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OIL SANDS DIALOGUE

S&P Global
Commodity Insights

Canadian oil sands production and emissions history

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Presented in June 2023.

Table of contents

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Three driving forces shaping energy today — and beyond

S&P Global Commodity Insights Canadian Oil Sands Dialogue, Ottawa

Presented in June 2023.

Jim Burkhard / S&P Global Commodity Insights / Vice President

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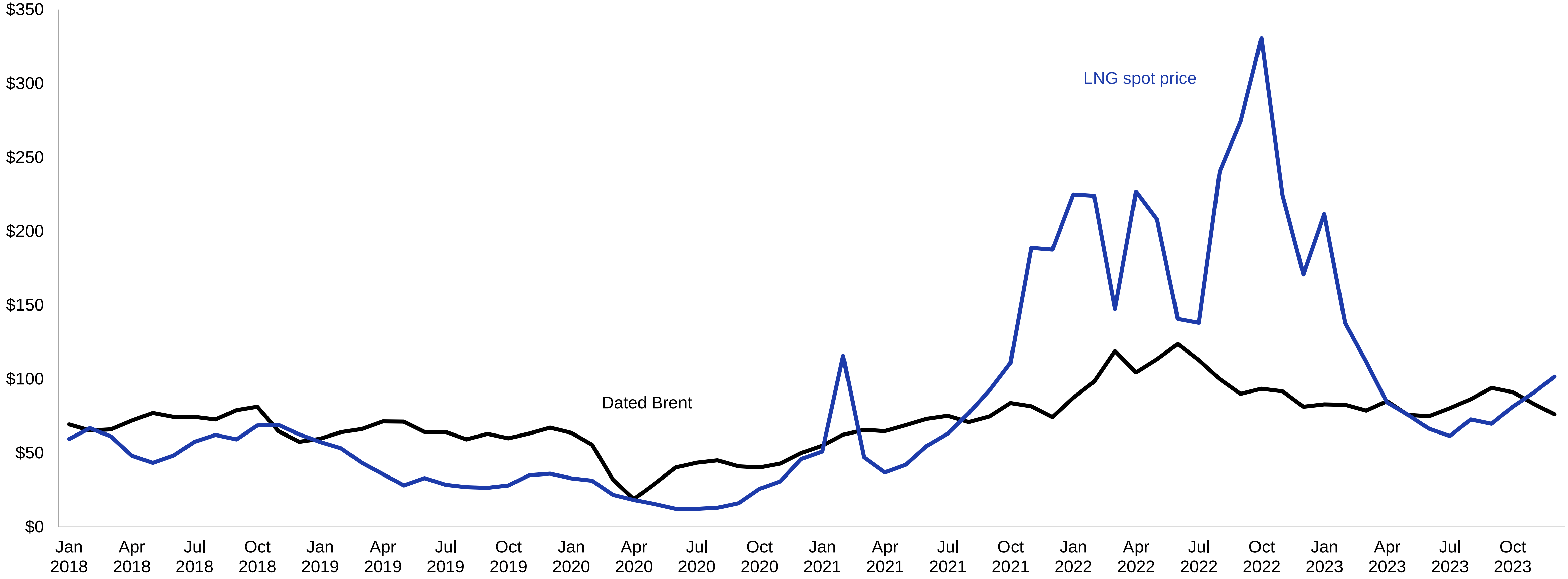
The starting point

Crude oil and spot LNG prices (US monthly average per barrel and per boe for LNG)



Date compiled Jan. 24, 2024.

boe = barrels of oil equivalent.

Crude oil prices are for Dated Brent. LNG prices are the Japan Korea Marker (JKM) spot price (Japan-South Korea).

Source: S&P Global Commodity Insights.

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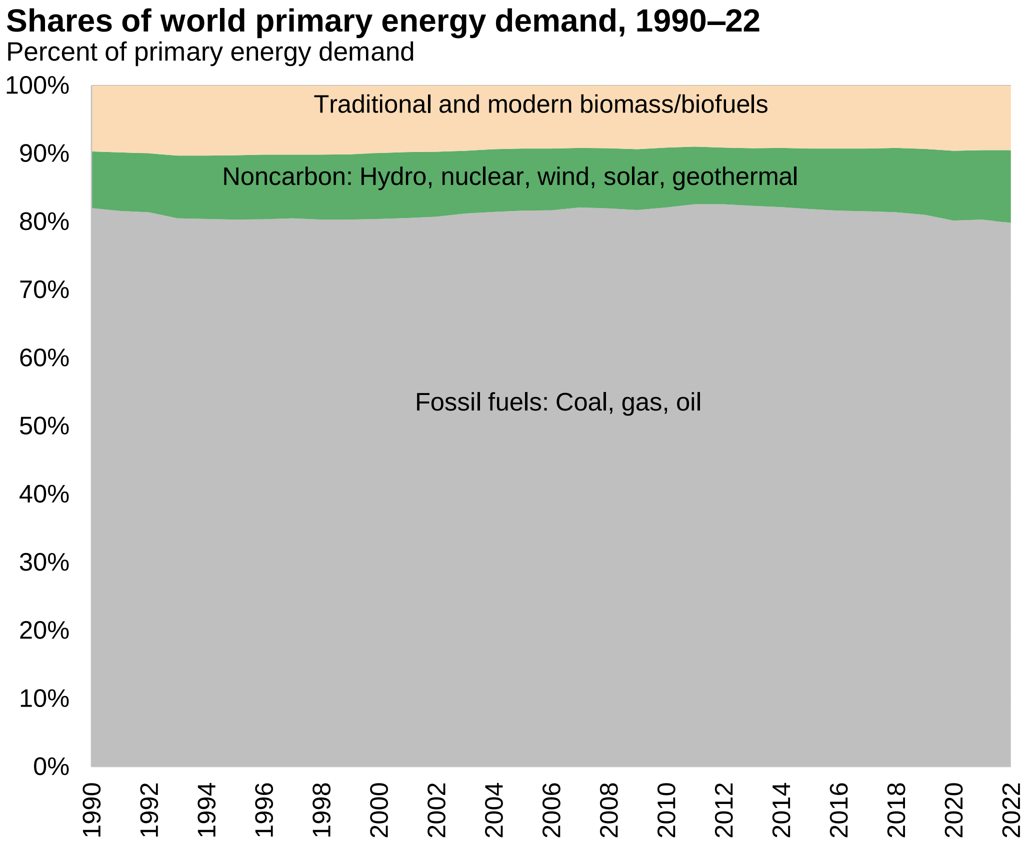
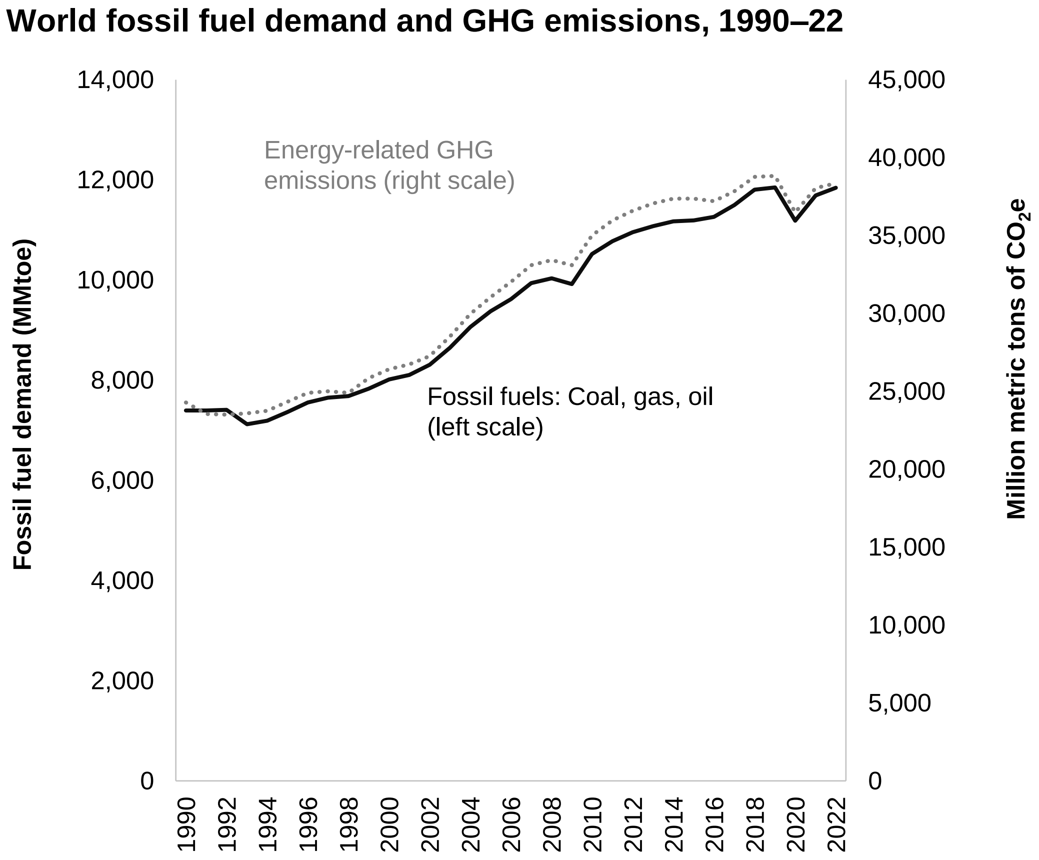
Little evidence yet of an energy transition at the global level





Date compiled May 19, 2023.

