Canadian Consumption of Domestically Produced Crude Oil and Natural Gas

CAPP CANADA'S OIL & NATURAL GAS PRODUCERS

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Summary of Canadian Consumption of Domestically Produced Crude Oil and Natural Gas

Canada consumes a mix of domestic production and imports for both crude oil and natural gas, with the United States being the dominant foreign supplier. Canada and the United States are highly integrated with supply delivered through a complex pipeline network that intertwines both countries.

Crude Oil Consumption Highlights

- In 2022, approximately 1.2 MMB/d of Canadian refinery crude runs were domestically sourced, equating to 73% of total receipts.
- Canada's reliance on crude oil imports to meet refinery needs has declined by roughly 50% to ~0.45 MMB/d in 2022 since peaking at ~0.93 MMB/d in 2004. This is primarily a function of the closures of import-dependent refineries in Eastern Canada, but also due to pipeline changes that have improved connectivity to domestic sources.
- Canada's refining complex is predominantly designed to process lighter-grade crude oils. Consequently, Canada's heavy oil sands barrels are mostly exported to complex coking refineries in the United States.

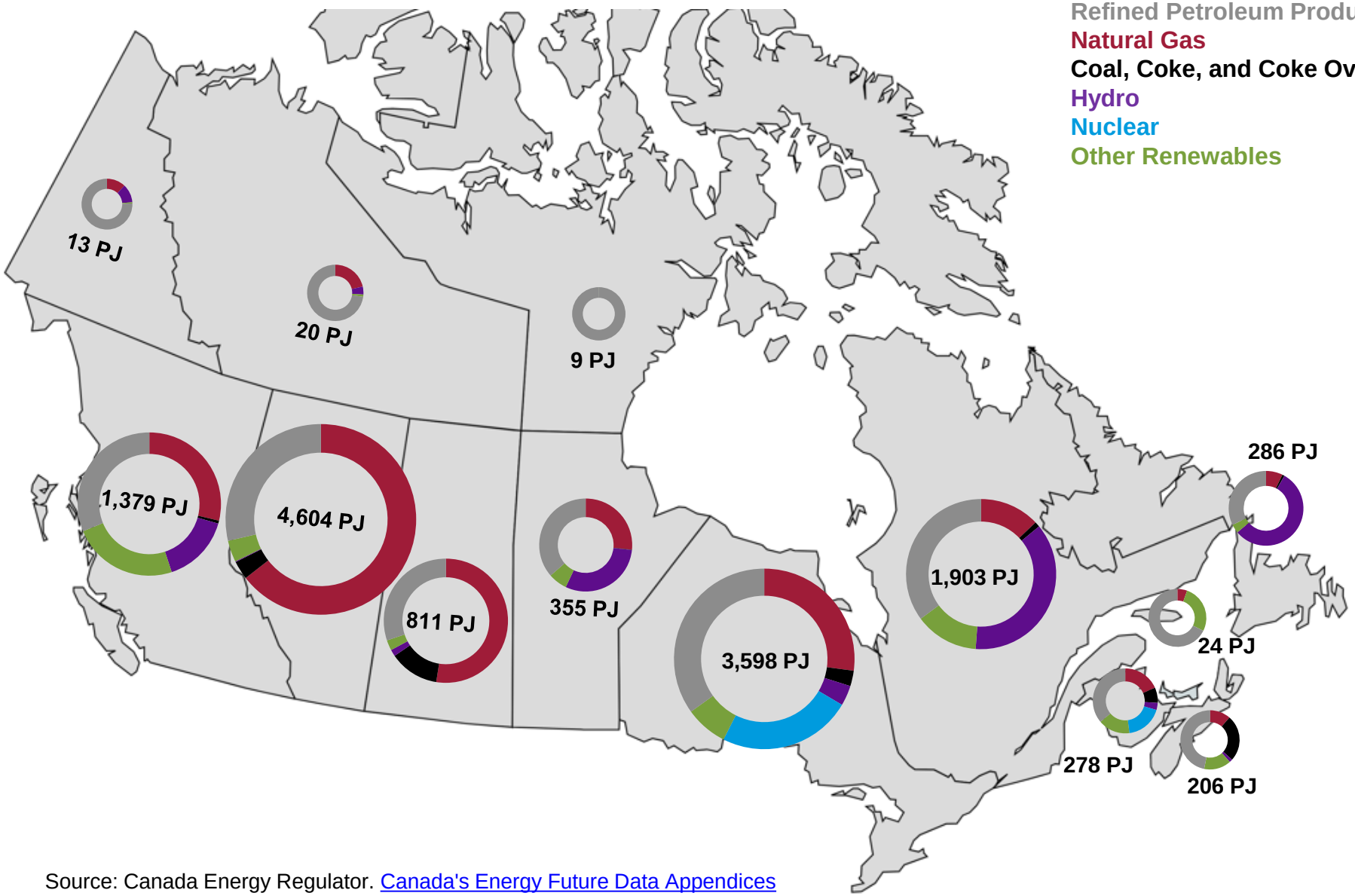
Natural Gas Consumption Highlights

- In 2022, according to Statistics Canada data, Canadian natural gas demand was 12.9 Bcf/d. Net of natural gas imports, the implied consumption of domestically produced natural gas was 9.8 Bcf/d or ~76% of total demand.
- The industrial sector[1] is Canada's largest natural gas consumer, accounting for ~7 Bcf/d or 54% of total demand in 2022.
- Provinces in Western Canada meet demand needs with domestic production. However, changes in North American supply/demand dynamics have led to an increased reliance on US natural gas imports for Eastern Canada and a loss in market share for Canadian gas producers in this region.

Source: Canada Energy Regulator, US Energy Information Administration, Statistics Canada. Table 25-10-0029-01 Supply and demand of primary and secondary energy in terajoules, annual, Table 25-10-0041-01 Refinery supply of crude oil and equivalent, monthly, Table 25-10-0063-01 Supply and disposition of crude oil and equivalent

[1] Includes producer consumption, non-energy use, public administration, and agriculture, fishing, hunting, and trapping

Canadian Primary Energy Demand by Province | 2022



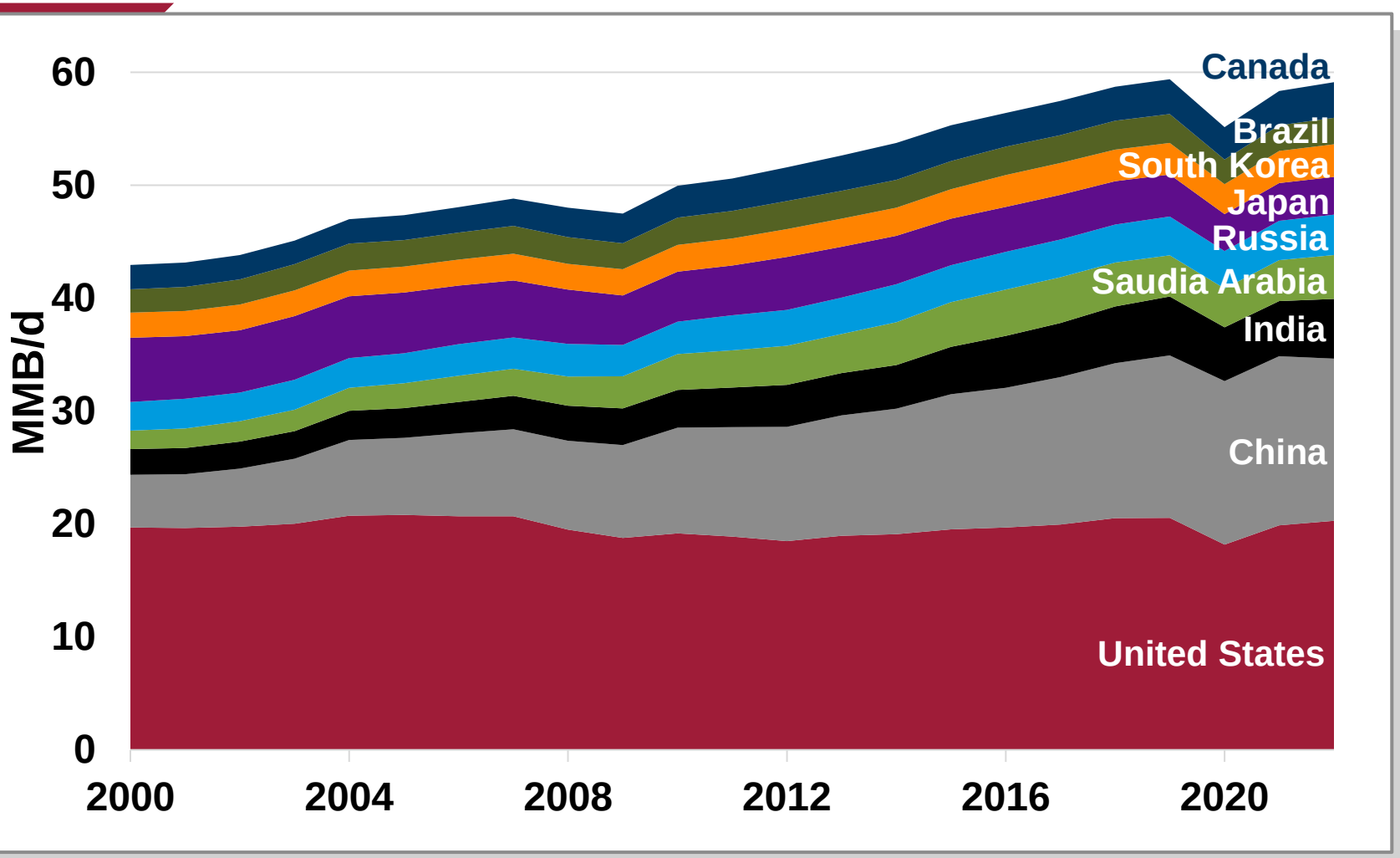
- Canada uses diverse fuel types to meet its primary energy needs.
- Alberta, Ontario, Quebec, and BC are the largest energy-consuming provinces in Canada, accounting for over 85% of the country's primary energy demand.
- From a fuel type perspective, crude oil (i.e., 'Refined Petroleum Products') and natural gas remain dominant fixtures in the overall energy mix. According to Canada's Energy Future 2023, these products made up over 70% of all primary energy consumed in the country in 2022.

Source: Canada Energy Regulator. Canada's Energy Future Data Appendices

Domestic Crude Oil Consumption

CANADA'S OIL & NATURAL GAS PRODUCERS

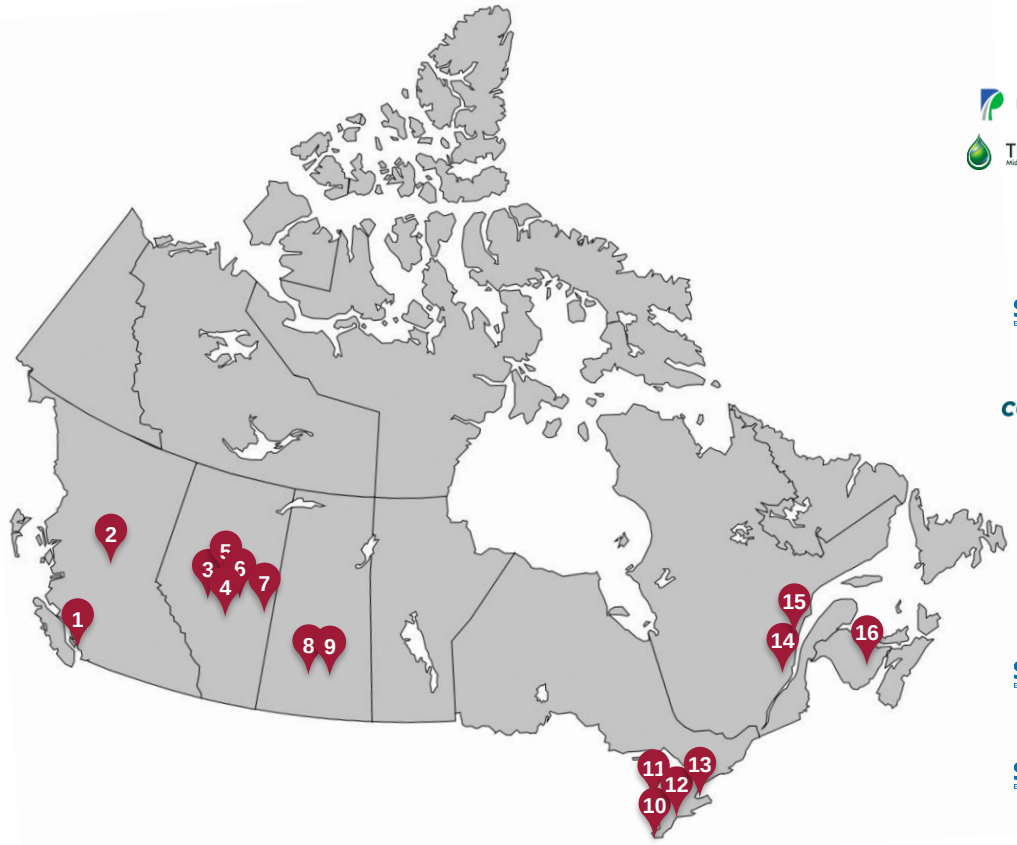
Global Liquids Demand by Select Countries | Annual | 2000 to 2022



- In 2022, Canada was the ninth largest consumer of crude oil globally, equating to roughly 2.3% of total demand.
- Collectively, the top 9 crude oil-consuming countries accounted for close to 60% of global demand.
- Canadian demand has remained relatively flat since the early 2000s.
- Since 2010, global demand growth has been predominantly driven by China and India.

