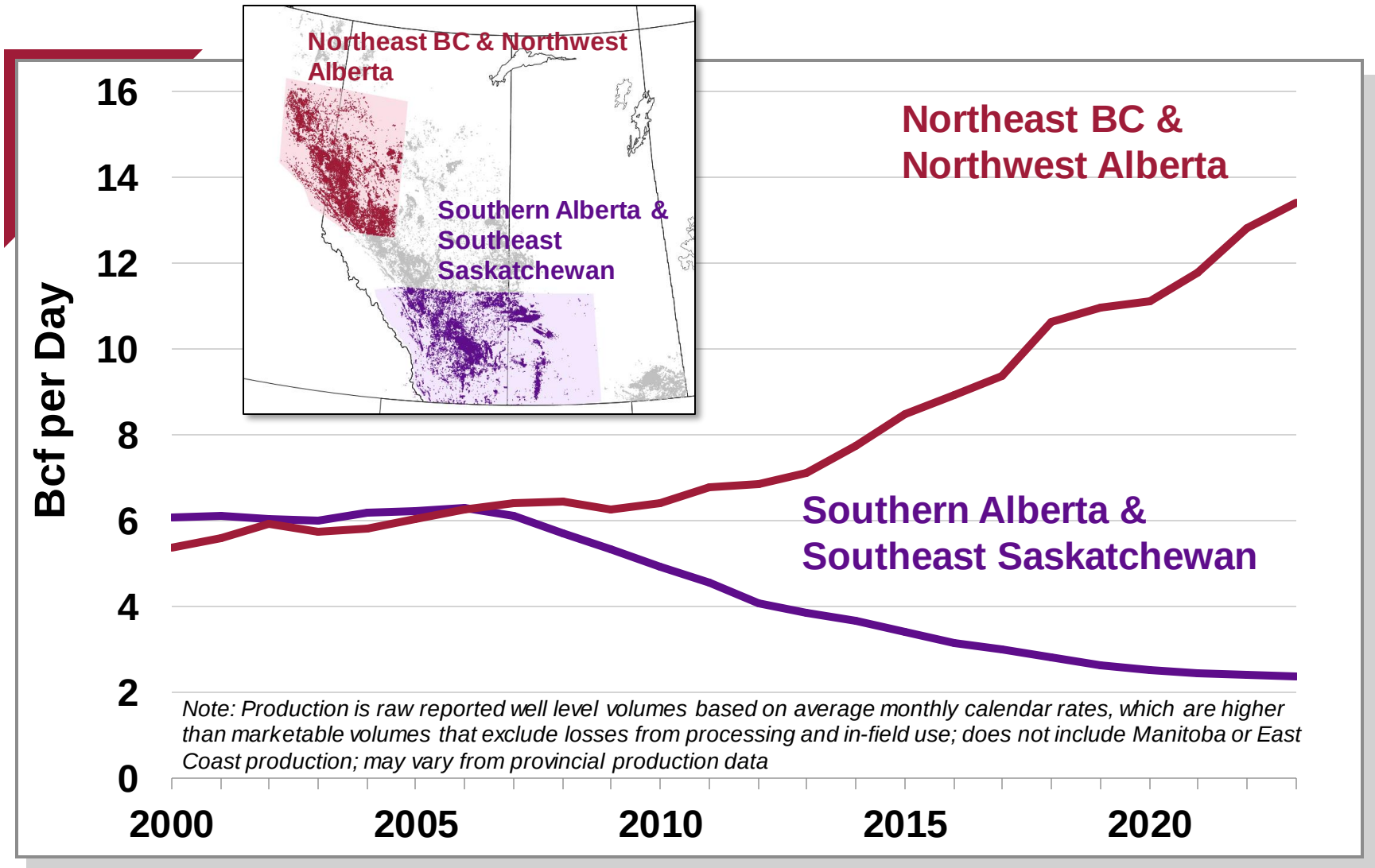


- Alberta's share of Canadian natural gas production fell from 80% in 2000 to 62% in 2022.
- Without the discovery of shale gas, Alberta production would have declined by more.
- Shale gas developments have more than doubled production from British Columbia since 2010.

Source: CAPP (2000-2017), Canada Energy Regulator (2018 to Current)

*2023 data is YTD average up to June 2023

Avg. Annual Raw Natural Gas Production by Select Region | 2000 to Q2/2023*

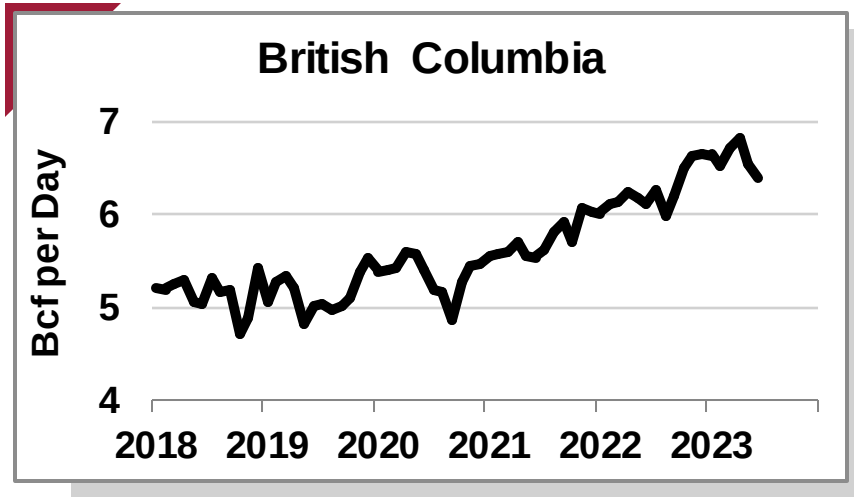


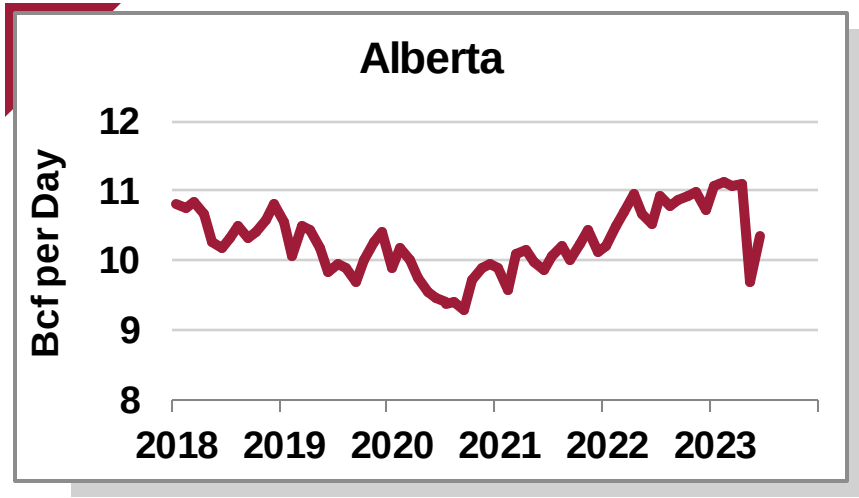
- Since 2010, the discovery of shale gas plays in Northeast BC and into Alberta has attracted capital investment and created strong production growth. Conventional gas regions have declined as they cannot compete with shale gas.
- Shale gas is also a source of liquids called condensates and pentanes plus used in oil sands.