MMtoe = million metric tons of oil equivalent.

Source: S&P Global Commodity Insights.

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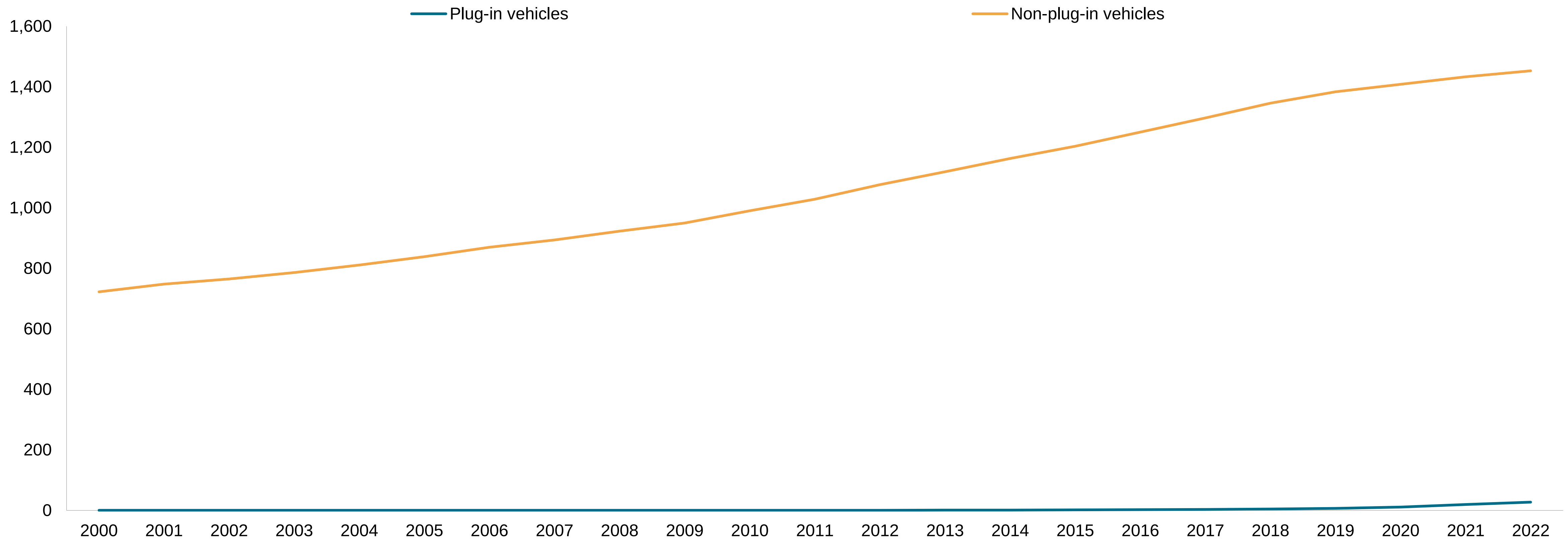
Oil powered cars (non-plug-ins) still dominate the world light vehicle fleet

Composition of the global LV fleet (million vehicles)



Date compiled May 19, 2023.

LV = light vehicle.

Sources: S&P Global Commodity Insights; S&P Global Mobility.

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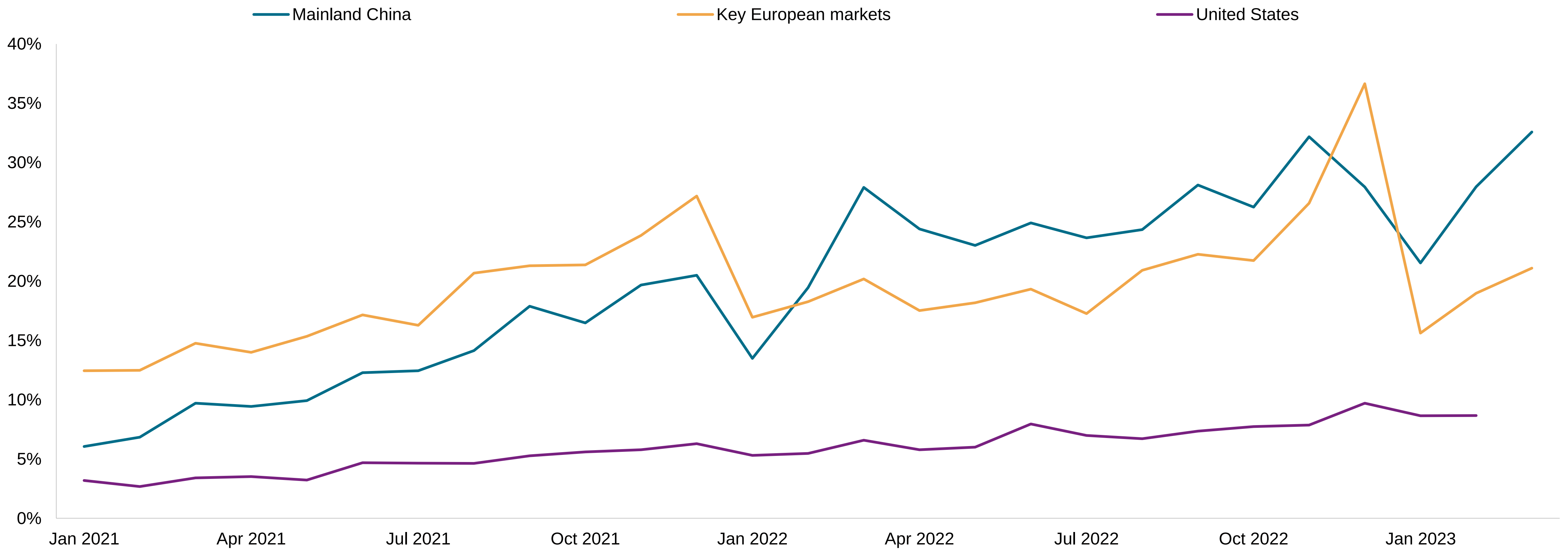
Electric car sales gaining market share of new car sales

Monthly BEV and PHEV share of total LV sales



Data compiled May 4, 2023.

BEV = battery-electric vehicle; PHEV = plug-in hybrid electric vehicle.

Sales are as measured by new registrations. Key European markets include Denmark, France, Germany, Italy, the Netherlands, Norway, Spain and the United Kingdom. March 2023 data for the United States are not yet available.

Sources: S&P Global Commodity Insights; S&P Global Mobility.

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Commodity Insights Scenarios: Green Rules and Inflections

Green Rules (alternative scenario)

In response to catastrophic climate-change-related events, the heavy and strong-hand of government, including enhanced global cooperation, transforms the world of energy. Global greenhouse gas emissions are cut by 50% in 2050 compared with 2019.

Inflections (base case)

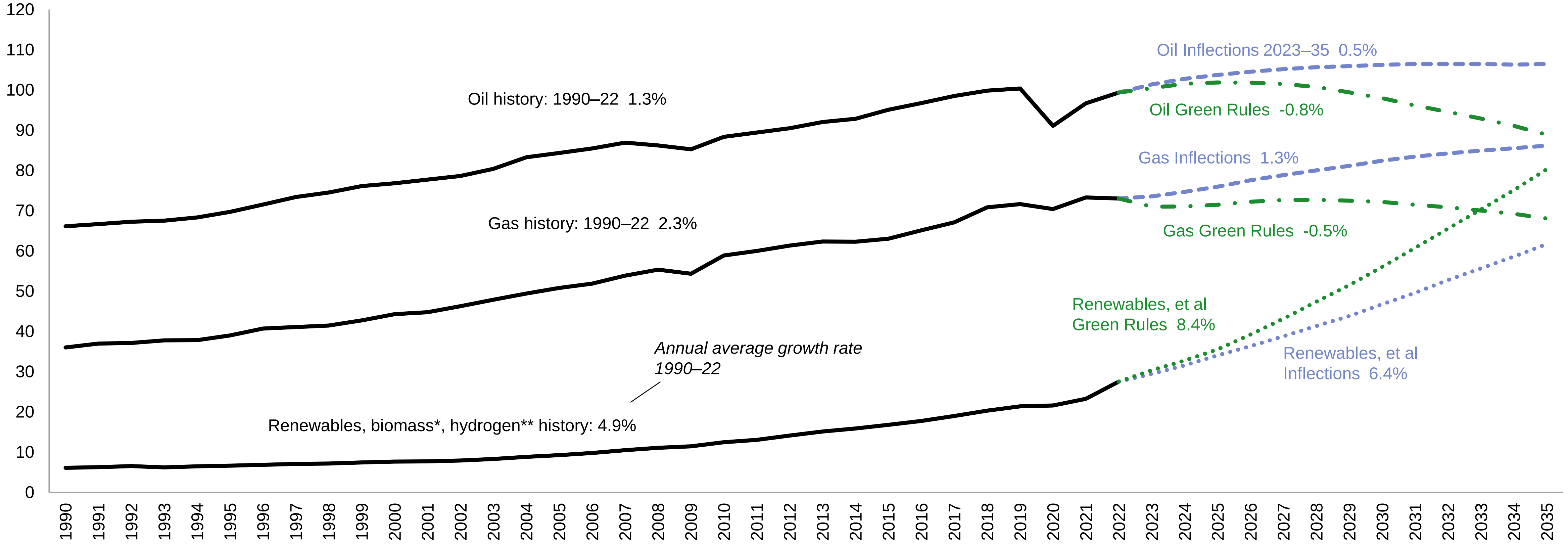
Domestic interests are prioritized over international cooperation to address climate change. This reflects a world where economic, political and technological power is more diffused than at any time since the 1940s. GHG emissions are cut by 16% in 2050 compared with 2019.