Source: Energy Institute 2023 Statistical Review of World Energy

Canadian Refinery Overview



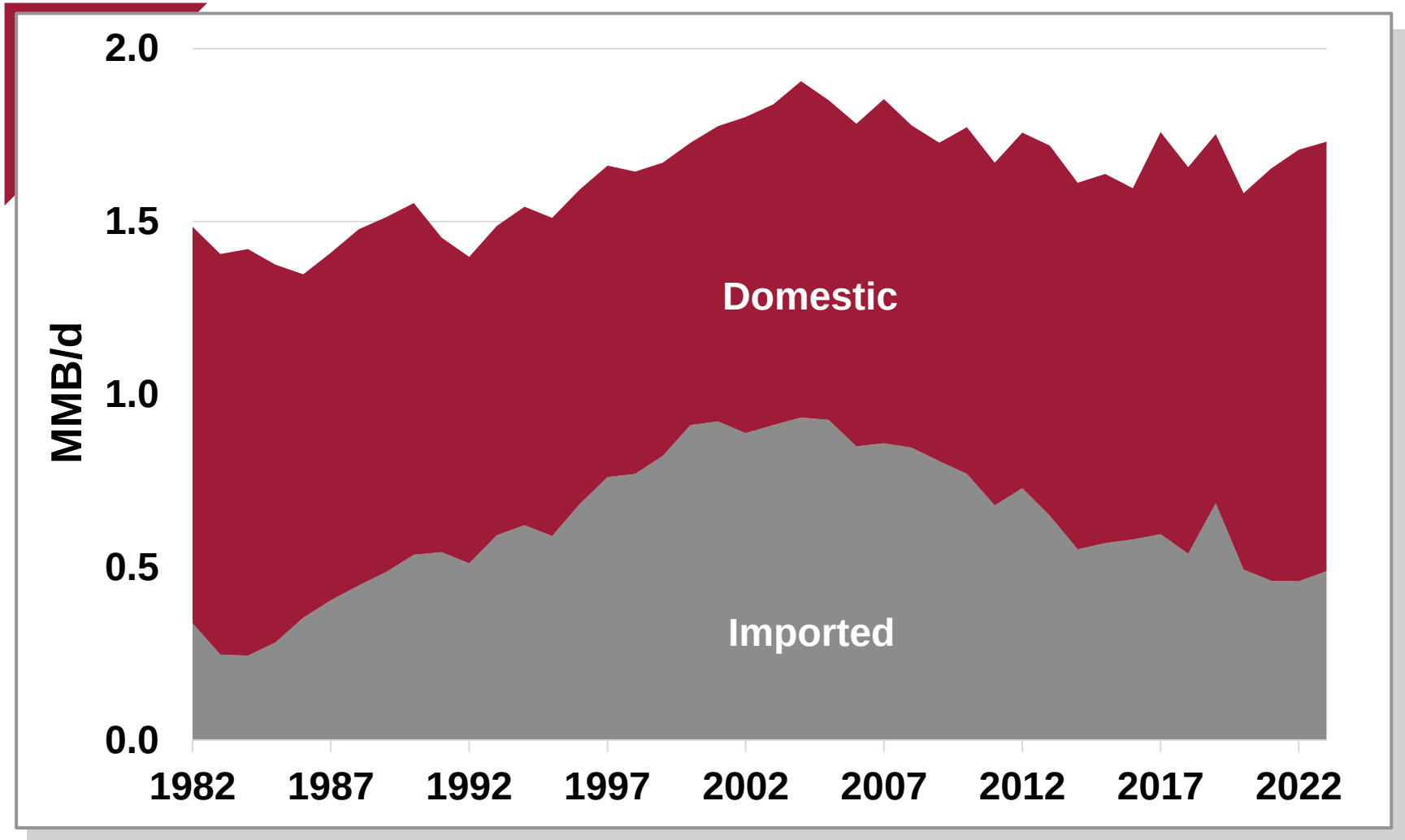
			Crude Refining Capacity[1] *(MB/d)*
PARKLAND	1	Burnaby Refinery	55
TIDEWATER	2	Prince George Refinery	12
Imperial	3	Strathcona Refinery	197
	4	Scotford Refinery	100
SUNCOR	5	Edmonton Refinery	146
	6	Sturgeon Refinery	79
cenovus	7	Lloydminster Refinery[2]	29
GIBSONS	8	Moose Jaw Refinery	22
CO-OP	9	Co-op Refinery	130
	10	Corunna Refinery	85
Imperial	11	Sarnia Refinery	123
SUNCOR	12	Sarnia Refinery	85
Imperial	13	Nanticoke Refinery	113
SUNCOR	14	Montreal Refinery	137
VALERO	15	Jean-Gaulin Refinery	230
IRVING	16	Irving Oil Refinery	320

- Refineries are the primary purchasers of crude oil, converting it into petroleum products, such as gasoline and distillate.
- There are currently 16 active refineries in Canada, equating to a total refining capacity of approximately 1.8 MMB/d.
- Roughly 60% of the country's refining capacity is in Eastern Canada, near major demand hubs in Ontario and Quebec. The Irving Oil Refinery in New Brunswick is Canada's largest refinery at 300 MB/d.
- After meeting domestic refining needs, almost all of the remaining Canadian crude oil production is exported to the United States.

Source: Canada Energy Regulator, Company Reports

[1] Refinery capacities are current as of January 1, 2023
[2] Asphalt refinery

Canadian Refinery Throughput by Source | Annual | 1982 to Q3/2023*

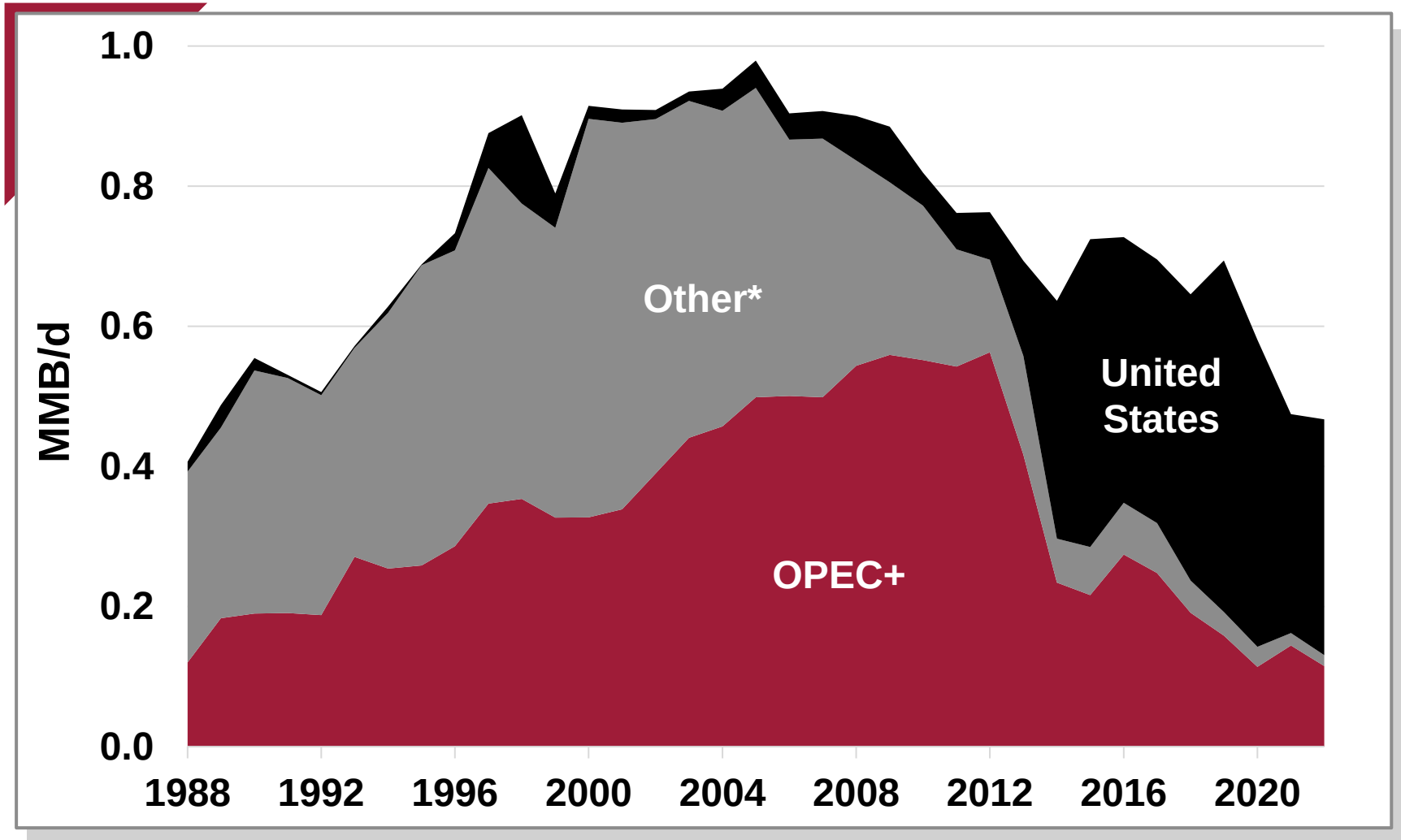


- In 2022, approximately 1.2 MMB/d of Canadian refinery crude oil receipts were domestically sourced, equating to 73% of total refinery receipts.
- Refineries in Quebec and New Brunswick have tidewater access and therefore possess additional optionality for sourcing their crude oil, often relying on imports.
- Canada's reliance on crude oil imports to meet refinery needs has declined since peaking at ~0.93 MMB/d in 2004, primarily a function of numerous closures of import-dependent refineries in Eastern Canada, but also due to pipeline changes that have improved connectivity to domestic sources.

Source: Statistics Canada. Table 25-10-0041-01 Refinery supply of crude oil and equivalent, monthly
Table 25-10-0063-01 Supply and disposition of crude oil and equivalent

*2023 data is YTD average up to Sep 2023

Crude Oil Imports | Annual | 1982 to 2022

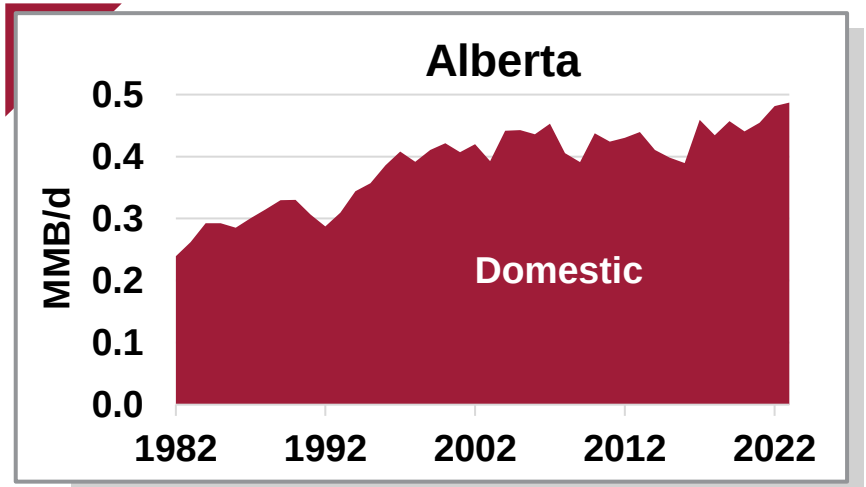


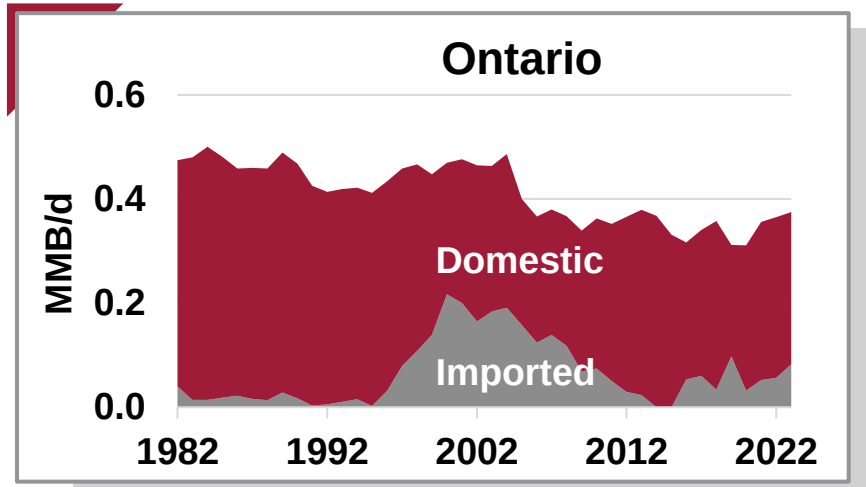
- The complexion of Canada's crude oil imports has changed since 2013, largely driven by the surge of US supply from shale oil. The US now accounts for a larger share of total imports, displacing OPEC+ and Other* imported barrels.
- In 2022, total US imports were 336 MB/d (72% of total imports), compared to 115 MB/d from OPEC+ members (25% of total imports).
- This dynamic has been partly driven by the closure of multiple import-reliant refineries in Eastern Canada, but also the reversal of Enbridge Line 9 in the 2010s which allowed more US crude oil to flow into Eastern Canada.