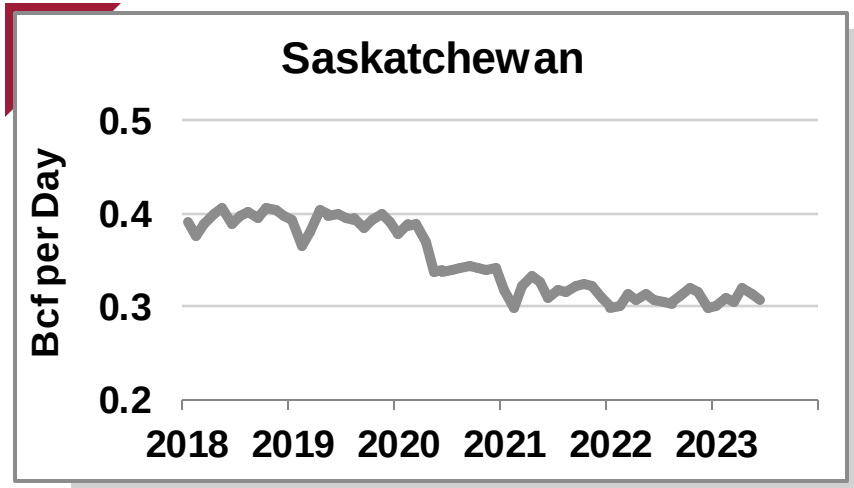
Source: geoSCOUT

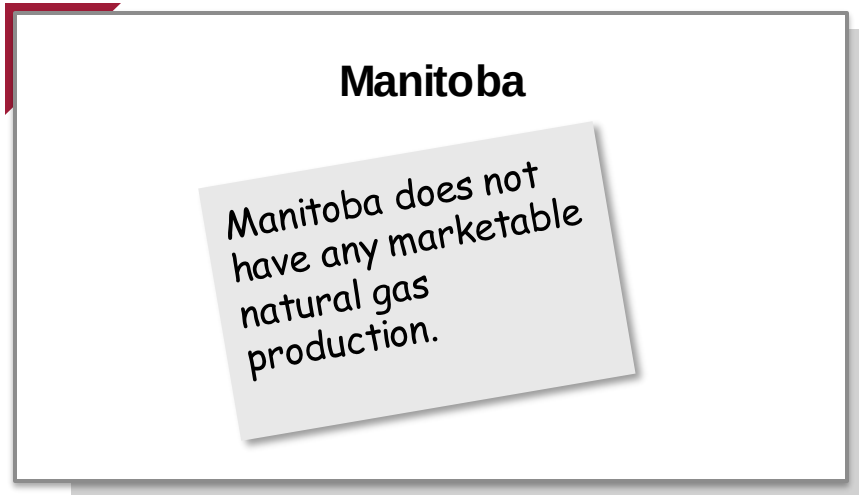
*2023 data is YTD average up to June 2023

Monthly Marketable Natural Gas Production by Province | 2018 to Q2/2023*







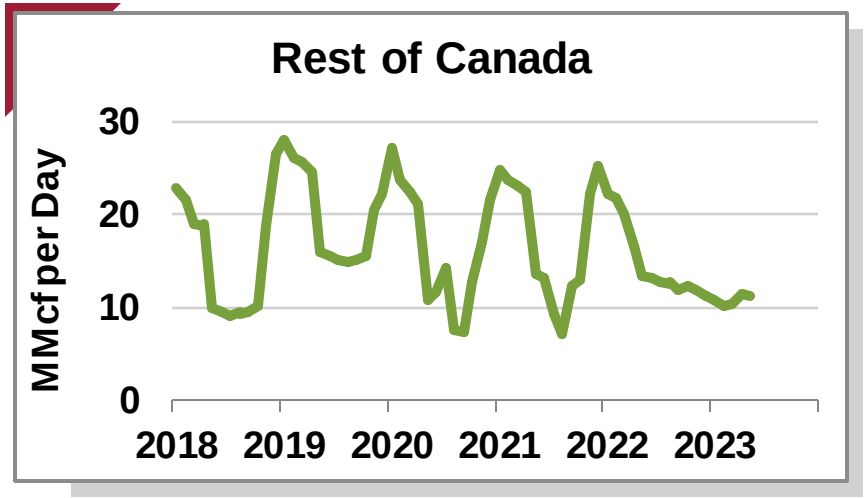


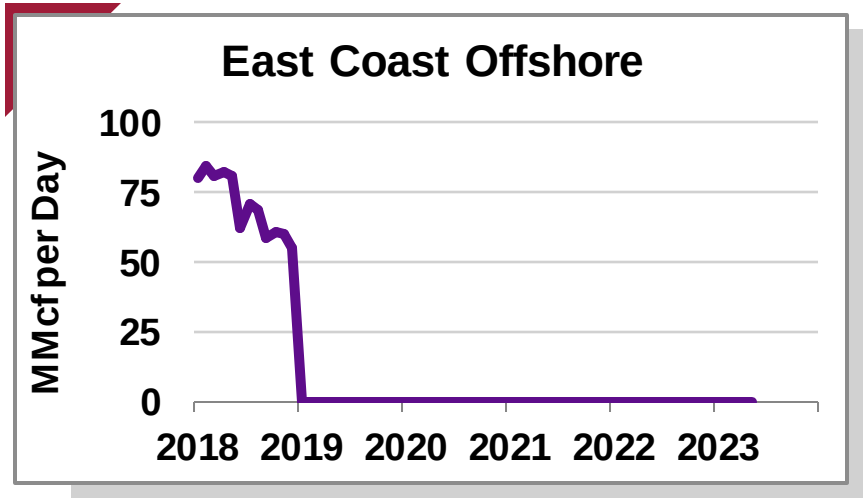
- Since 2018, BC production has grown over 1.5 Bcf/d.
- Alberta's production had recently surpassed pre-COVID levels before companies temporarily shut-in production due to wildfires in May 2023.
- Saskatchewan's natural gas is largely a byproduct of oil production.

Source: Canada Energy Regulator

*2023 data is YTD average up to June 2023

Monthly Marketable Natural Gas Production by Province | 2018 to Q2/2023*





- Note the scaling for these graphs is in MMcf, not Bcf as in the previous slide.
- Rest of Canada includes Ontario, Northwest Territories, and New Brunswick.
- Currently, marketable natural gas production outside the WCSB is approximately 10 MMcf/d.