* See the Oct. 29, 2020, IHS Markit Strategic Report, *The energy transition: Moving beyond slow motion.*

Source: S&P Global Commodity Insights.

Oil, gas and renewable energy demand outlook

World oil (total liquids), gas and renewables (et al) demand to 2035 (million b/d for oil and million boe/d for gas and renewables, et al)



Date compiled May 19, 2023.

* Modern biomass, includes biofuels, biogas, biowaste, wood chips and wood pellets.

** Hydrogen does not include unabated (gray) hydrogen.

Source: S&P Global Commodity Insights.

Canadian oil sands historical performance and outlook

S&P Global Commodity Insights Canadian Oil Sands Dialogue, Ottawa

Presented in June 2023.

Celina Hwang / North American Crude Oil Markets / Director

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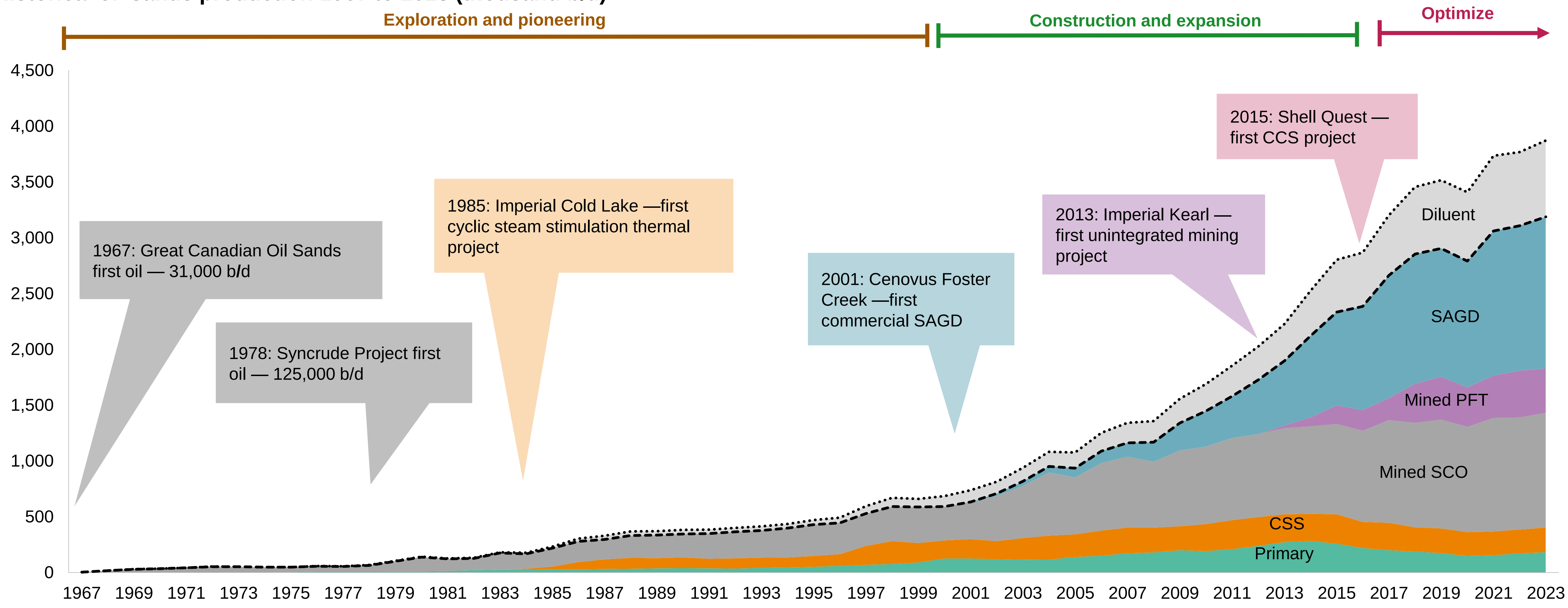
Key messages

- **The Canadian oil sands form a critical part of the western Canadian sedimentary basin that influences unconventional through to petrochemical investment and activity.** The Canadian oil sands demand for diluent, an ultra light crude oil also known as condensate, which topped 700,000 b/d in 2022, results in a regional price premium that has helped support western Canadian unconventional production. In turn, unconventional activity has been producing greater quantities of natural gas and natural gas liquids, which will contribute to future LNG exports and provide abundant low-cost feedstock for petrochemical plants.
- **Canadian oil sands growth will come from the optimization of existing capacity.** Throughout the history of the oil sands there have been various stages of life. The early years focused on technology and first-of-kind operations to unlock the oil sands’ potential. In the most recent period, the industry was focused on the construction and ramp-up of new, large-scale extraction facilities. Today, with significant capacity in place, and pressure to prioritize returns and decarbonization, the industry is looking at optimization to drive growth.
- **Stronger balance sheets and greater confidence in the future price of oil have led to increased guidance into future plans, which contributed to the first upward revision in our oil sands outlook in over half a decade.** By 2030, Canadian oil sands production could reach 3.7 million b/d. This is over half a million barrels more than 2022 and represents an upward revision of 140,000 b/d compared with our 2021 outlook. Western Canadian prices will be supported with the completion of Trans Mountain Expansion (TMX) in early 2024.
- **Looking forward, the oil sands are expected to continue posting new record production and export levels.** A deceleration in growth is expected to begin in the mid-to-late 2020s before a shallow decline begins in the early 2030s. Further optimizations could provide an upside risk to the outlook, while policy — particularly the advancing federal oil and gas cap — could add downside risk.

Throughout its history, the oil sands have gone through various stages of life

Historical oil sands production 1967 to 2023 (thousand b/d)



Data complied May 10, 2023.

SAGD = Steam-assisted gravity drainage; CCS = Carbon capture and storage; PFT = Paraffinic froth treatment; SCO = Synthetic crude oil; CSS = Cyclic steam stimulation.

Sources: Alberta Energy Regulator, formerly the Energy and Utilities Board; S&P Global Commodity Insights.