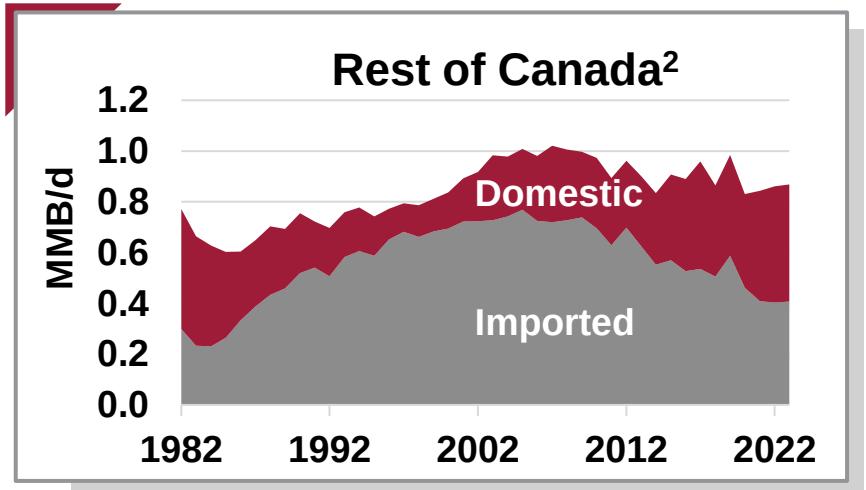
Source: Canadian International Merchandise Trade database

*Historically, 'Other' major imports have predominantly included Norway and the United Kingdom

Provincial Refinery Throughput by Source | Annual | 1982 to Q3/2023*







[1] Due to data confidentiality, refinery-level data from Statistics Canada is unavailable for select refineries in Quebec, New Brunswick, Saskatchewan, and BC.

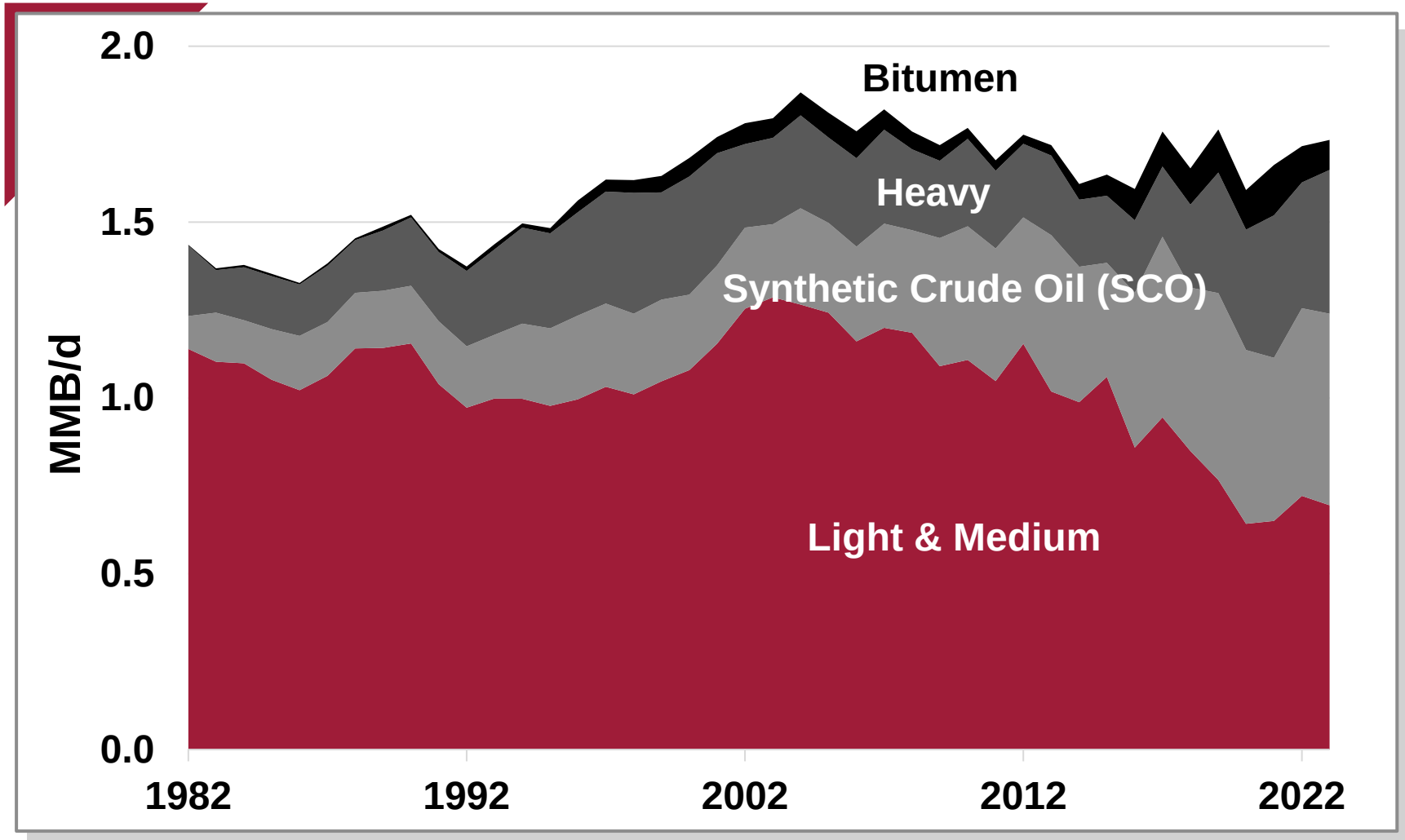
[2] Aggregate data for refineries in Quebec, New Brunswick, Saskatchewan, and BC has been accounted for in the 'Rest of Canada' category.

- Refineries in Saskatchewan[1], Alberta, and BC[1] benefit from proximity to local production and therefore domestically source 100% of their crude oil receipts.
- In 2022, Ontario domestically sourced 84% of its 365 MB/d of crude oil receipts, with the balance imported from the United States. The Enbridge Mainline is directly connected to the four Ontario refineries. Pipeline changes have allowed for increased pipeline flows from Western Canada, reducing the need for imports.
- Refineries in Quebec[1] are now mostly reliant on US imports, while New Brunswick[1] refineries are mostly dependent on overseas imports.

Source: Statistics Canada. Table 25-10-0041-01 Refinery supply of crude oil and equivalent, monthly
Table 25-10-0063-01 Supply and disposition of crude oil and equivalent

*2023 data is YTD average up to Sep 2023

Canadian Refinery Throughput by Composition | Annual | 1982 to Q3/2023*

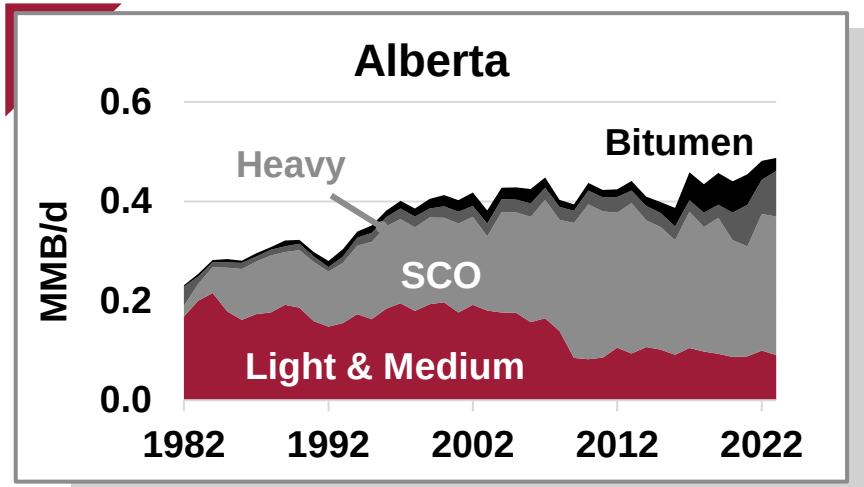


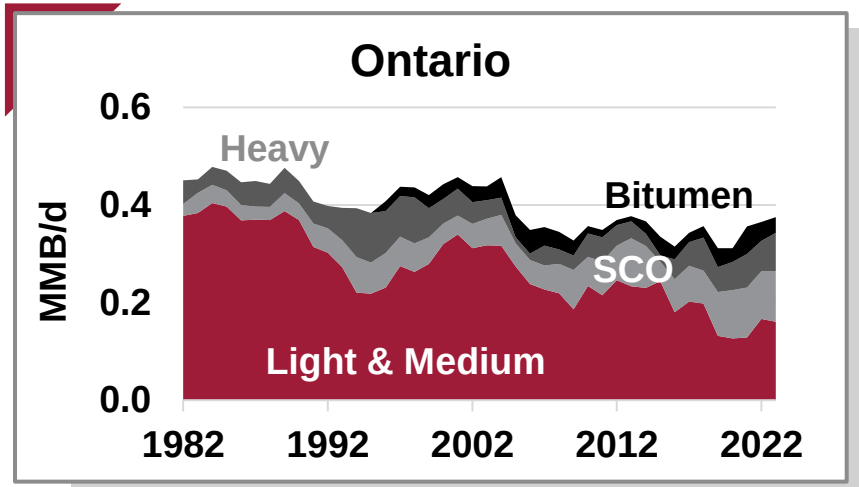
- Canada's refining complex is predominantly designed to process lighter-grade[1] crude oil blends, which made up ~73% of total refinery receipts in 2022.
- By comparison, over 52% or 2.6 MMB/d of Canada's oil production in 2022 was comprised of heavy oil and bitumen. The vast majority of this heavy oil is exported, as it is not suited for many of Canada's refineries.
- Due to this compatibility disconnect, the primary market for Canadian heavy barrels is the United States in PADD 2 (US Midwest) and PADD 3 (US Gulf Coast), regions that have heavy oil processing capacity.

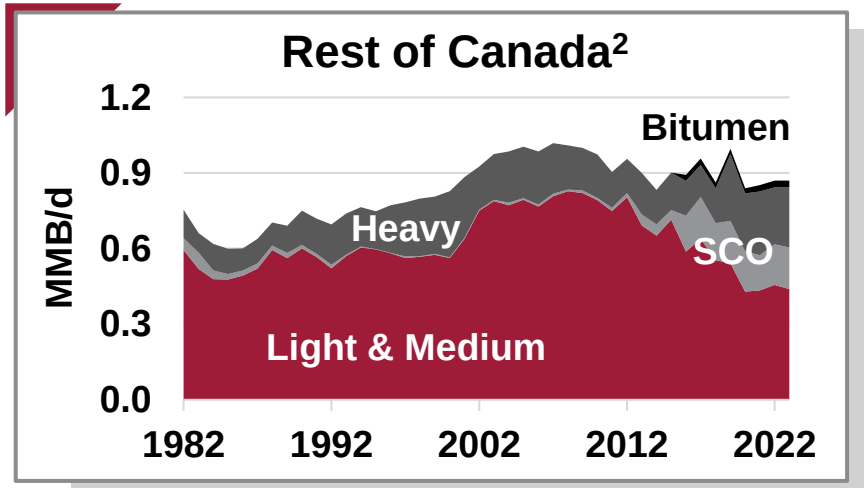
Source: Statistics Canada. Table 25-10-0041-01 Refinery supply of crude oil and equivalent, monthly
Table 25-10-0063-01 Supply and disposition of crude oil and equivalent

*2023 data is YTD average up to Sep 2023
[1] Includes 'Light & Medium' and SCO

Provincial Refinery Throughput by Crude Type | Annual | 1982 to Q3/2023*







[1] Due to data confidentiality, refinery-level data from Statistics Canada is unavailable for select refineries in Quebec, New Brunswick, Saskatchewan, and BC.