- East Coast Offshore includes production from Nova Scotia only. Nova Scotia currently has no producing natural gas projects.
- Encana's Deep Panuke field was permanently shuttered in May 2018.
- After almost 20 years of producing natural gas, the Sable Offshore Energy Project (SOEP) ceased production in December 2018.

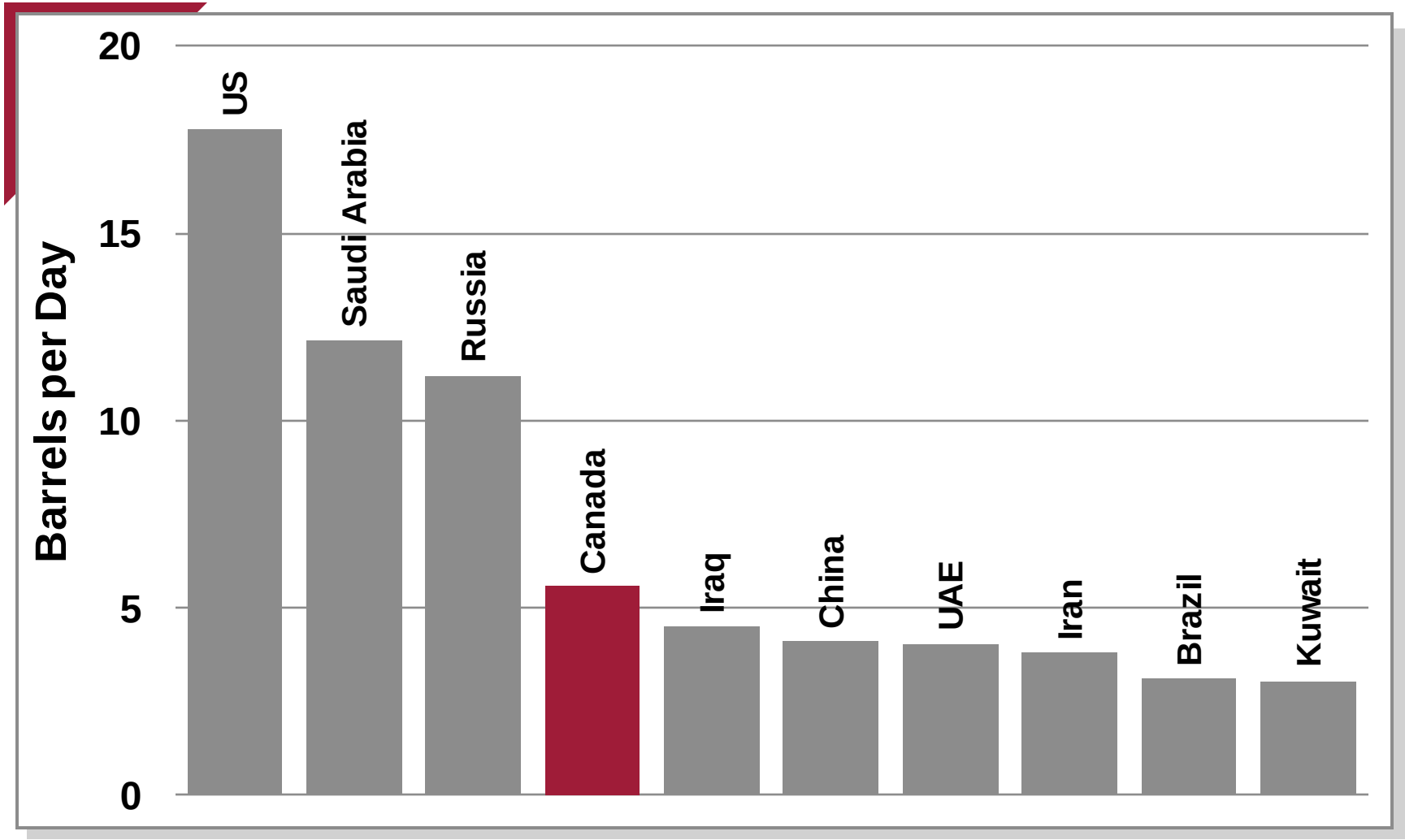
Source: Canada Energy Regulator

*2023 data is YTD average up to May 2023

Crude Oil

CANADA'S OIL & NATURAL GAS PRODUCERS

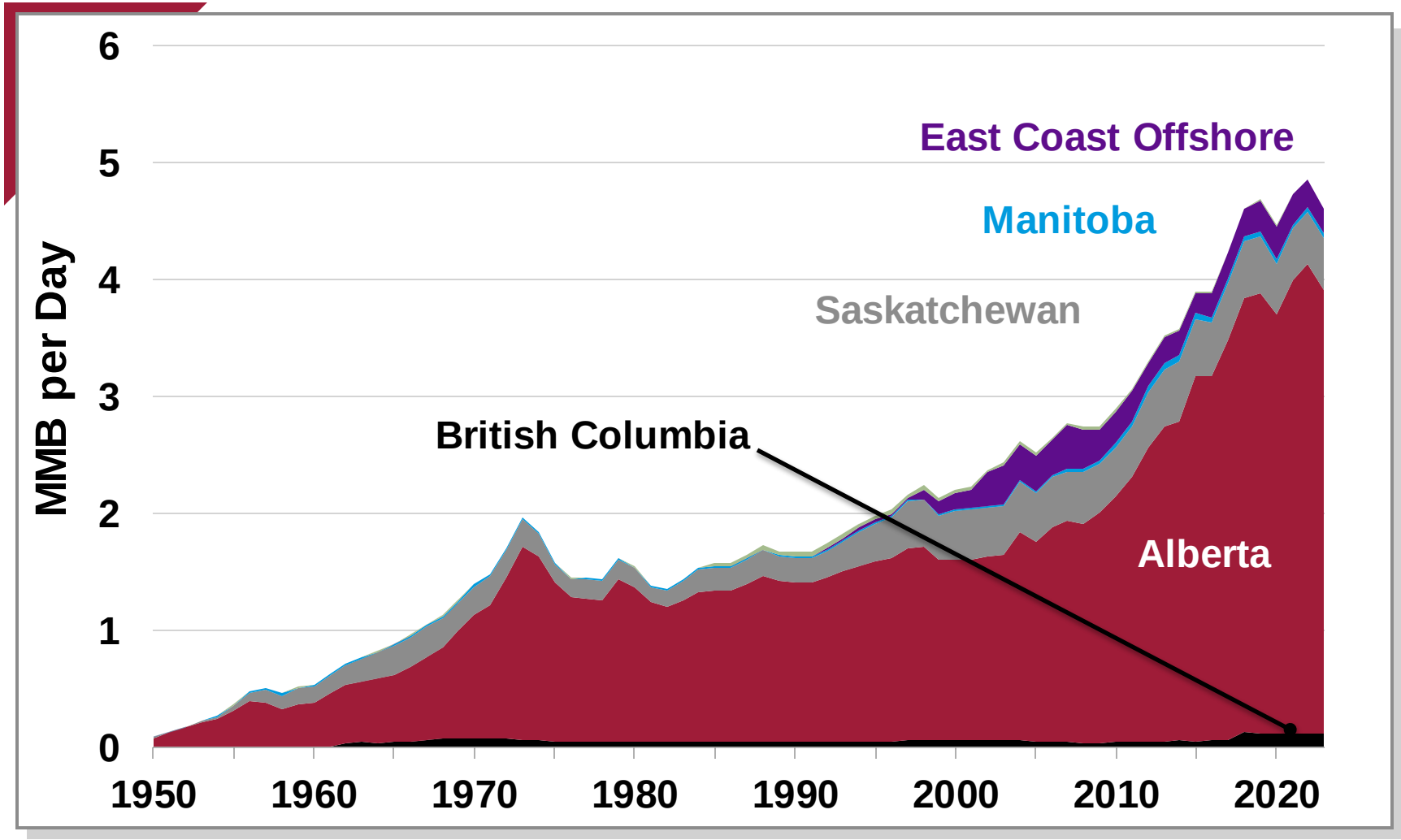
Canada is the World's Fourth Largest Oil Producer | 2022