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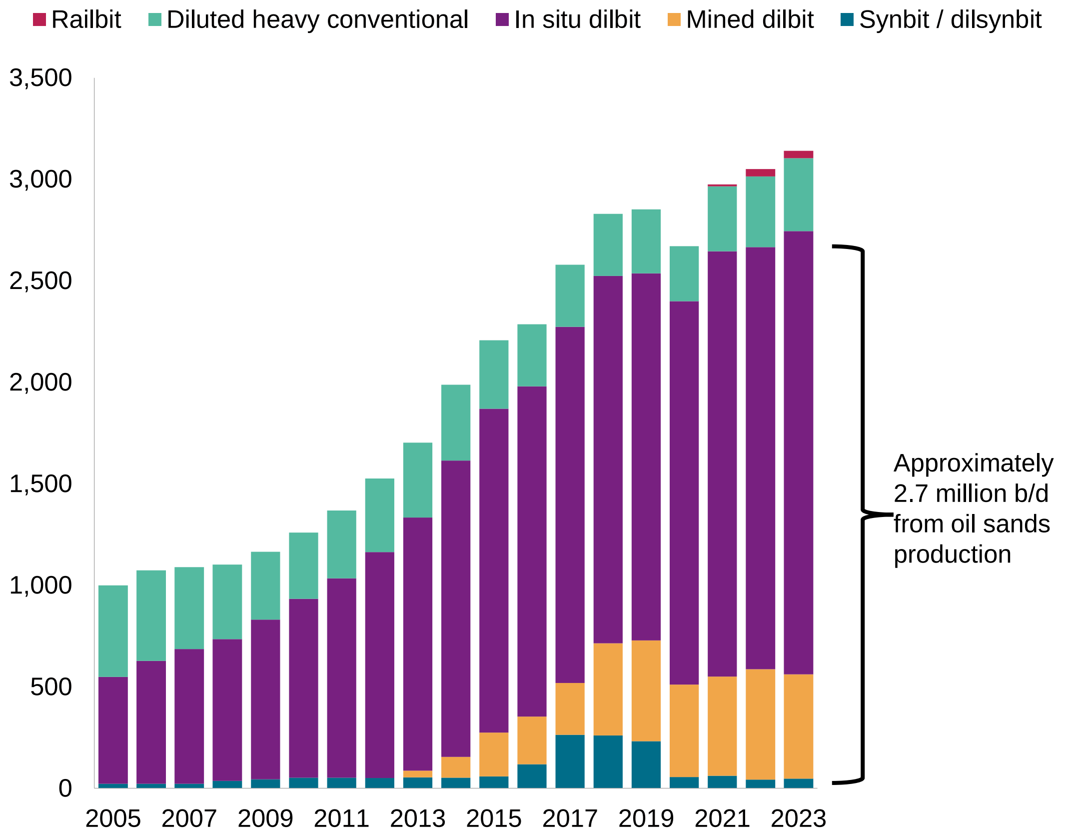
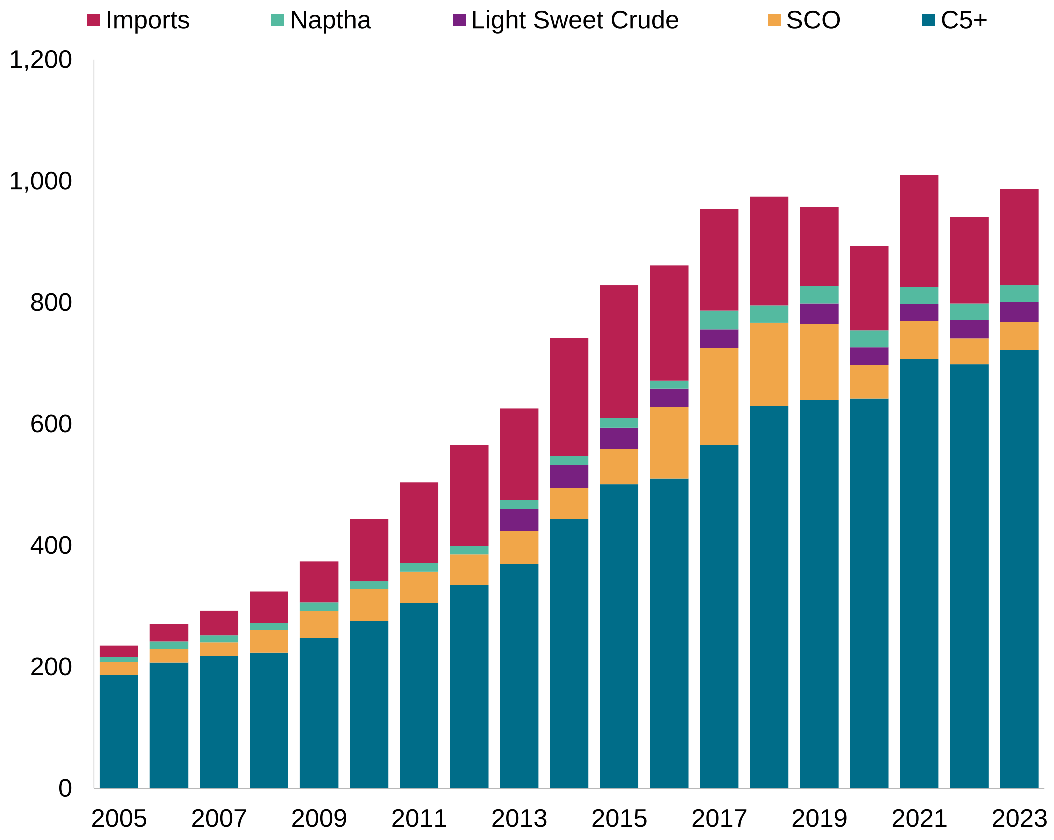
As oil sands operations grew, newer operations opted to forego the capital cost of upgrading and chose to market diluted bitumen blends (dilbit)

Western Canadian crude requiring diluent (thousand b/d)



Breakdown for diluent required for oil sands (thousand b/d)



Data compiled May 26, 2023.

C5+ = Condensate.

Source: S&P Global Commodity Insights.

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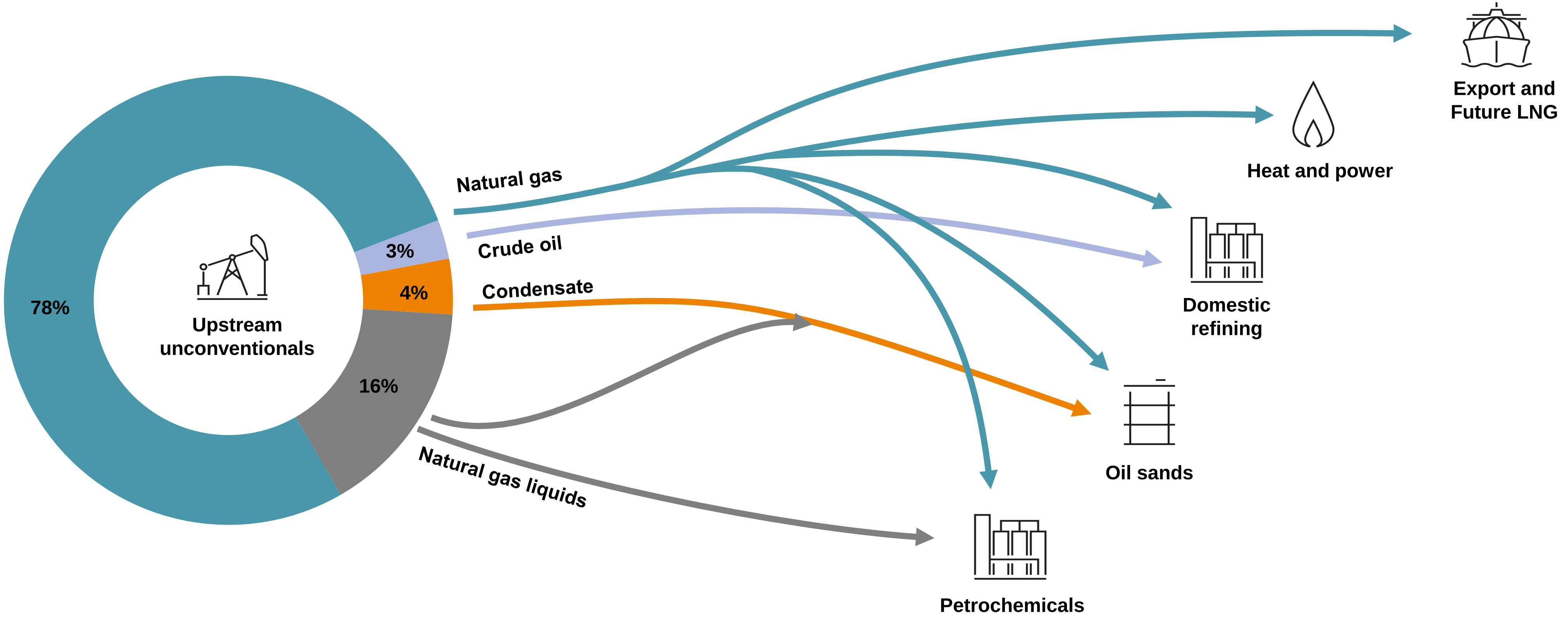
Oil sands diluent demand helped stimulate unconventional crude and natural gas production in western Canada, which in turn supported the petrochemical sector

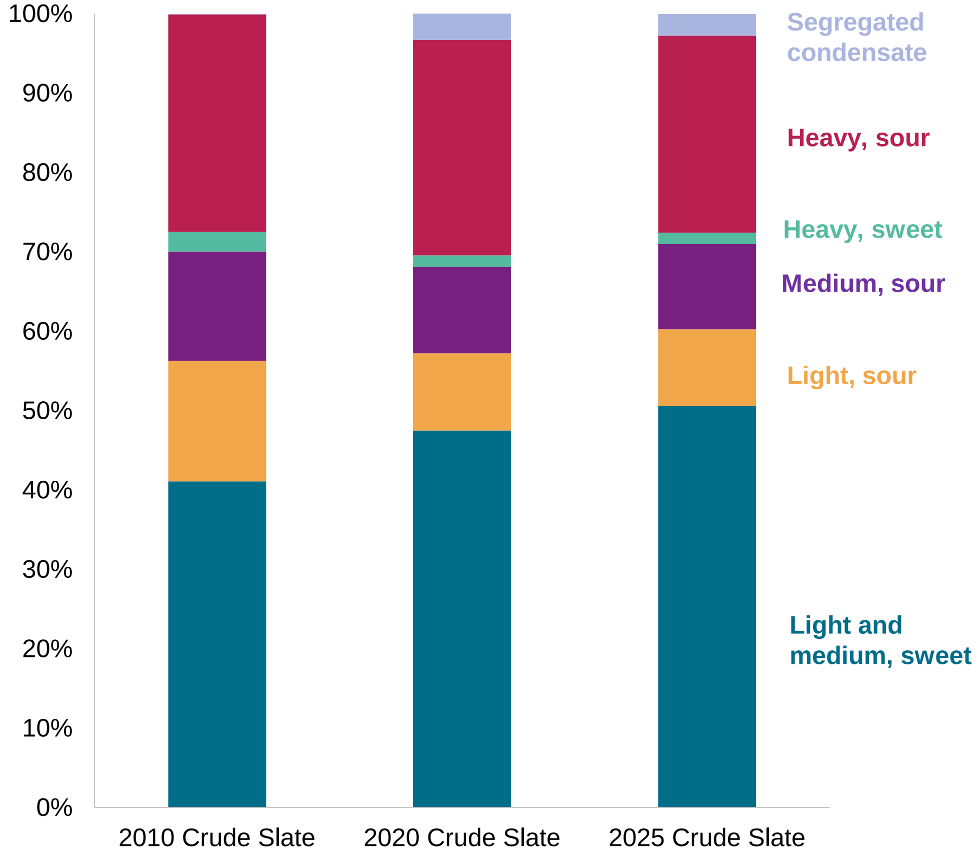
Typical type-curve (or yield) of Montney well in 2022*