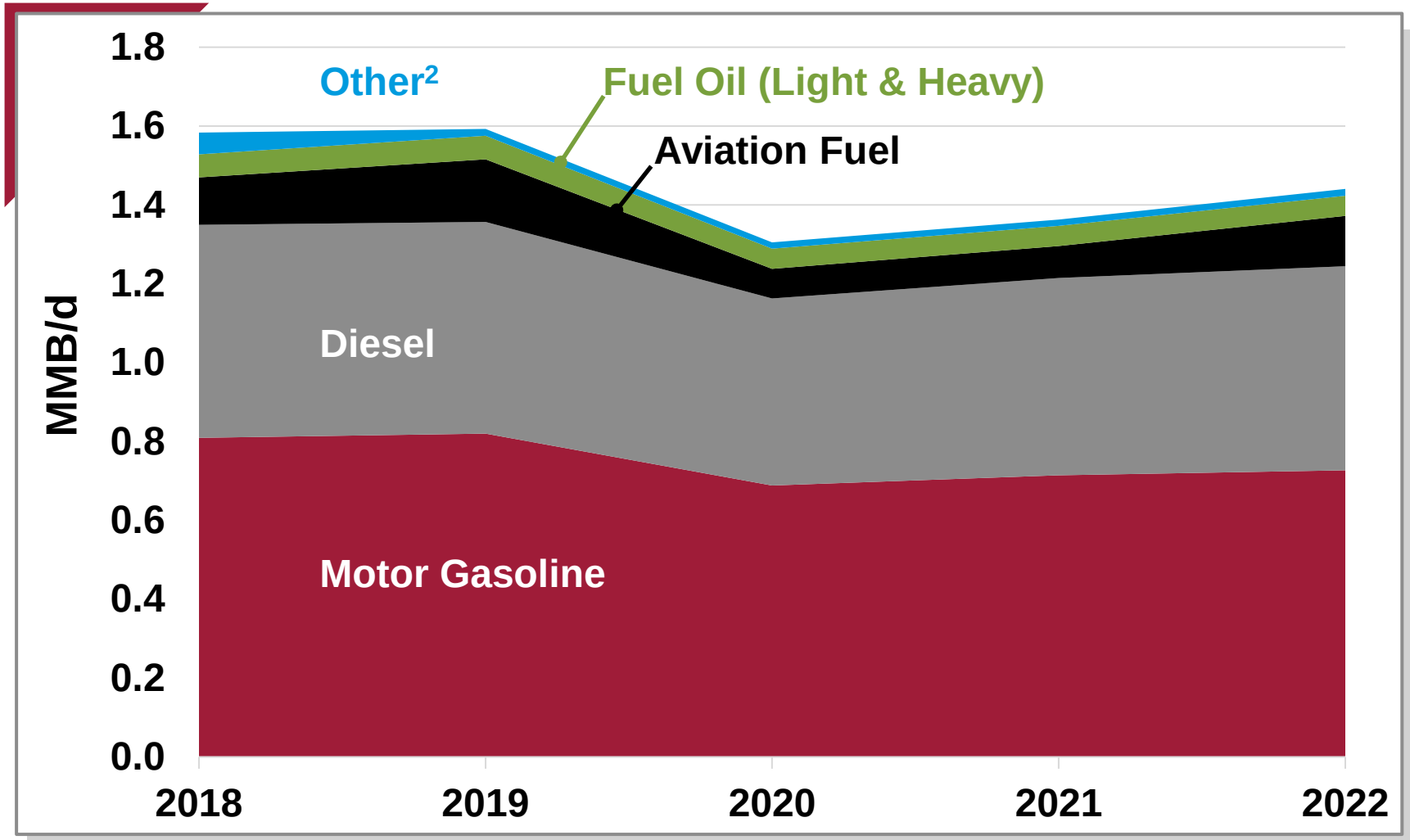
[2] Aggregate data for refineries in Quebec, New Brunswick, Saskatchewan, and BC has been accounted for in the 'Rest of Canada' category.

- Alberta refineries are the primary consumers of SCO barrels, accounting for 57% of total feedstock in 2022, with light & medium, heavy, and bitumen making up the balance at 21%, 14%, and 8%, respectively.
- Comparatively, Ontario refineries process a slightly more balanced slate of crude oil, consisting of 46% light & medium, 27% SCO, 17% heavy, and 11% bitumen.
- Crude oil consumption of Rest of Canada[2] refineries consists of 52% light & medium, 19% SCO, 26% heavy, and 3% bitumen.

Source: Statistics Canada. Table 25-10-0041-01 Refinery supply of crude oil and equivalent, monthly
Table 25-10-0063-01 Supply and disposition of crude oil and equivalent

*2023 data is YTD average up to Sep 2023

Canadian Refined Petroleum Product[1] Consumption by Fuel Type | Annual | 2018 to 2022

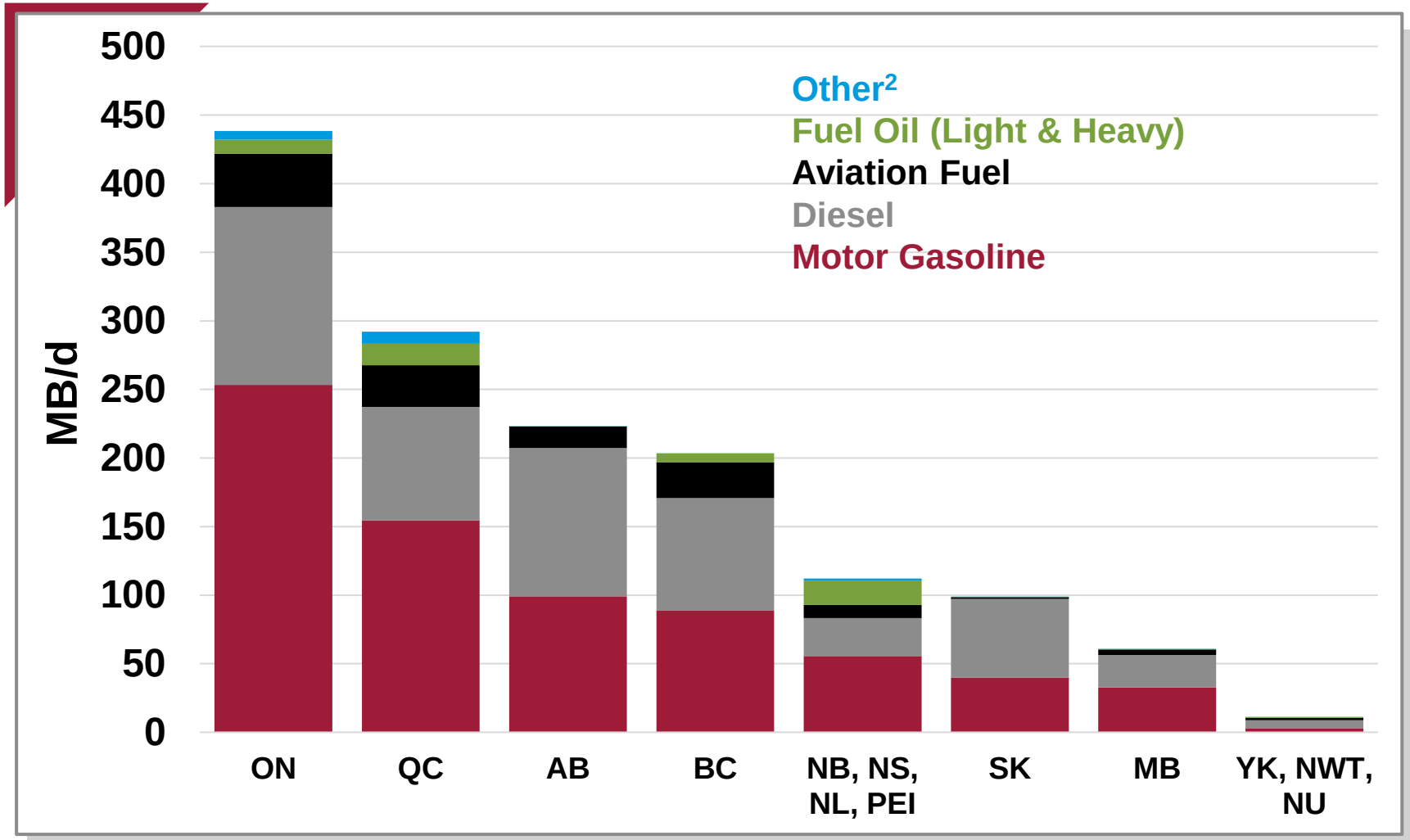


- Refined petroleum product (RPP) demand in Canada peaked in 2019 at roughly 1.6 MMB/d.
- RPP demand has yet to recover to pre-COVID levels as the demand for motor gasoline and aviation fuel continues to rebound. For context, demand reached ~1.4 MMB/d in 2022, which is still 10% below 2019 levels.
- Meanwhile, diesel demand has remained relatively consistent from 2018 to 2022 at approximately 0.5 MMB/d.

Source: Statistics Canada. Table 25-10-0030-01 Supply and demand of primary and secondary energy in natural units

[1] Does NOT include biofuels [2] Other consists of kerosene, petroleum coke, liquid petroleum gases, still gas, and non-energy products

Canadian Refined Petroleum Product[1] Consumption by Province | 2022



- Ontario is the largest consumer of refined petroleum products (RPPs) in Canada, accounting for roughly 28% of total demand in 2022, or ~438 MB/d. Given its higher population, motor gasoline demand in Ontario was the highest in Canada in 2022 at approximately 250 MB/d.
- Comparatively, as a percentage of overall RPP demand, provinces such as Alberta (48%), BC (40%), Saskatchewan (58%), and Manitoba (38%) consume a higher proportion of diesel for agriculture, and for heavy industry and trucking as a result of more industrial economies.
- Provinces in Atlantic Canada utilize a higher proportion of fuel oil for heating and for marine transportation.

Source: Statistics Canada. Table 25-10-0030-01 Supply and demand of primary and secondary energy in natural units

[1] Does NOT include biofuels [2] Other consists of kerosene, petroleum coke, liquid petroleum gases, still gas, and non-energy products