- In 2018, the US passed Saudi Arabia and Russia as the largest producer of oil in the world.
- US production doubled between 2009 and 2019 driven by the shale oil boom.
- Canada is a major supplier of secure, reliable oil and accounts for 6% of world supply.
- The oil sands have been the main source of Canadian production growth since the mid 2000s.

Source: Energy Institute Statistical Review of World Energy
Note: Production includes crude oil, shale oil, oil sands, condensates and NGLs.

Annual Oil Production by Province | 1950 to Q2/2023*

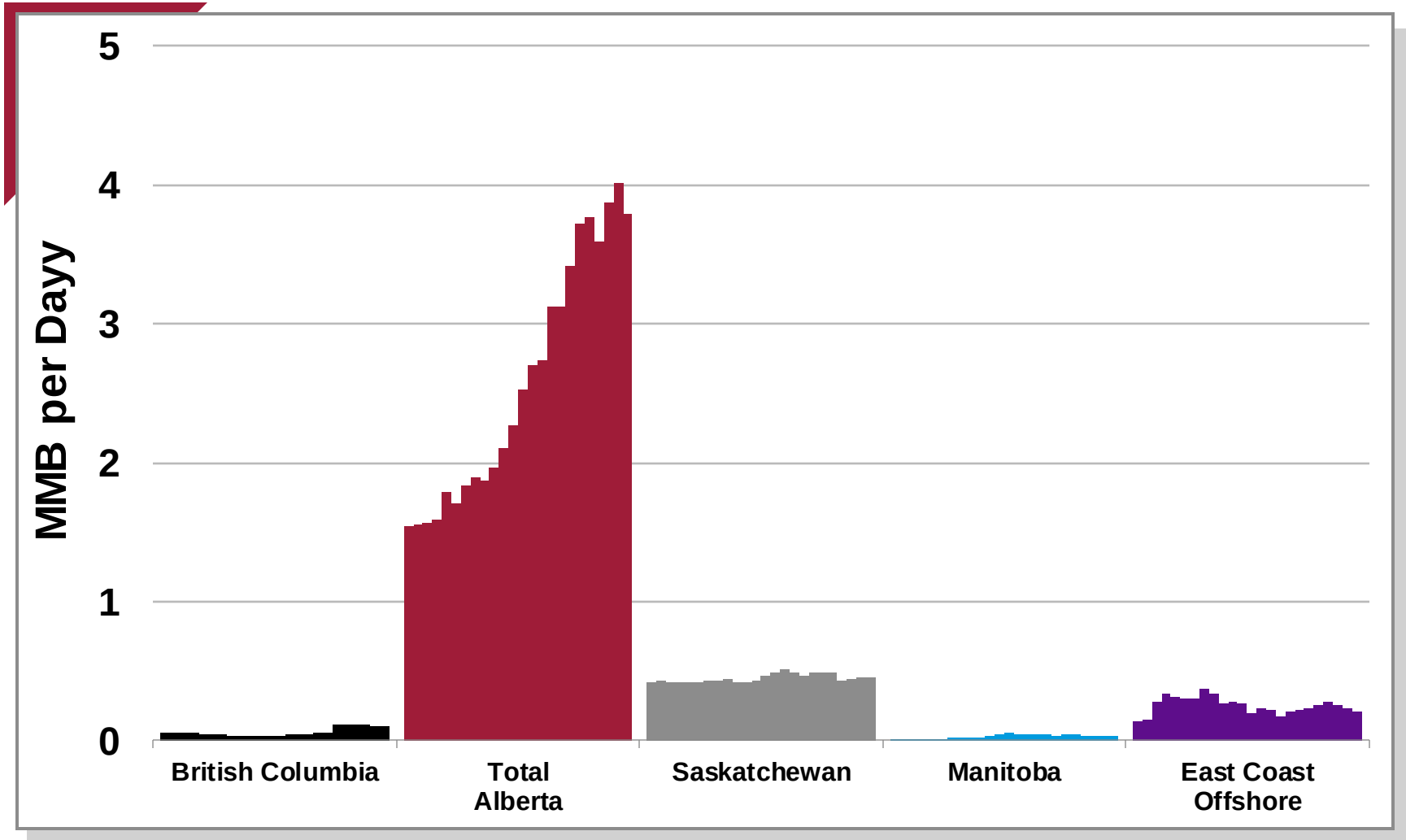


- For the most part, oil production in Canada has been on an upward trajectory.
- The Rest of Canada only adds up to less than 10,000 b/d and is too small to see on the graph.