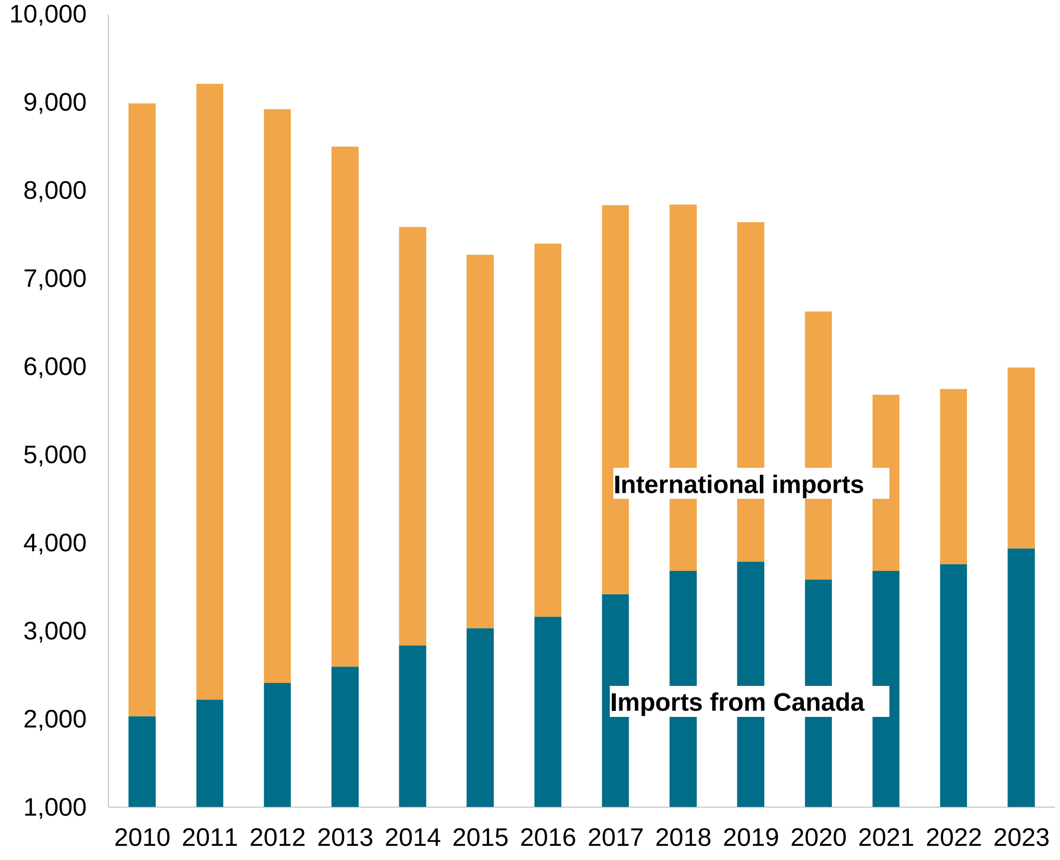
Data compiled May 23, 2023.
* Based on all active Montney wells in 2022.
Sources: S&P Global Commodity Insights; Accumaps.

Canadian oil sands were always export orientated, and as production grew increasing volumes headed south

US crude slate change, 2010–25



US crude oil imports (thousand b/d)

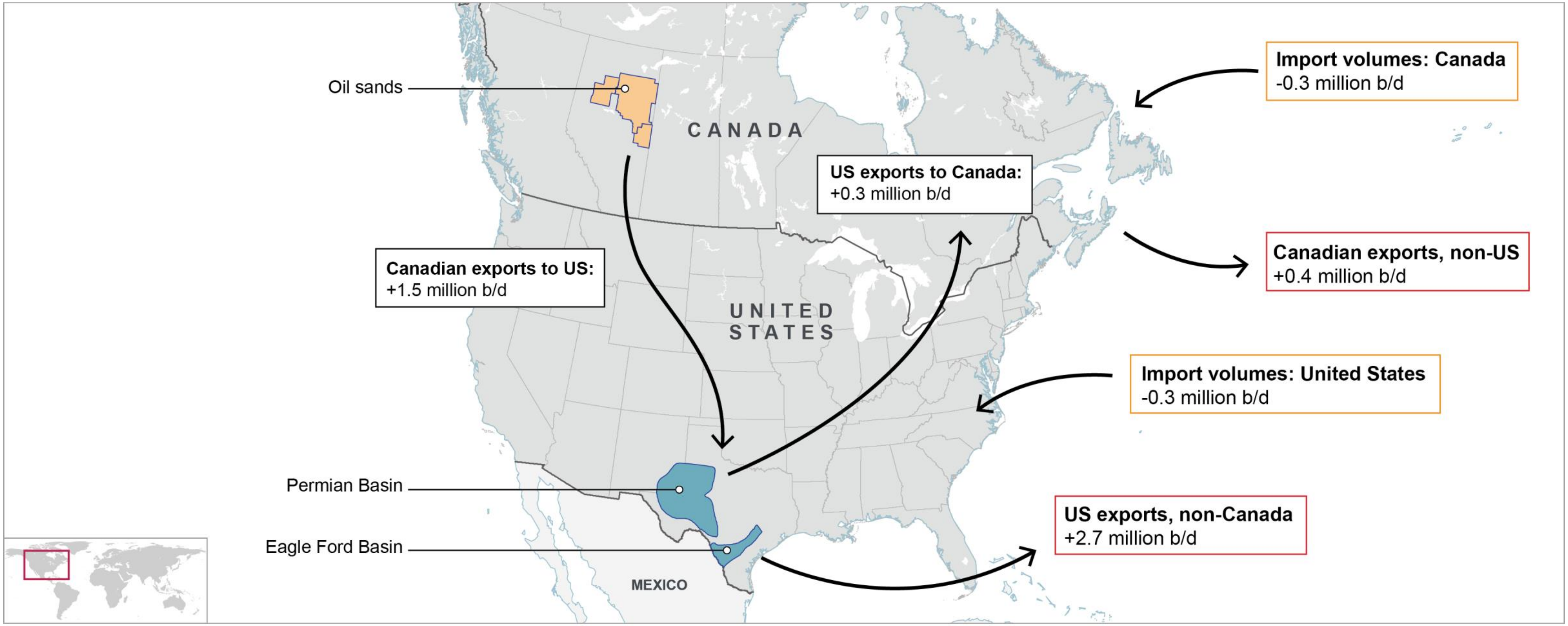


Data compiled May 25, 2023.
Source: S&P Global Commodity Insights.

Oil supply growth helped strengthen North American energy security

Cross border oil trade helped displaced offshore imports

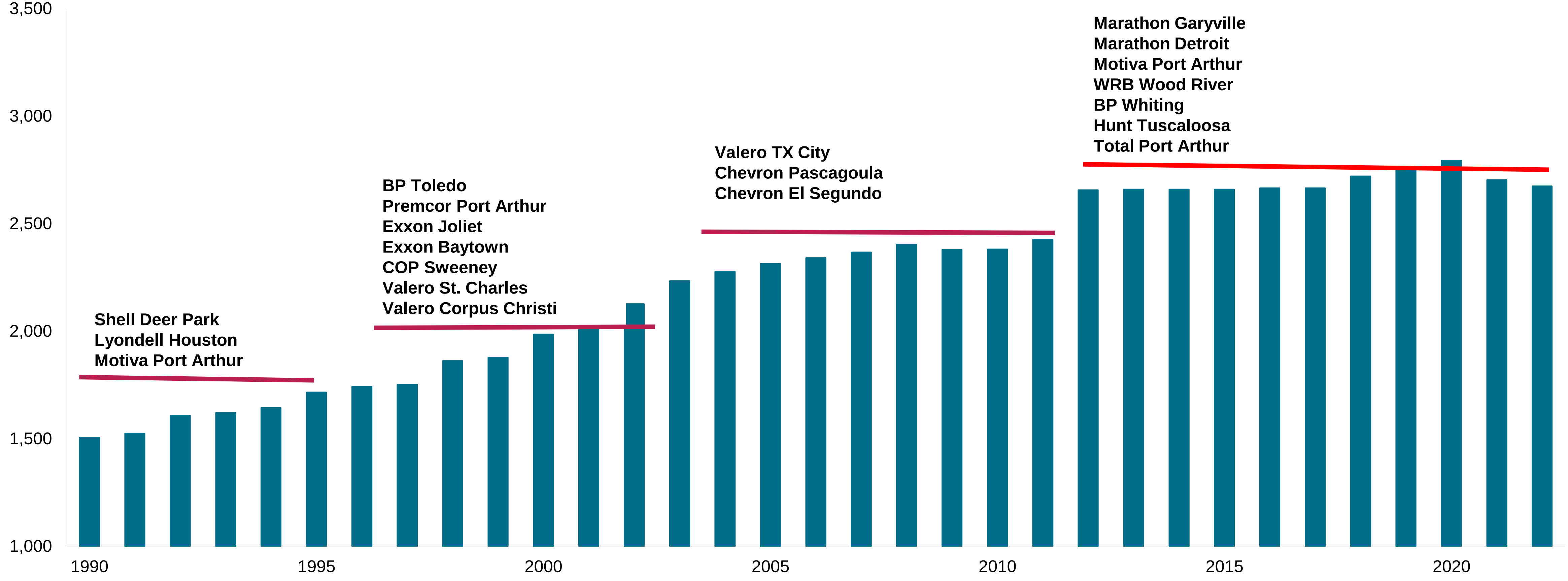
North American crude trade flows and displacement of offshore imports (2010–21)