Domestic Natural Gas Consumption

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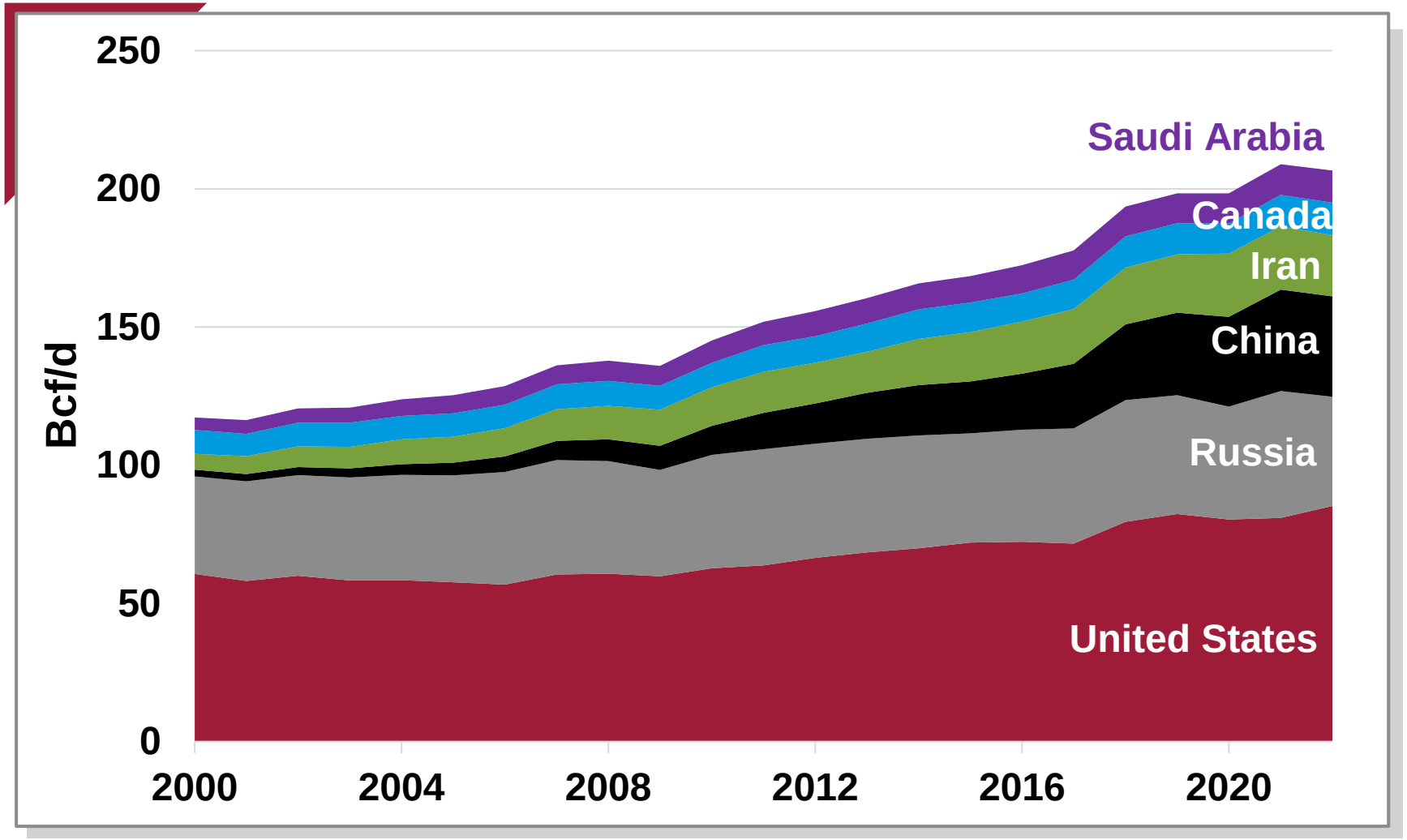
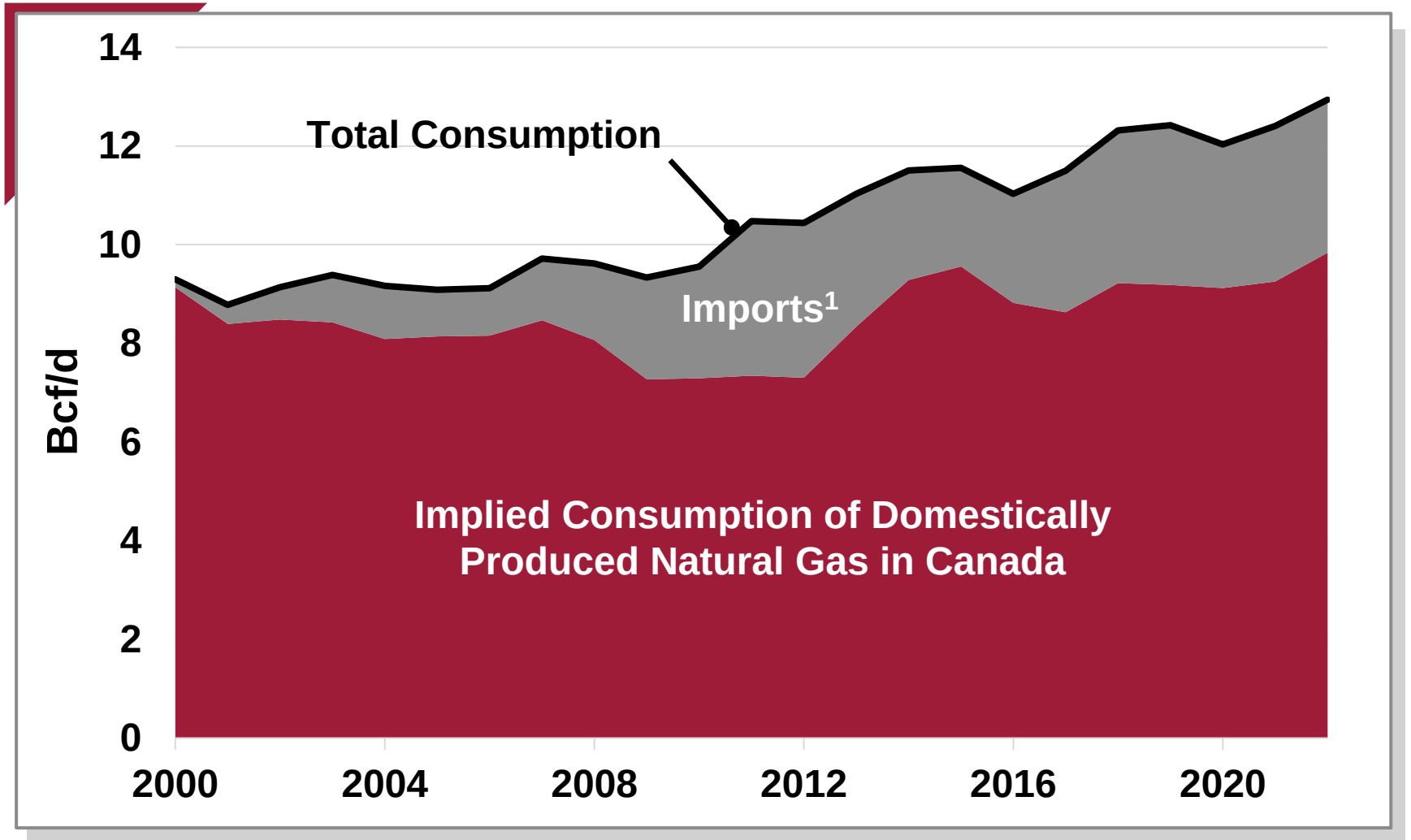
Global Natural Gas Consumption by Select Countries | Annual | 2000 to 2022



- Despite a relatively low population, Canada is the fifth largest consumer of natural gas in the world, accounting for roughly 3% of global natural demand in 2022.
- Since 2010, natural gas demand in Canada has grown by 32%.
- The United States, the world's largest consumer of natural gas, accounted for ~22% of global natural gas consumption, or ~85 Bcf/d.
- The world's top six natural gas-consuming countries (US, Russia, China, Iran, Canada, and Saudi Arabia) accounted for 54% of global natural gas demand in 2022.

Source: Energy Institute 2023 Statistical Review of World Energy

Canada Implied Consumption of Domestically Produced Natural Gas | Annual | 2000 to 2022

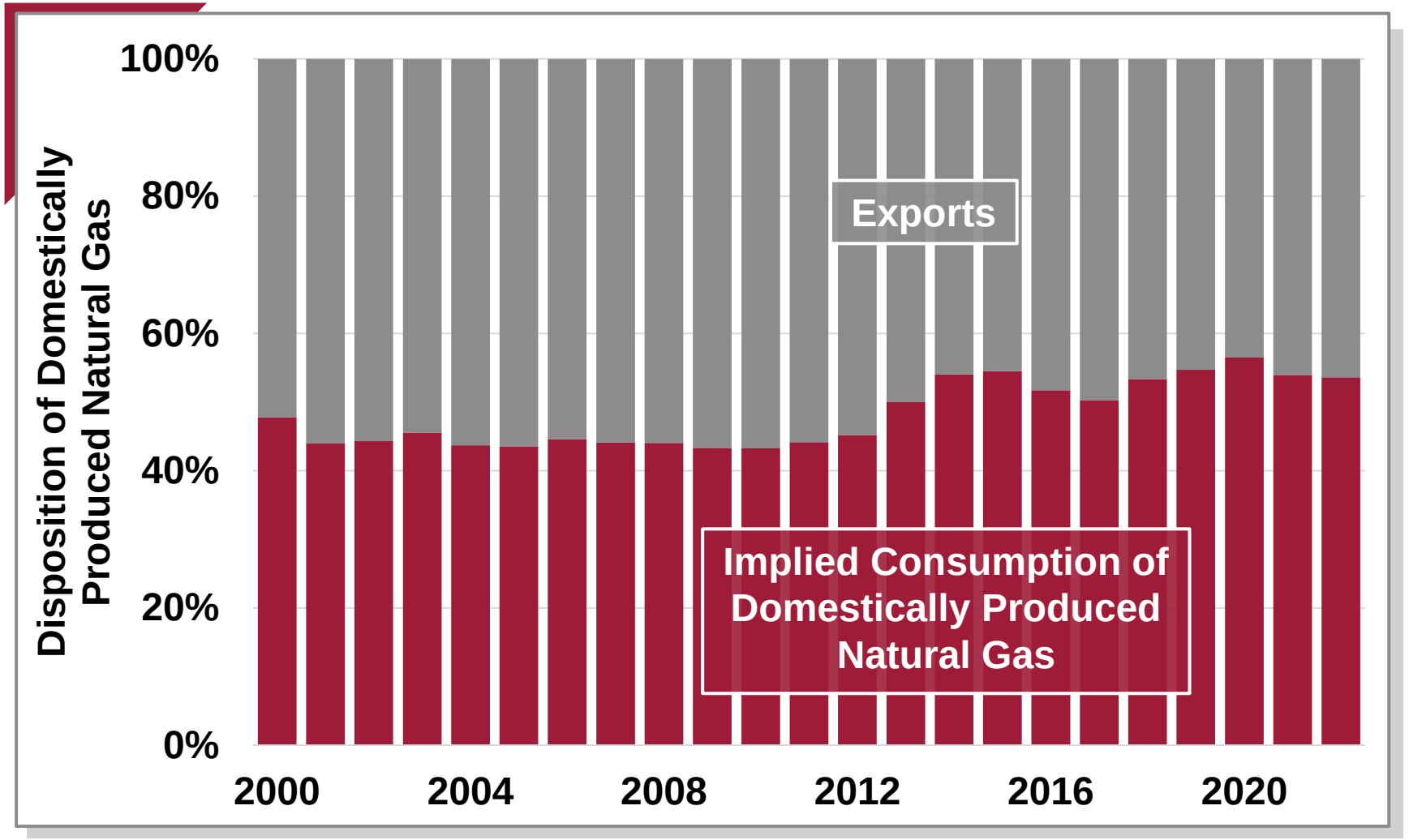


- Since 2000, Canadian natural gas consumption has increased, averaging 12.9 Bcf/d in 2022, up roughly 40% from 2000 levels, primarily driven by the industrial sector, particularly related to the oil sands.
- Net of natural gas imports[1], the implied consumption of domestically produced natural gas in 2022 was 9.8 Bcf/d, equating to ~76% of total demand.
- Eastern Canada and Atlantic Canada's reliance on supply from the United States started growing in 2008. Increased imports resulted from a surge in US production from the development of low-cost shale gas and a shortage of pipeline capacity connecting demand to production in Western Canada.

Source: Statistics Canada. Table 25-10-0029-01 Supply and demand of primary and secondary energy in terajoules, annual

[1] Imports include some re-exports of Canadian gas

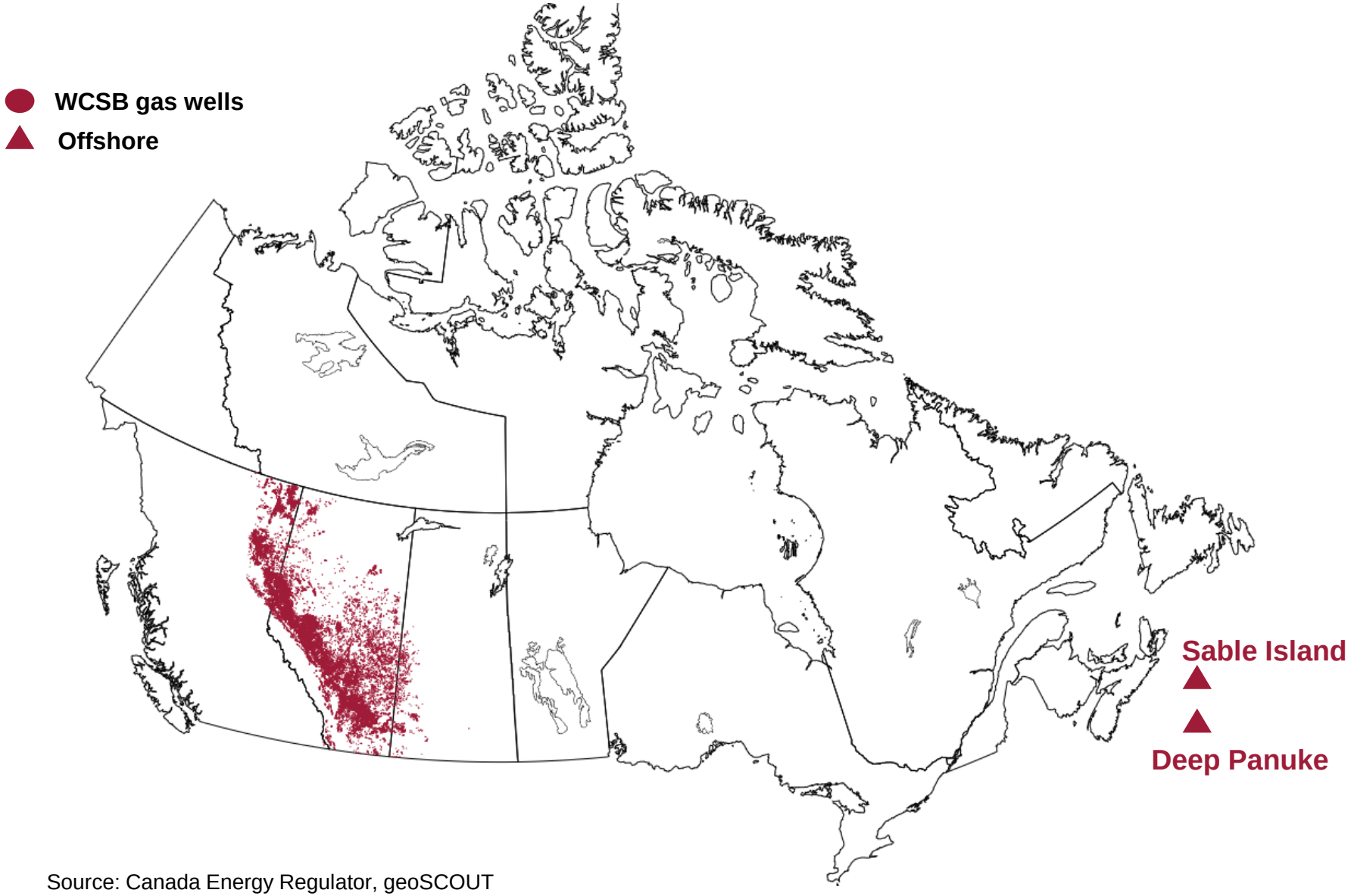
Disposition of Canadian Natural Gas | Domestic Consumption *vs.* Exports | Annual | 2000 to 2022



- Since 2000, domestically produced natural gas consumption as a percentage of total domestic production has ranged from ~45% to ~55%.
- Western Canada meets its demand needs with domestically produced natural gas.
- Ontario and Quebec rely on a mix of Western Canadian supply and US imports.
- Atlantic Canada no longer has marketable natural gas production and now relies on US imports and LNG imports via the Saint John terminal in New Brunswick to meet demand.