Source: CAPP (1950-2017), Canada Energy Regulator (2018 to Current)
Note: Oil includes crude oil, condensates and pentanes plus and does not include NGLs

*2023 data is YTD average up to June 2023

Annual Oil Production by Province | 2000 to Q2/2023*

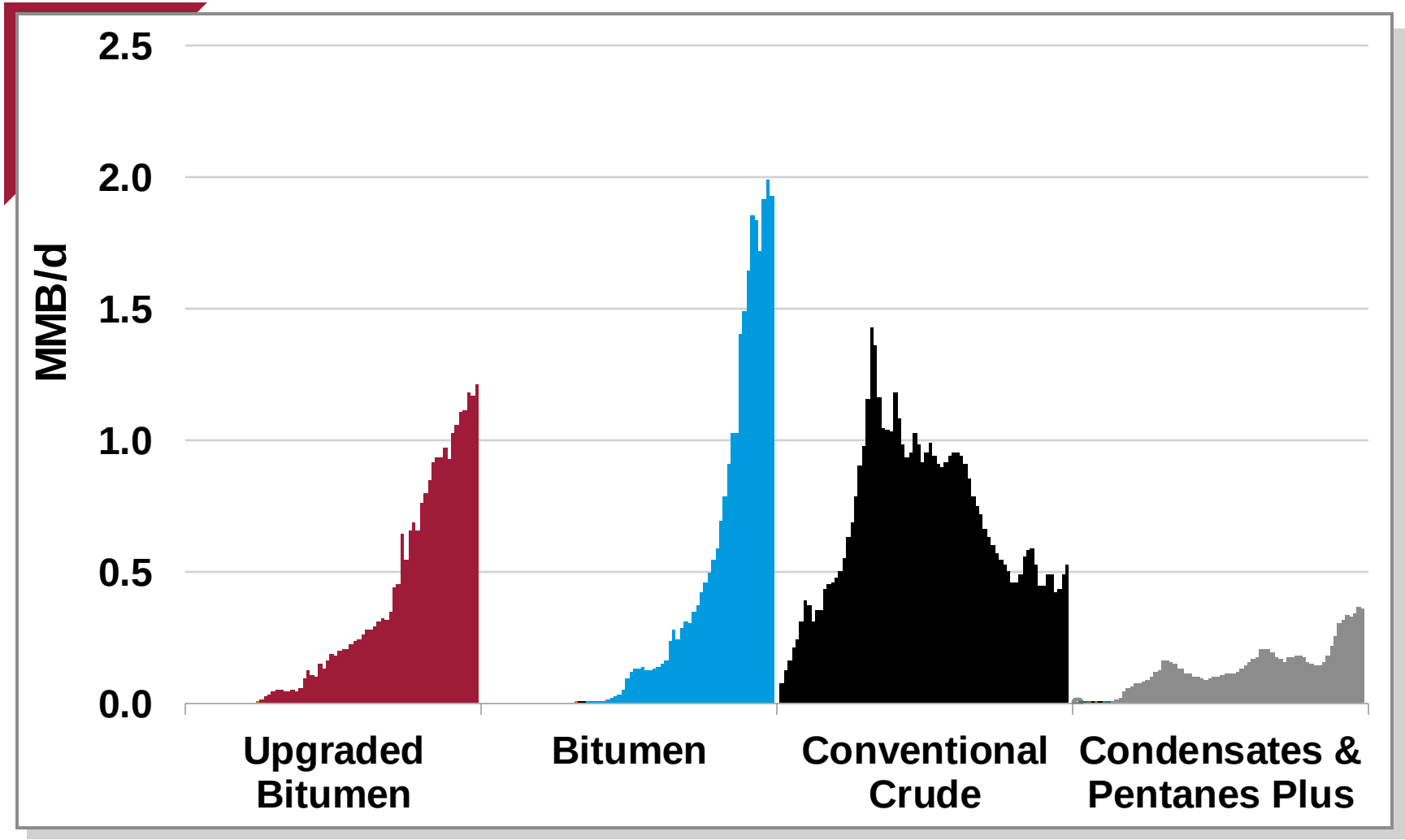


- Over 80% of Canada's oil comes from Alberta.
- Since 2005, oil sands production has tripled to over 3.1 MMB/d. Growth has moderated after 2018, with production relatively stable in 2022 and 2023.
- Saskatchewan is the 2nd largest in Canada producing just under 0.5 MMB/d.
- All of Canada's East Coast production comes from Newfoundland and Labrador.

Source: CAPP (2000-2017), Canada Energy Regulator (2018 to Current)
Note: Oil includes crude oil, condensates and pentanes plus and does not include NGLs.