Data compiled Nov. 30, 2023.
Sources: Data taken from S&P Global Commodity Insights upstream E&P content (Accumap)/Annual Strategic Workbook 2022: 2011620

Heavy oil conversion capacity has increased in the US since 1990, providing a home for Canadian heavy crude

US total coking capacity (thousand b/d)

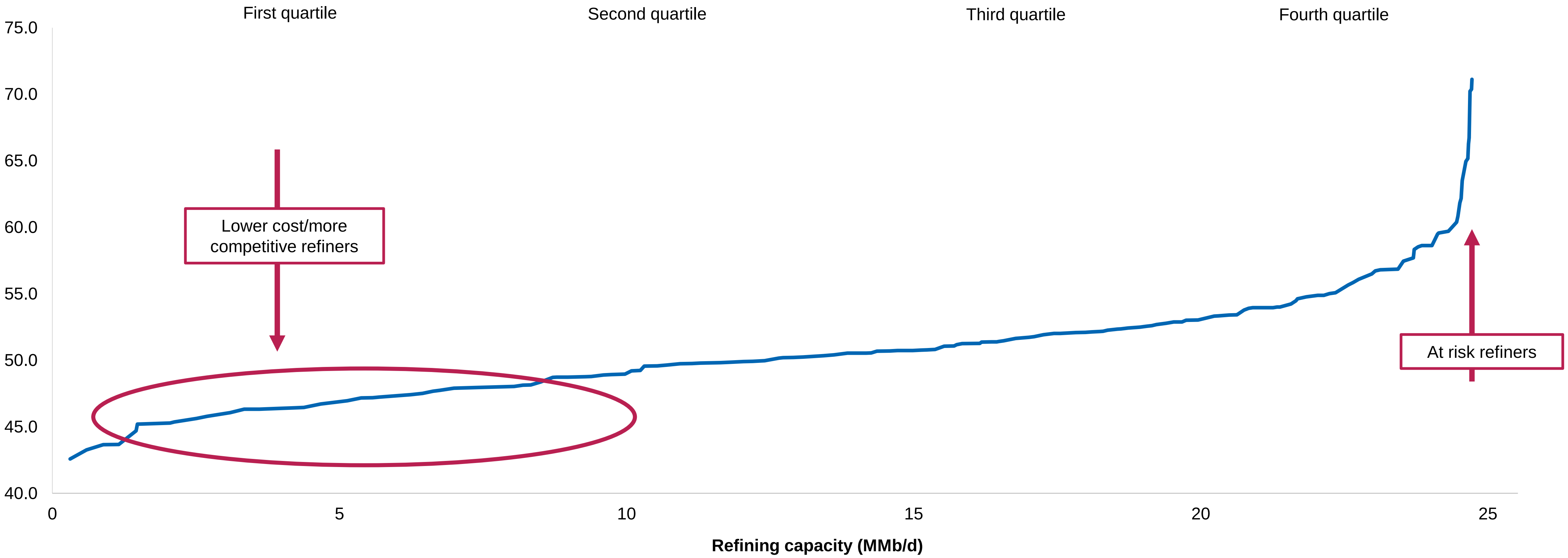


Data compiled June 1, 2023.

Sources: S&P Global Commodity Insights, US Energy Information Administration.

Several complex coking refineries are competitive and expected to maintain reasonably high crude run rates

Cash cost of light product (gasoline and distillate), 2016 US$/barrel



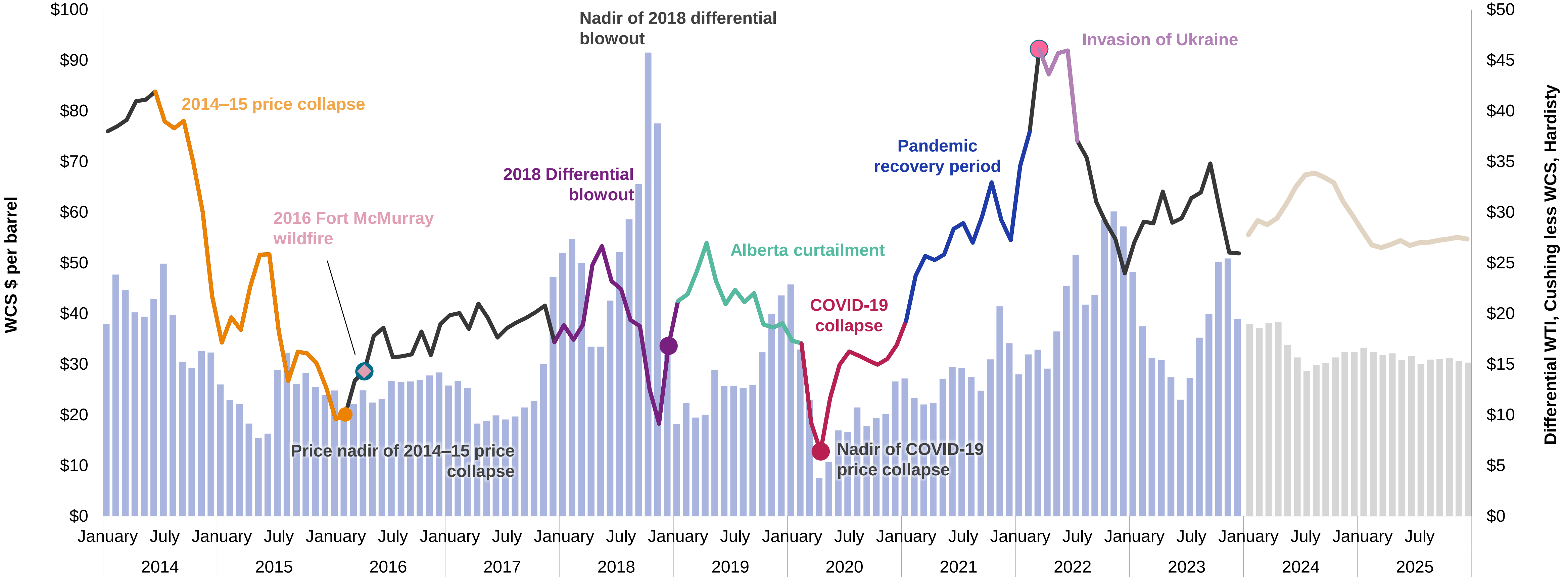
Data compiled 2017.

Cash cost of light products is the break-even price for gasoline and diesel after the refinery has accounted for crude cost, operating costs and by-product credit from other products. This chart shows the US and European refineries.

Source: S&P Global Commodity Insights.

Western Canada has grappled with price instability driven by global and local factors since 2014

Western Canadian heavy sour price (WCS, Hardisty, 2014–25)



Data compiled Jan. 24, 2024.

WCS = Western Canada Select; WTI = West Texas Intermediate.

Source: S&P Global Commodity Insights.