Source: Canada Energy Regulator, Statistics Canada. Table 25-10-0029-01 Supply and demand of primary and secondary energy in terajoules, annual

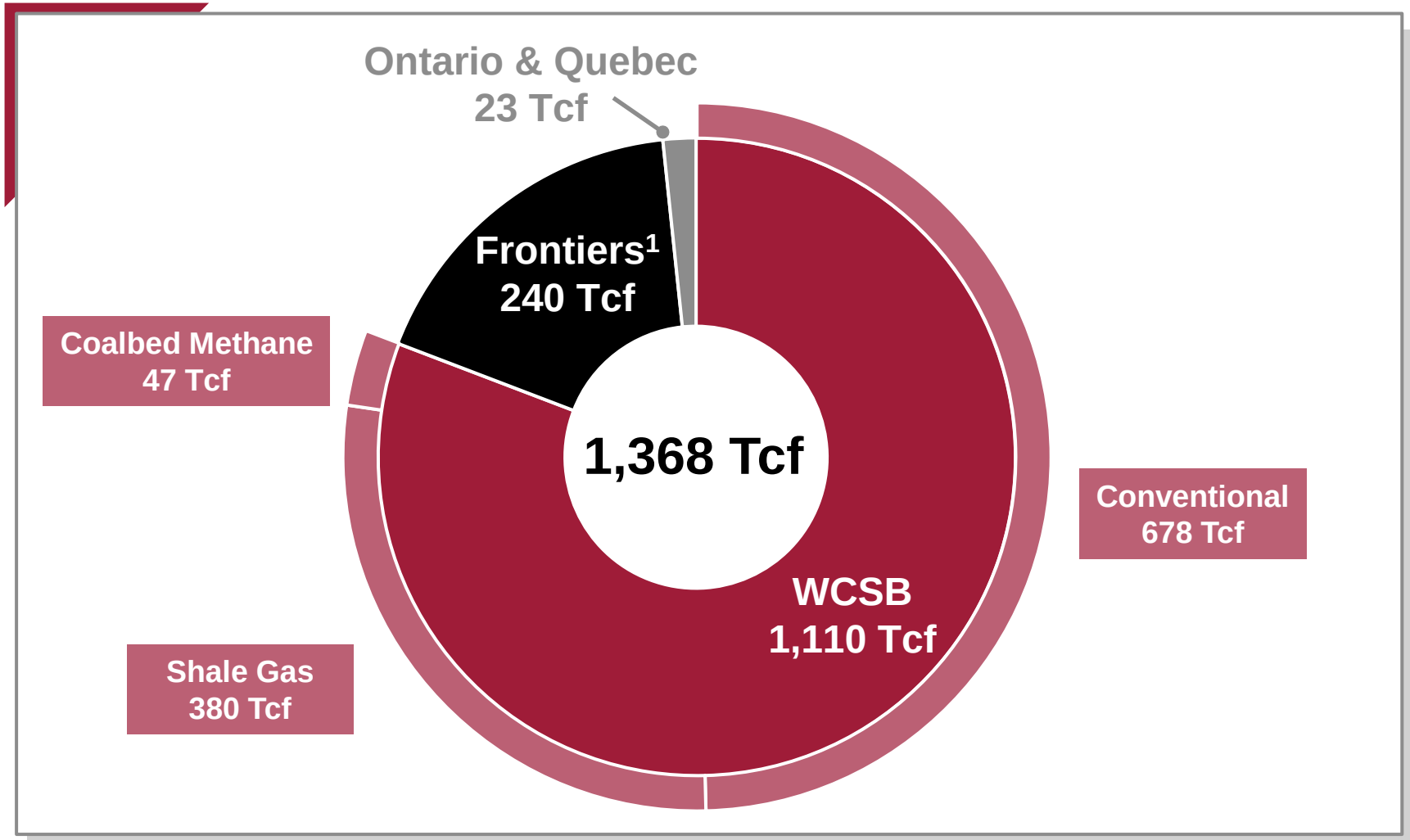
Geography of Canadian Natural Gas Supply



- Nearly all of Canada's marketable natural gas production occurs in the Western Canadian Sedimentary Basin (WCSB) in the provinces of Alberta, BC, and Saskatchewan.
- Natural gas was previously produced in offshore Nova Scotia at Sable Island and Deep Panuke. Production from these sources ended in 2013 and 2018, respectively.

Source: Canada Energy Regulator, geoSCOUT

Natural Gas Resource Base in Canada | 2022

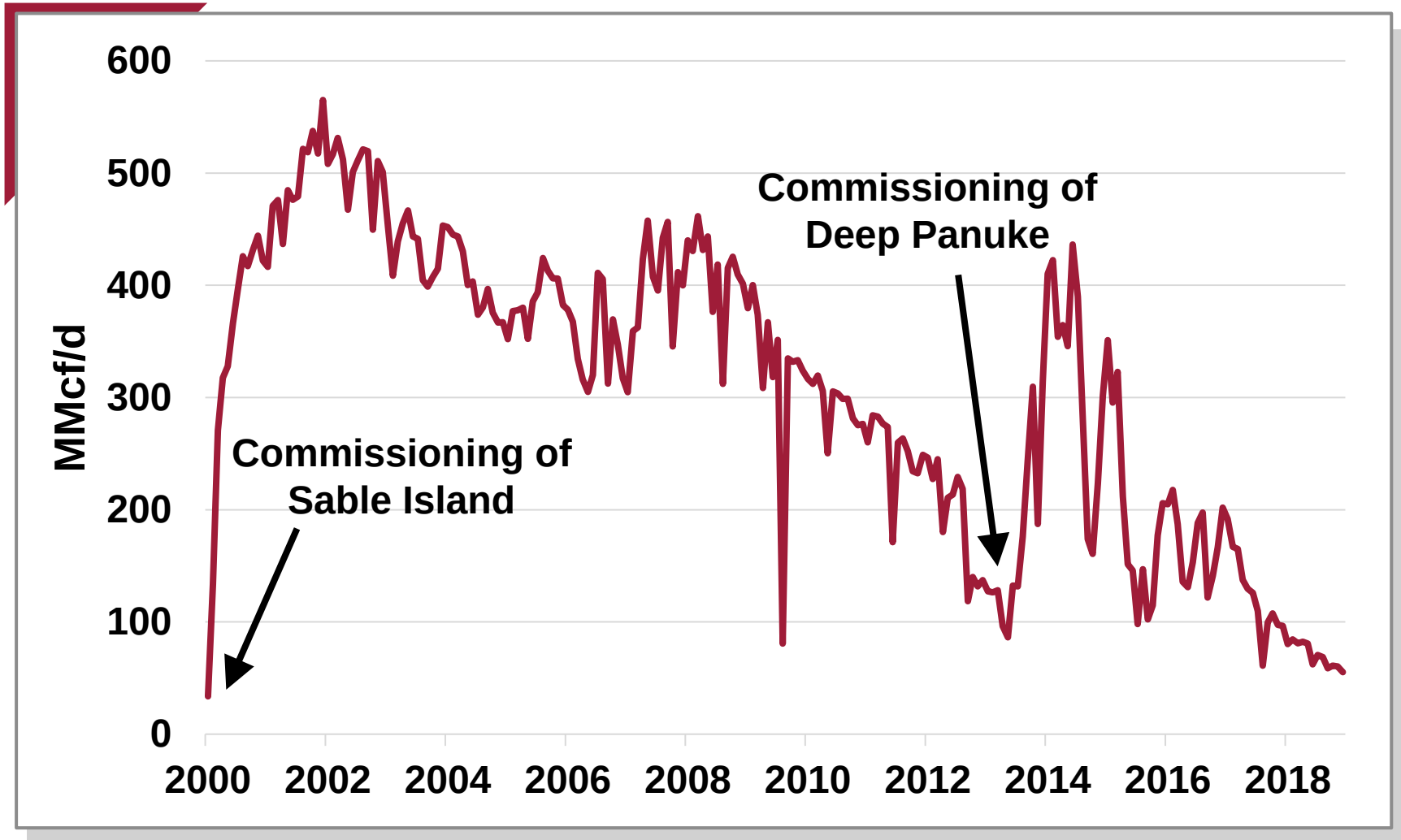


- According to data from Canada's Energy Future 2023, as of 2022, it is estimated that there is a natural gas resource base of 1,368 Tcf in Canada, which equates to over 250 years worth of Canada's current consumption level.
- Over 80% of Canada's natural gas resources are in the Western Canadian Sedimentary Basin (WCSB). However, there is also significant resource potential in Atlantic Canada, with roughly 85 Tcf of resource (captured in the Frontiers category).

Source: Canada Energy Regulator. Canada's Energy Future Data Appendices

[1] Frontiers includes Offshore Atlantic Canada, West Coast Offshore, Northwest Territories and Yukon Mainland, Artic Islands, and Mackenzie - Beaufort

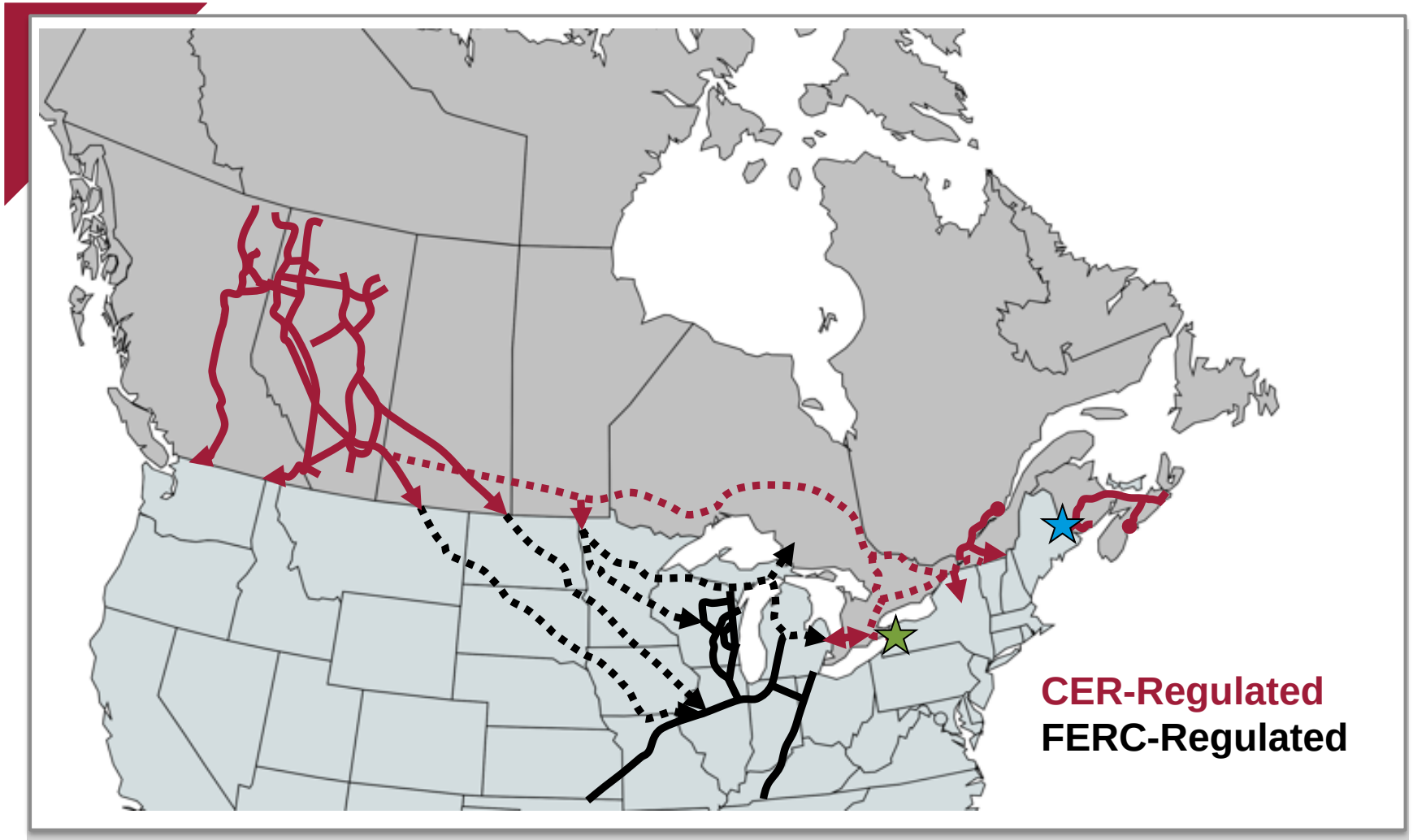
Nova Scotia Marketable Natural Gas Production | Monthly | Jan 2000 to Dec 2018



- Marketable natural gas production in Nova Scotia commenced in 2000 following the commissioning of Canada's first offshore natural gas project, Sable Island. Another project, Deep Panuke, was then commissioned in 2013.
- Offshore natural gas production in Nova Scotia ended in December 2018, and both projects have been plugged and abandoned following a period of production decline.
- Collectively, the Sable Island and Deep Panuke projects produced over 2.2 Tcf while operational.