*2023 data is YTD average up to June 2023

Alberta | Annual Oil Production | 1950 to Q2/2023*

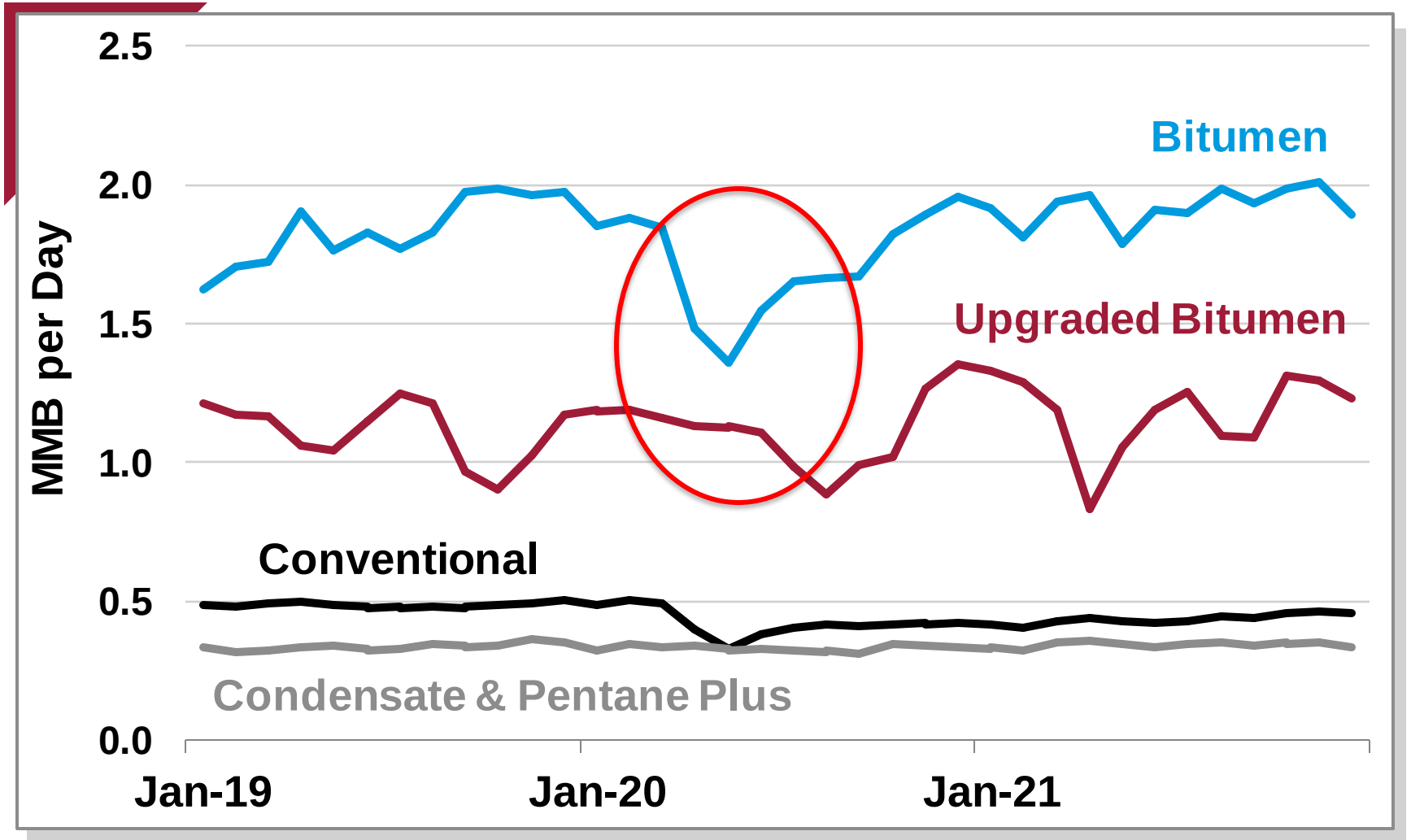


- Alberta production growth has been dominated by the oil sands. However, since 2018, the growth started to moderate.
- Alberta's conventional production has been in decline. The loss has partly been offset by growth in condensates and pentanes plus from shale plays.

Source: CAPP (1950-2017), Canada Energy Regulator (2018 to Current).
Does not include NGLs

*2023 data is YTD average up to June 2023

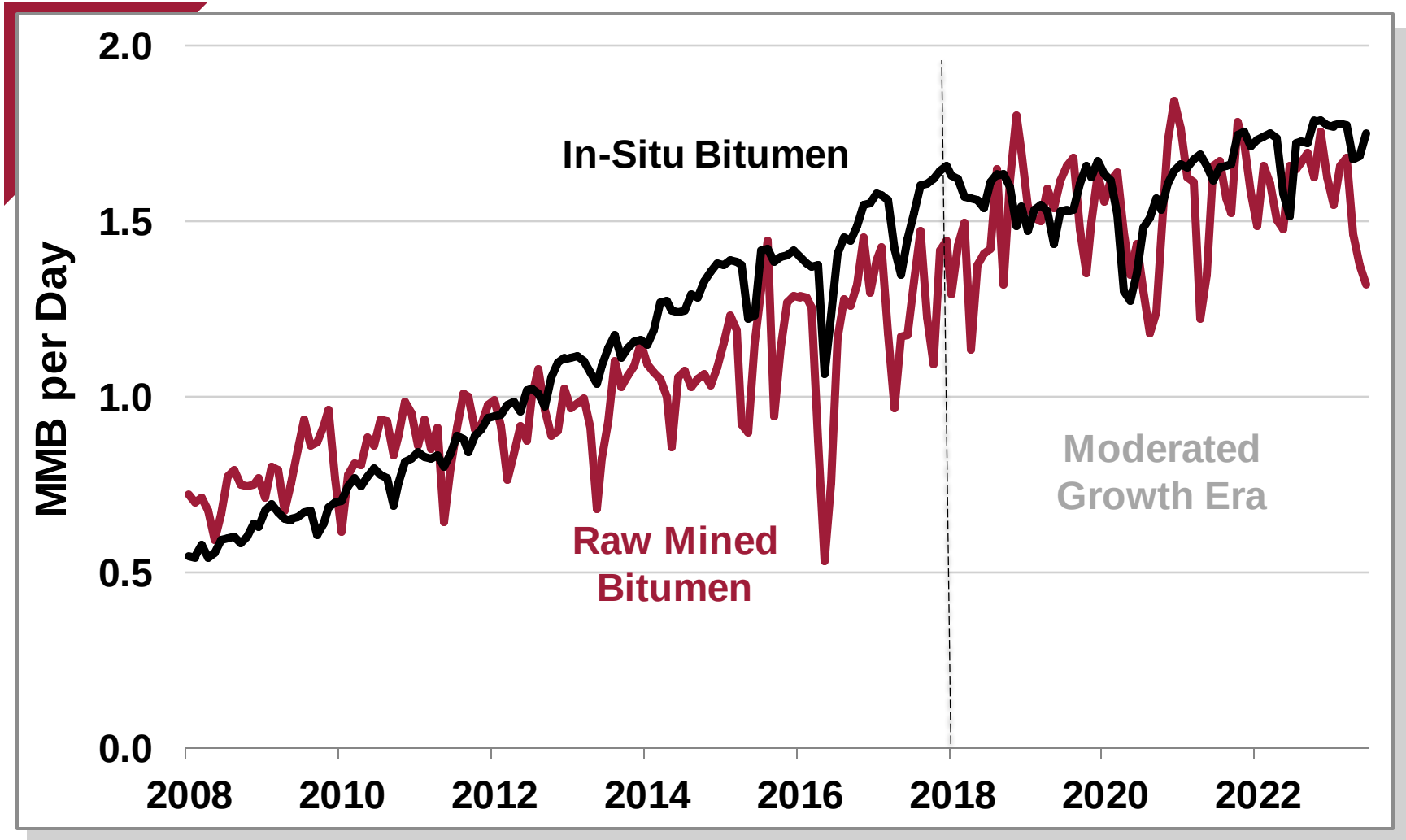
Alberta | Monthly Oil Production During COVID | 2019 to December 2021



Source: CAPP (1950-2017), Canada Energy Regulator (2018 to Current), US Energy Information Administration
Does not include NGLs

- During COVID, Canada's oil output was temporarily cut by 850,000 B/d, or 20%.
- This was the single largest contraction in Canada's oil history.
- By the end of 2020, oil sands had recovered to pre-COVID levels; total production from conventional, condensates, and pentane plus took until 2H 2022.
- US oil declined 25% from COVID and took until summer 2023 to return to those levels.
- Canada's relatively fast COVID recovery shows greater resiliency vs. the US, partly driven by lower base declines associated with oil sands production.

Alberta | Monthly Raw Bitumen Production | 2008 to Q2/2023*



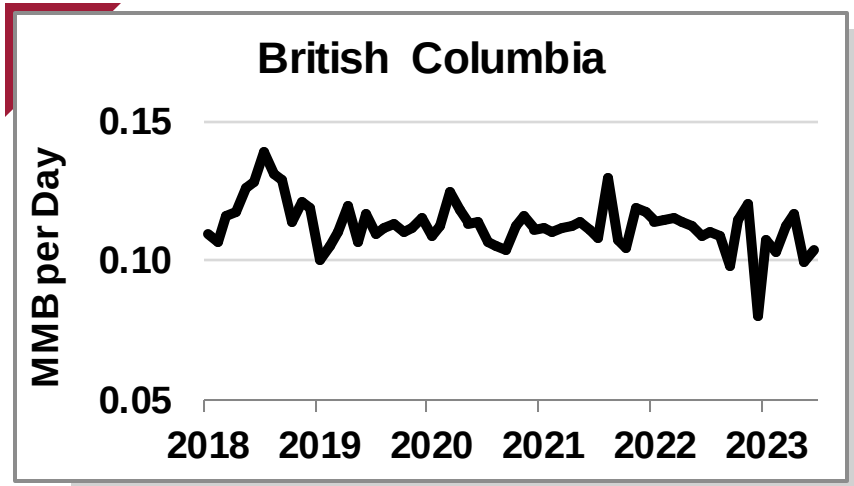
- Bitumen is mined or, for deep reserves, it is produced from wells using steam (in-situ).
- Both production types have grown in tandem since 2008. However, a leveling out of production began in 2018 due to the lack of new projects and egress out of the basin.
- Production (before upgrading) is about equal, with 1.6 MMB/d (mined) and 1.7 MMB/d (in-situ).
- June 2023 raw mined bitumen production dropped due to maintenance at oil sands mines[1].