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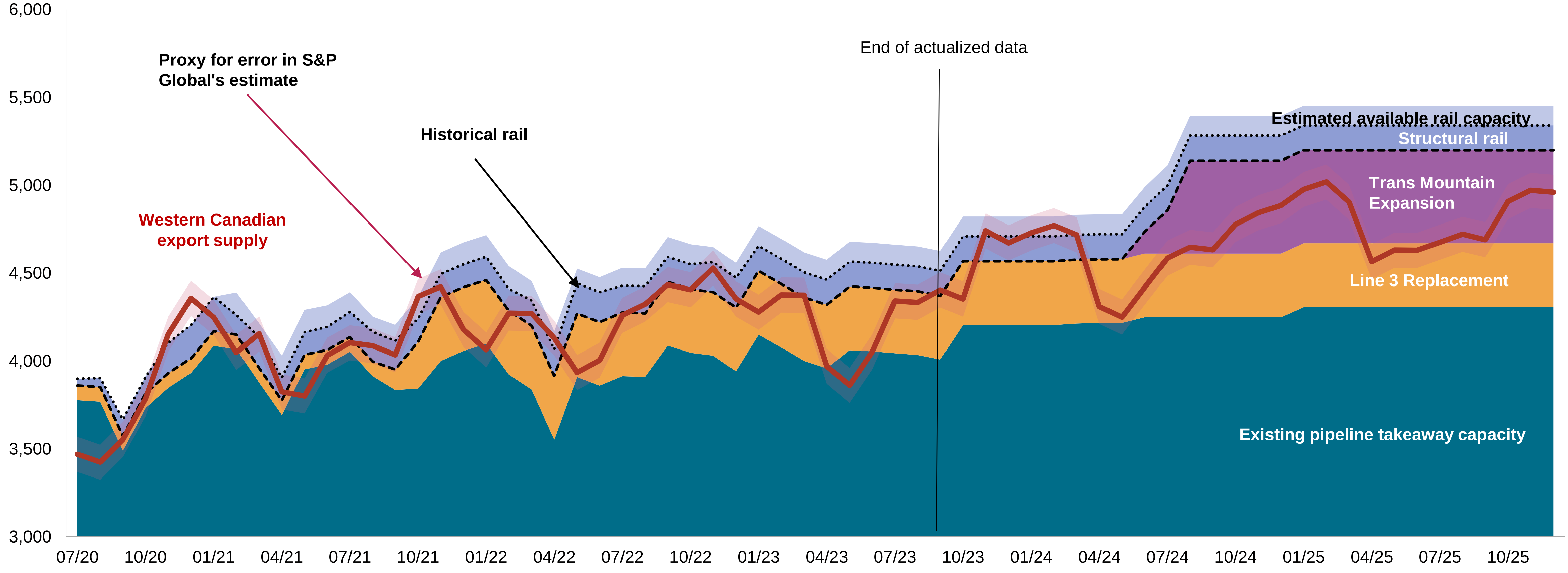
TMX remains critical to ensure adequacy of western Canadian export capacity…

Western Canada crude oil takeaway capacity (thousand b/d)



Date compiled Jan. 22, 2024.
Sources: S&P Global Commodity Insights, Canadian Energy Regulator.

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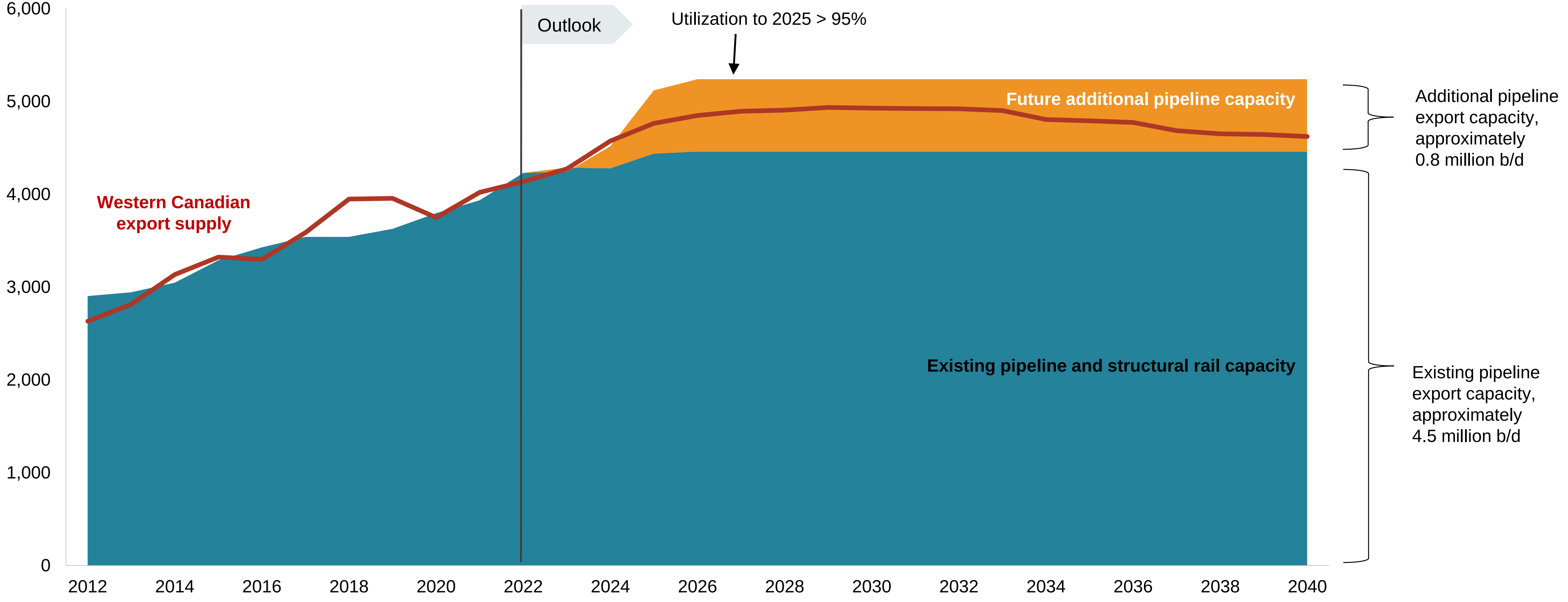
…but even with TMX, export capacity utilization could reach 95% by the mid 2020s, and remains a source of price uncertainty for western Canada

Western Canada crude oil pipeline export capacity (thousand b/d)

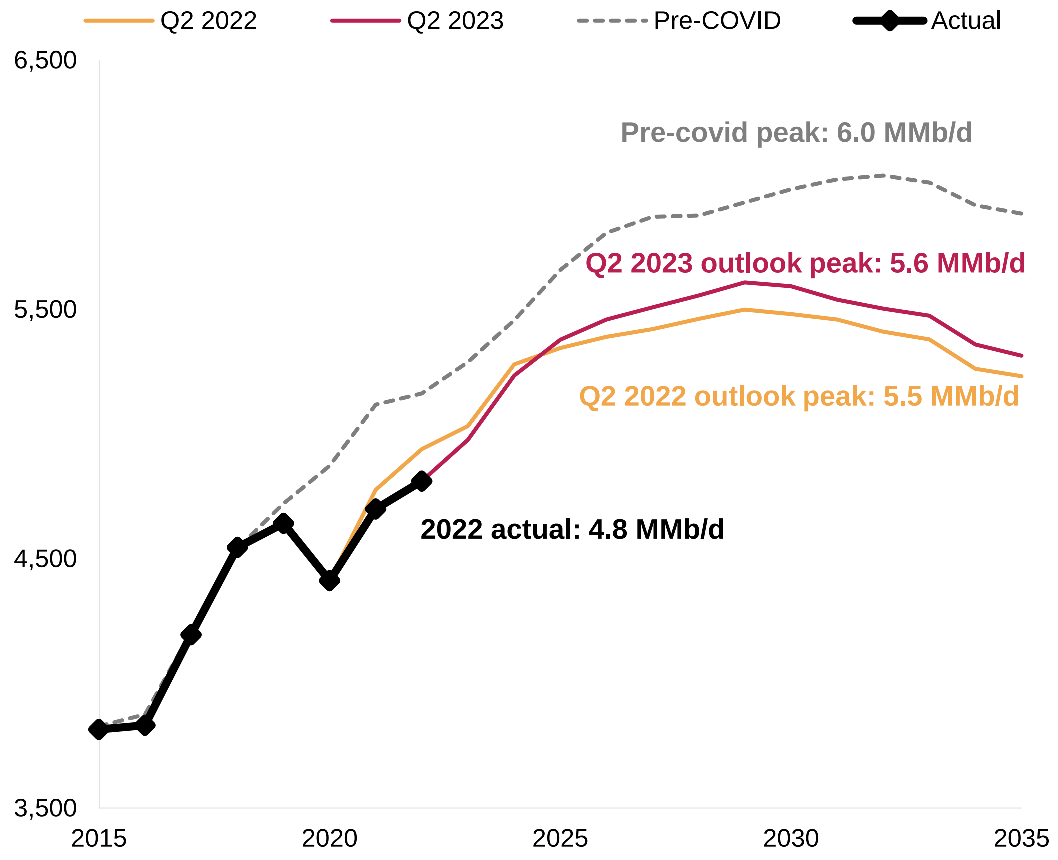


Data complied May 10, 2023.
Pipeline operational capacity. Future additional pipeline capacity includes potential optimization projects, including Trans Mountain Expansion, Enbridge mainline optimization and Keystone optimization.
Sources: S&P Global Commodity Insights, Canadian Energy Regulator.