Source: Canada Energy Regulator, Company Reports

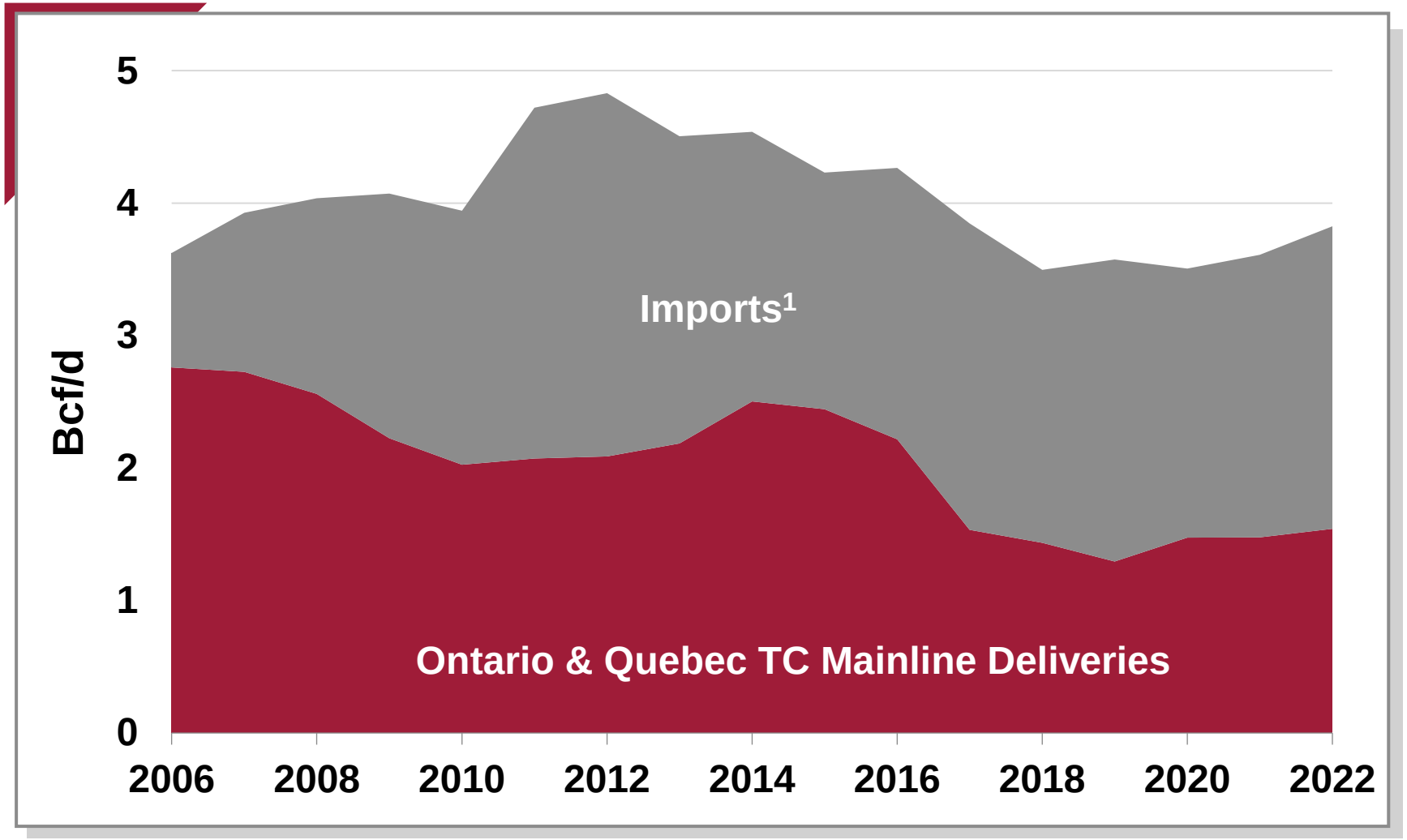
Canada and United States Natural Gas Pipeline Infrastructure*



- The TC Canadian Mainline (red dashed line) transports natural gas produced in Western Canada to markets in Eastern Canada.
- The Alliance, Northern Border, Great Lakes Gas Transmission, and Viking Gas Transmission pipelines (black dashed lines) supply markets in the US Midwest with Canadian gas, some of which is re-exported back into Ontario. These pipelines also supply US gas to Canada via various interconnects (not shown).
- US gas is also primarily imported into Ontario at Niagara and Chippawa (green star) and into New Brunswick (blue star) via US pipelines (not shown).

Source: Canada Energy Regulator
*This diagram does not capture ALL pipeline infrastructure. It is meant to showcase major inter-Canada and import/export pipelines

TC Canadian Mainline Ontario and Quebec Pipeline Deliveries | Annual | 2006 to 2022



- Pipeline deliveries to Ontario and Quebec via the TC Mainline have steadily decreased following the expansion of US natural gas production and associated infrastructure build out to accommodate increased transportation of US gas into Canada. In 2022, combined Mainline deliveries into Ontario and Quebec from the WCSB were ~1.5 Bcf/d, down from ~2.8 Bcf/d in 2006.
- High transportation costs on the TC Mainline have hindered Canada's ability to re-capture market share. However, due to long-term fixed contracts in 2017, followed by a reduction in base tolls from 2021 to 2026 and resulting rate rider reductions as part of a toll settlement, subsequently lower tolls have stopped further erosion of Canada's market share.

Source: TC Energy, Canada Energy Regulator

[1] US imports include some re-exports of Canadian natural gas

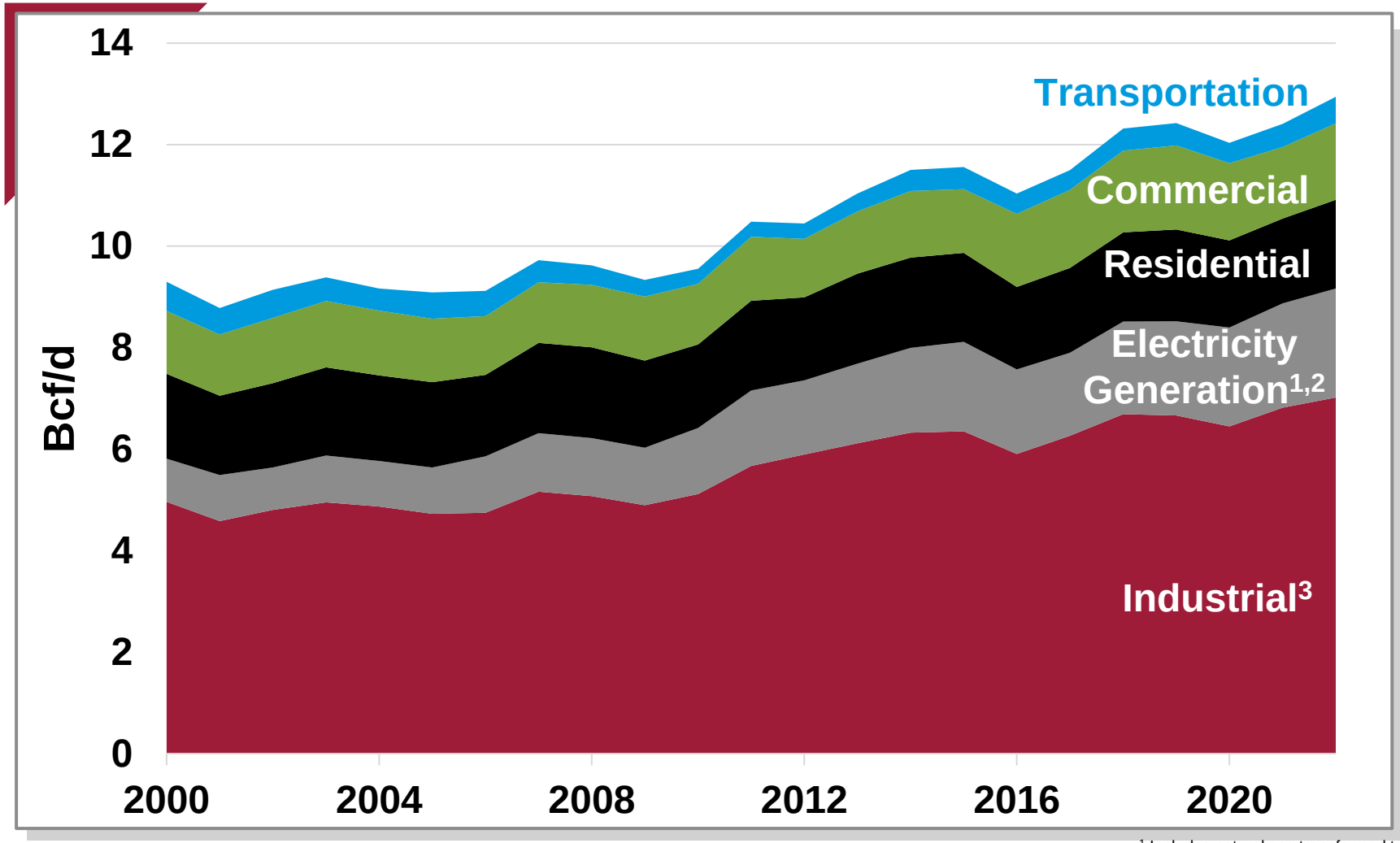
End-Users of Natural Gas

- The primary end-users of natural gas include the following sectors: **industrial**, **electricity generation**, **residential**, **commercial**, and **transportation**. In Canada, over 20 million Canadians use natural gas every day[1].
  - Uses of natural gas in the **industrial sector** include fuel for the generation of steam, source of process heat, and as a feedstock in the production of petrochemicals and fertilizers, amongst others.
  - Natural gas is also used for **electricity generation** by industry and utilities. Utilities then sell electricity to end-users in the residential, commercial, industrial, and transportation sectors.
  - In the **residential and commercial sectors**, natural gas uses include but are not limited to, space heating, water heating, cooking applications, and clothes drying.
    - The residential sector includes single-family residences, apartments, apartment hotels, condominiums, and farm homes. In Canada, nearly 50% of all residential consumers rely on natural gas for heating, cooking, and fueling appliances[1].
    - The commercial sector includes service industries related to mining, transportation, storage and warehousing, communications and utility (excluding electricity and natural gas), wholesale and retail trade, finance and insurance, real estate and business service, education, health and social services, and other service industries.
  - Additionally, although a relatively small consumption wedge, natural gas is used as an alternative fuel in the **transportation sector**. Some heavy-duty fleets are switching to natural gas to fuel trucks and buses to help reduce emissions.