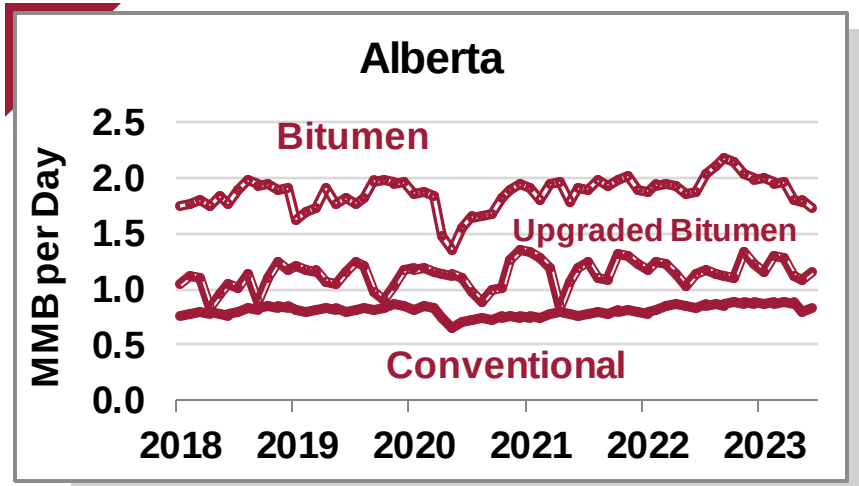
Source: Canada Energy Regulator, Alberta Energy Regulator

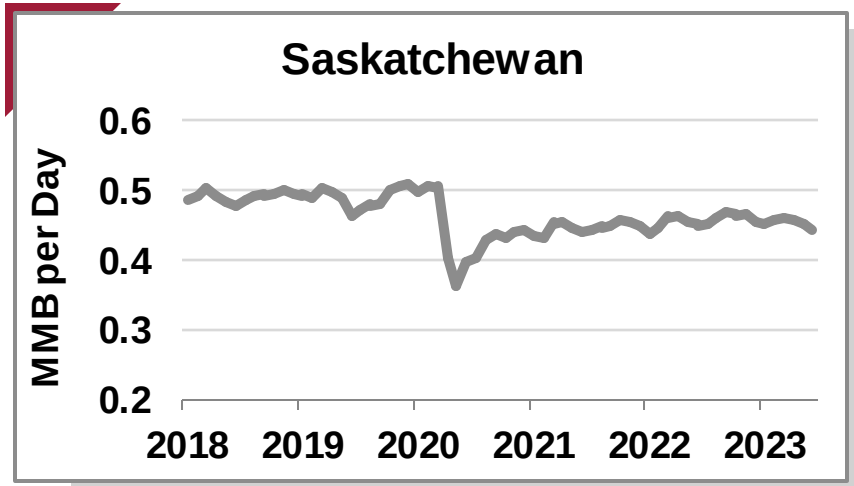
[1] https://www.worldoil.com/news/2023/8/1/alberta-crude-oil-production-falls-to-seven-year-low-amidst-oil-sands-mines-maintenance/

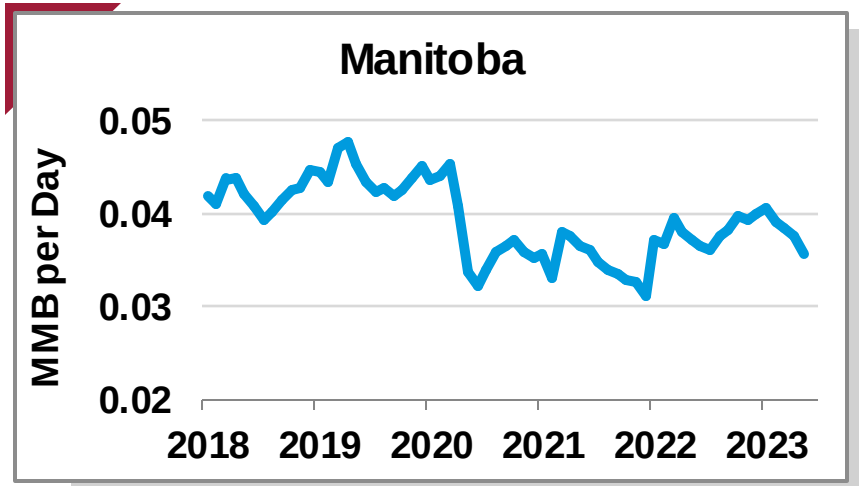
*2023 data is YTD average up to June 2023

Monthly Oil Production by Province | 2018 to Q2/2023*









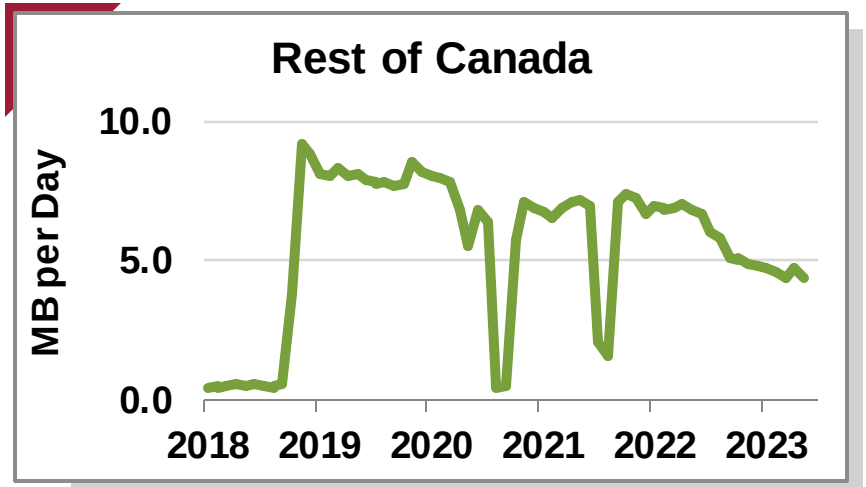
- BC's oil is mostly from condensates and pentane plus, by-products from natural gas production.
- Alberta's bitumen production fell in June 2023 compared to the prior month due to extended maintenance at several refiners and upgraders.
- Saskatchewan and Manitoba's oil production have not yet recovered to pre-COVID levels.
- Saskatchewan production was 444 MB/d in June 2023. Its goal is to reach 600 MB/d by 2030[1].