Source: Statistics Canada. Table 25-10-0029-01 Supply and demand of primary and secondary energy in terajoules, annual, Canada Energy Regulator, US Energy Information Administration, Canadian Natural Gas Vehicle Alliance,

[1] Fuelling Canada

Canadian Natural Gas Consumption by Sector | Annual | 2000 to 2022

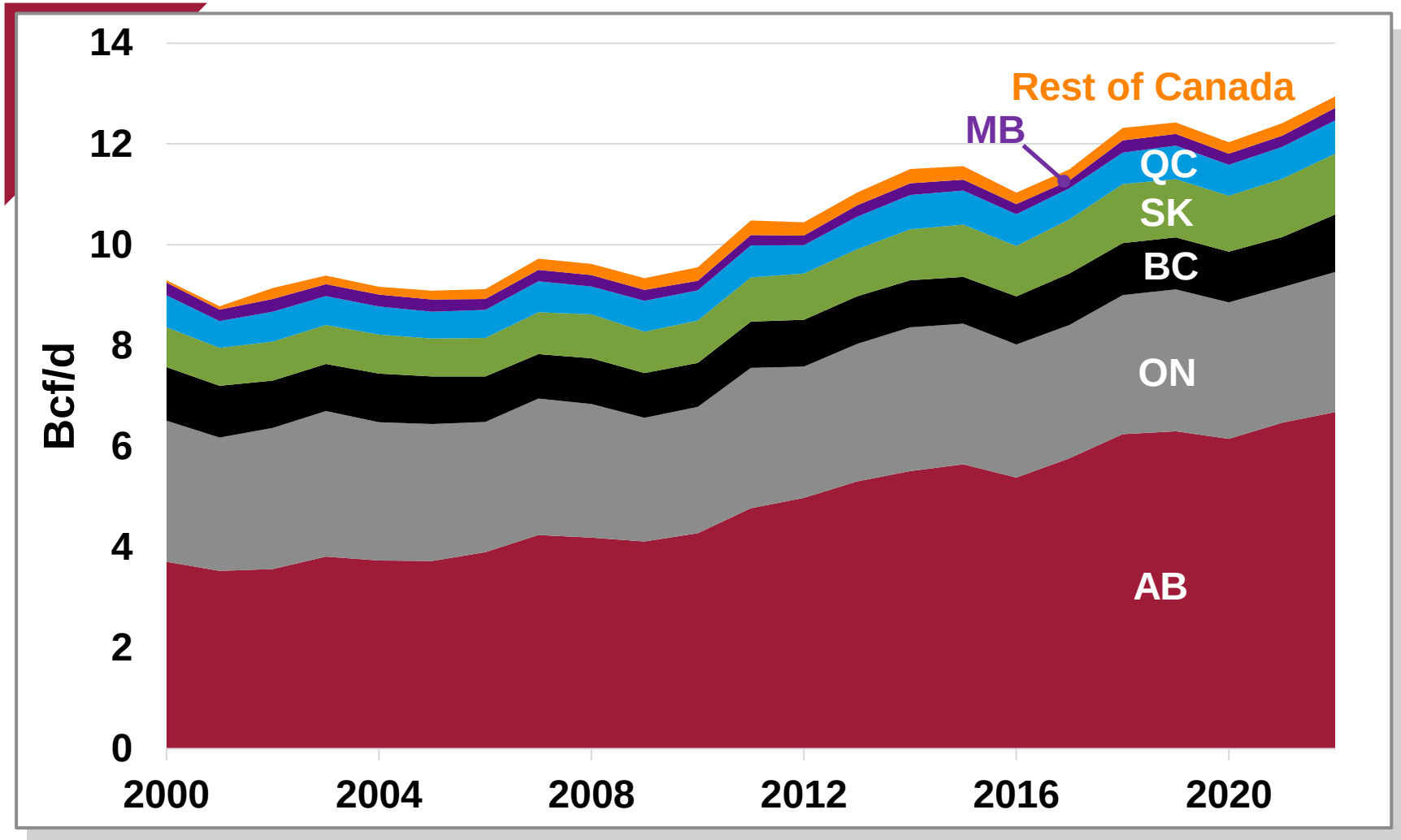


- The industrial sector is Canada's largest natural gas consumer, accounting for ~7 Bcf/d or 54% of total demand in 2022. Comparatively, the electricity generation, residential, commercial and transportation sectors accounted for roughly 17%, 13%, 12% and 4% of total demand, respectively.
- Since 2000, Canada's growth in natural gas demand has been primarily driven by the industrial sector, particularly the "mining and oil and gas extraction" sub-sector.
- Electricity generation (2.2 Bcf/d), residential (1.8 Bcf/d), commercial (1.5 Bcf/d), and transportation (0.5 Bcf/d) demand accounted for the remaining balance in 2022.

Source: Statistics Canada. Table 25-10-0029-01 Supply and demand of primary and secondary energy in terajoules, annual

[1] Includes natural gas transformed to electricity by utilities and industry
[2] Data unavailable from 2005-2013 due to confidentiality. Data was inferred during this period as a result.
[3] Includes producer consumption, non-energy use, public administration, and agriculture, fishing, hunting, and trapping

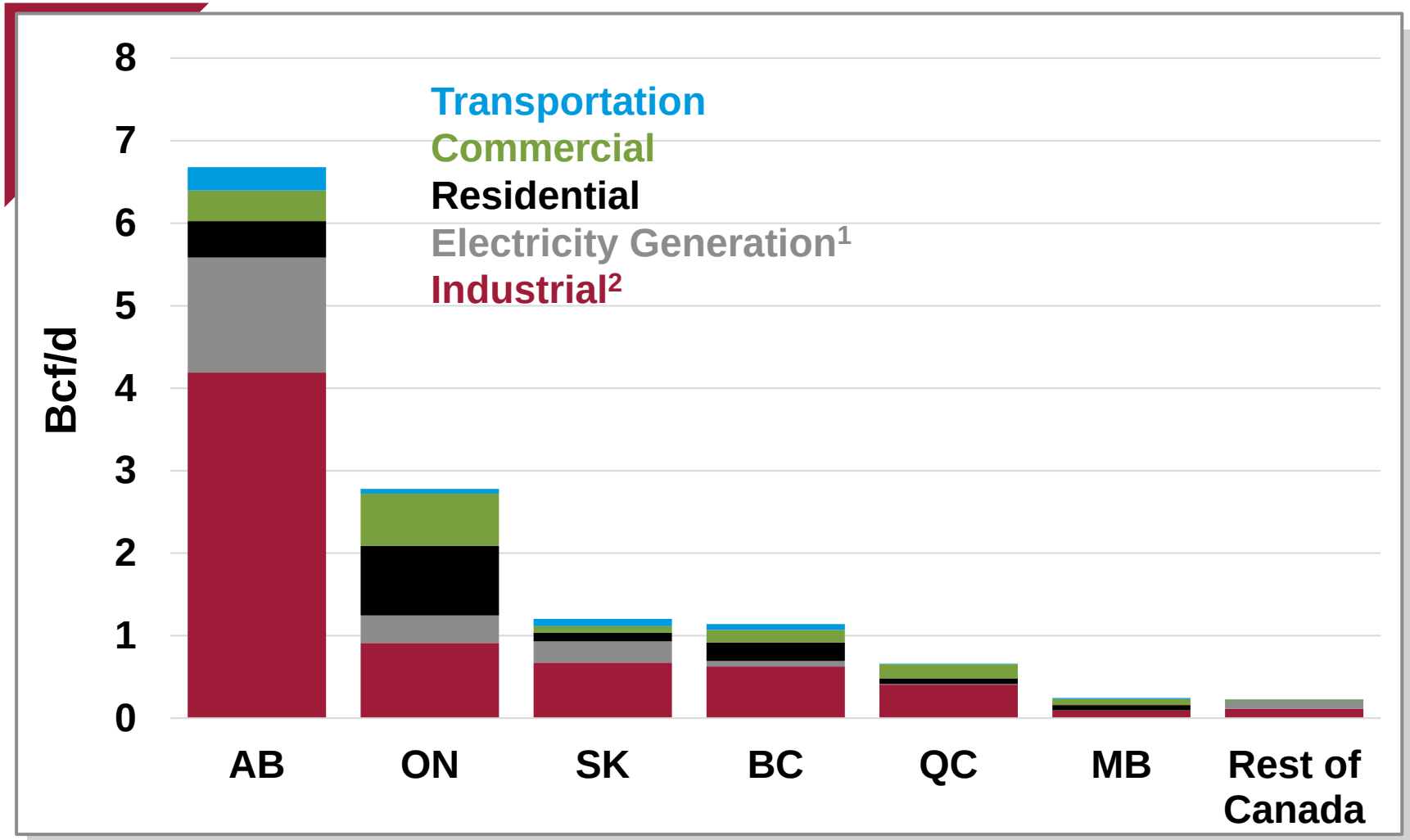
Natural Gas Consumption by Province | Annual | 2000 to 2022



- Alberta is Canada's largest consumer of natural gas, accounting for more than 50% of the country's total demand, and more than double the second-largest consumer, Ontario.
- In 2022, Alberta consumed ~6.7 Bcf/d, 100% of which was domestically sourced.
- Canada's natural gas demand is predominantly concentrated in Alberta, Ontario, BC, Saskatchewan, Quebec, and Manitoba.
- Natural gas demand from the remaining provinces and territories is small due to the sparse population and a lack of infrastructure.

Source: Statistics Canada. Table 25-10-0029-01 Supply and demand of primary and secondary energy in terajoules, annual

Provincial Natural Gas Consumption by Sector | 2022

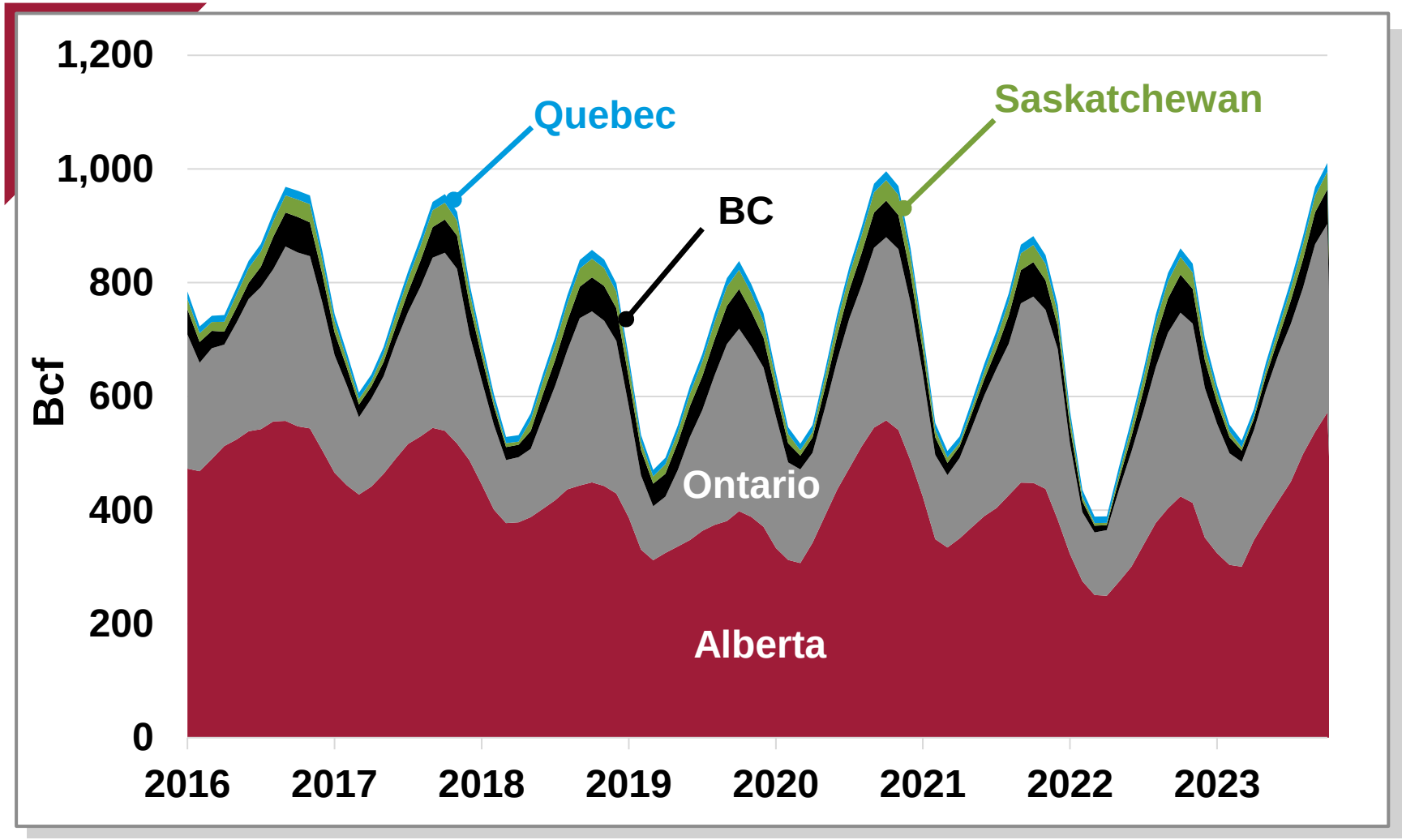


- The industrial sector is the largest consumer of natural gas in each province. In 2022, at ~4.2 Bcf/d, Alberta's industrial sector demand was roughly 5x greater than Ontario's, the second-highest industrial-consuming region.
- A large portion of the industrial demand in Alberta comes from the oil sands, which use natural gas to generate steam to heat underground reservoirs, separate bitumen from sand, upgrade the bitumen, and generate electricity.
- Compared to the rest of Canada, Alberta also relies heavily on natural gas for electricity generation.

Source: Statistics Canada. Table 25-10-0029-01 Supply and demand of primary and secondary energy in terajoules, annual

[1] Includes natural gas transformed to electricity by utilities and industry
[2] Includes producer consumption, non-energy use, public administration, and agriculture, fishing, hunting, and trapping

Natural Gas Storage in Canada | Monthly | 2016 to Q4/2023*



- Natural gas storage ensures the reliability of supply amidst seasonal demand fluctuations, particularly in winter months when demand can be 1.5-2X times greater than in the summer. Thanks to storage, natural gas is readily available and can be quickly deployed during periods of high demand, particularly when renewable sources such as wind and solar are producing less energy. This flexibility can complement renewable sources with less reliability to maintain a stable power supply.
- In recent years, Canada's cumulative storage levels have reached as high as ~1 Tcf during injection season and sub 0.4 Tcf during withdrawal season. There are numerous storage facilities throughout the highest-consuming regions in the country.

Source: Statistics Canada. Table 25-10-0057-01 Canadian natural gas storage, Canada and provinces, monthly (x 1,000)

*2023 data is to Oct 2023