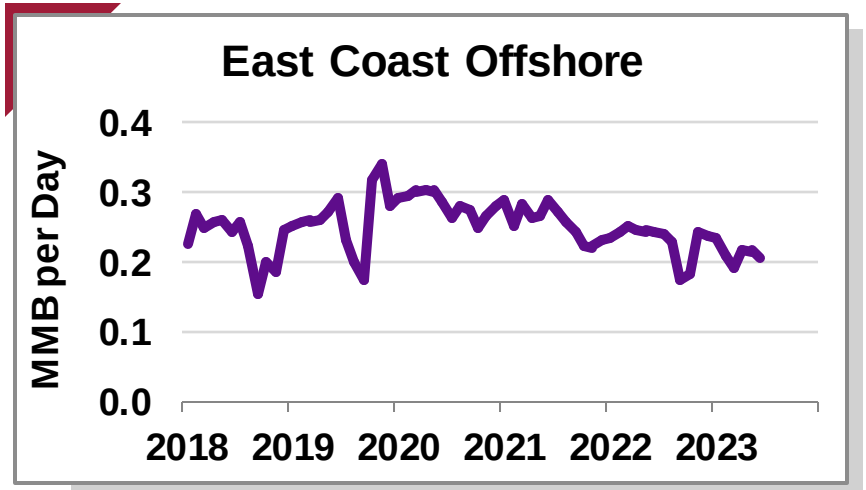
Source: Canada Energy Regulator. Does not include NGLs.

[1] Saskatchewan's Growth Plan: The Next Decade of Growth, 2020-2030

*2023 data is YTD average up to June 2023 (May 2023 for Manitoba)

Monthly Oil Production by Province | 2018 to Q2/2023*



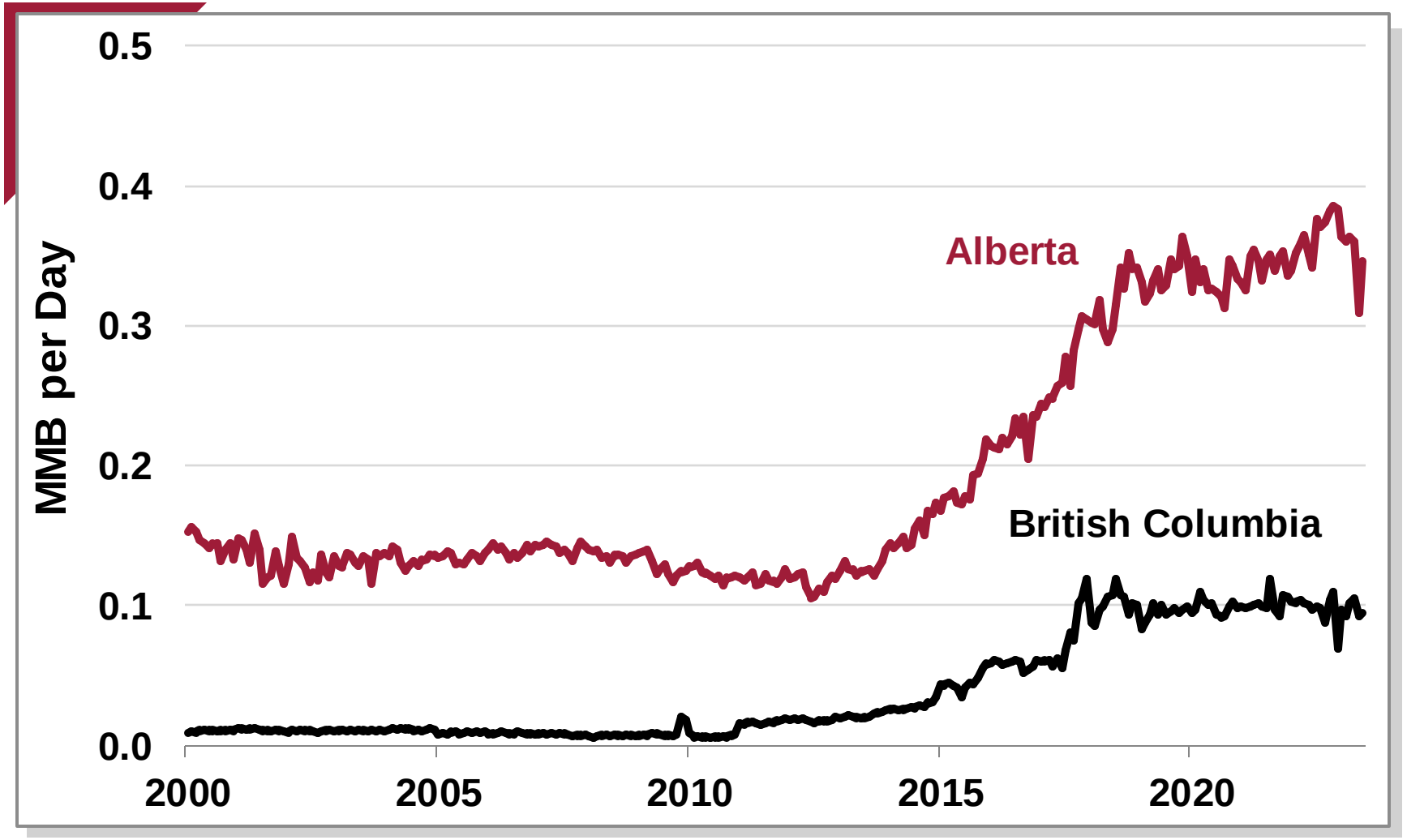


- Rest of Canada includes Ontario, New Brunswick, and Northwest Territories. Production is minimal at less than ~5,000 B/d and mainly from the Northwest Territories.
- East Coast Offshore includes production from Newfoundland and Labrador. Production was down ~16% in June 2023 from a year ago. Production declined across all operating oilfields in June.
- Terra Nova FPSO restart preparation and commissioning activities are underway.

Source: Canada Energy Regulator
Does not include NGLs

*East Coast Offshore 2023 data is YTD average up to June 2023. Rest of Canada 2023 data is YTD average up to May 2023.

Monthly Condensate and Pentanes Plus Production | 2000 to Q2/2023*



- Shale plays produce condensate and pentanes plus from natural gas production.
- As shale gas and shale oil output have grown, so has the production of these light liquids.
- Condensate and pentanes plus are sources of diluent for Canada's oil sands.
- Revenue from condensate has also greatly helped the economics of Canadian shale gas.

Source: Canada Energy Regulator

*2023 data is YTD average up to June 2023