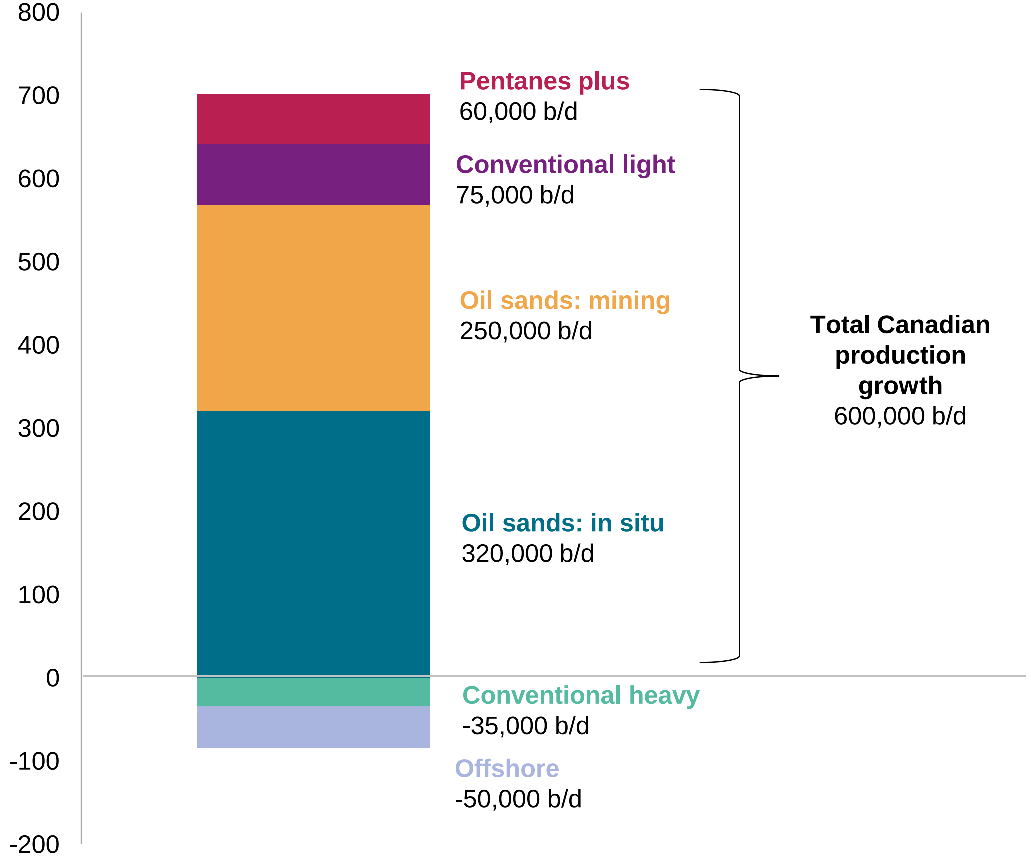
Canadian crude oil output expected to grow 600,000 b/d over the next decade

Oil sands to be more resilient compared to other streams thanks to their low decline rate

Canadian crude oil production to 2035 (thousand b/d)



Canadian production by stream growth from 2022–35 (b/d)



Data compiled May 23, 2023.
Canadian offshore production expected to decline over 2021–32.
Sources: S&P Global Commodity Insights.

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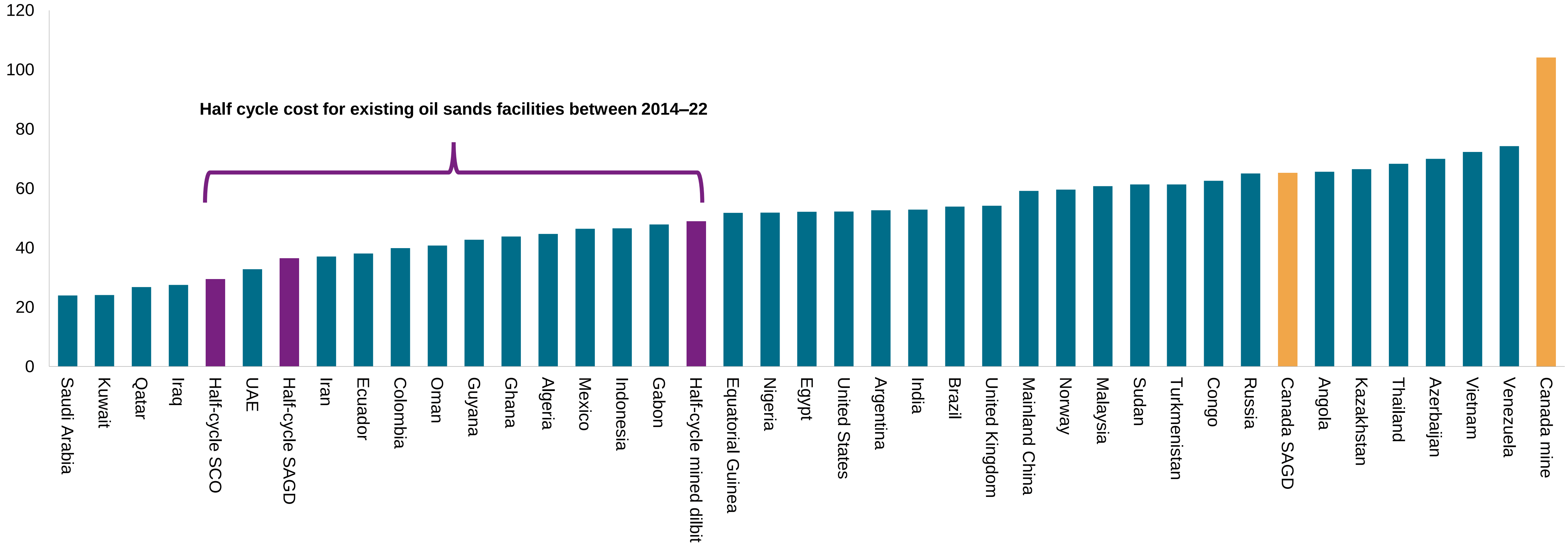
Compared with other global crude production, existing oil sands assets have lower cost of supply with a lower decline rate

Average full-cycle costs and oil sand half-cycle costs in terms of Dated Brent ($/barrel)



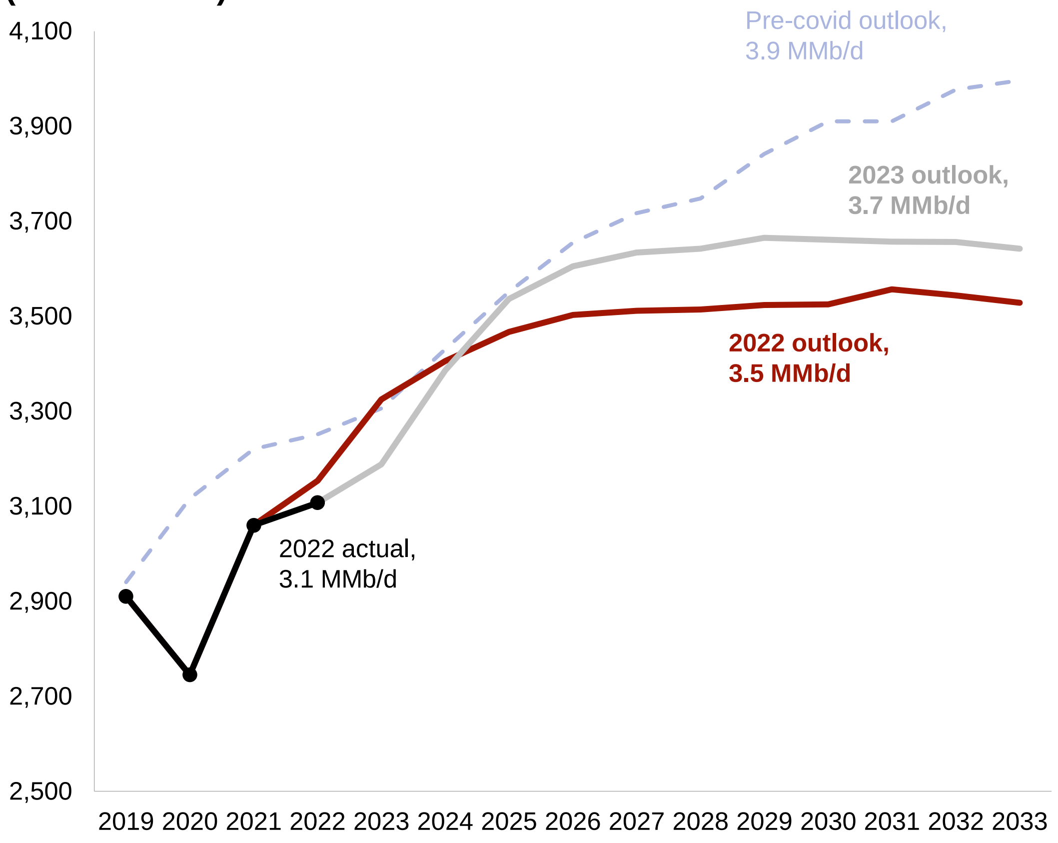
Data compiled May 31, 2023.

Half-cycle costs for oil sands include diluent and transportation costs as well as a quality difference to light tight oil and is estimated on a WTI basis plus the 2023 estimated Dated Brent-WTI spread of $4.49/barrel. The half-cycle cost spread is the 2014–22 range.

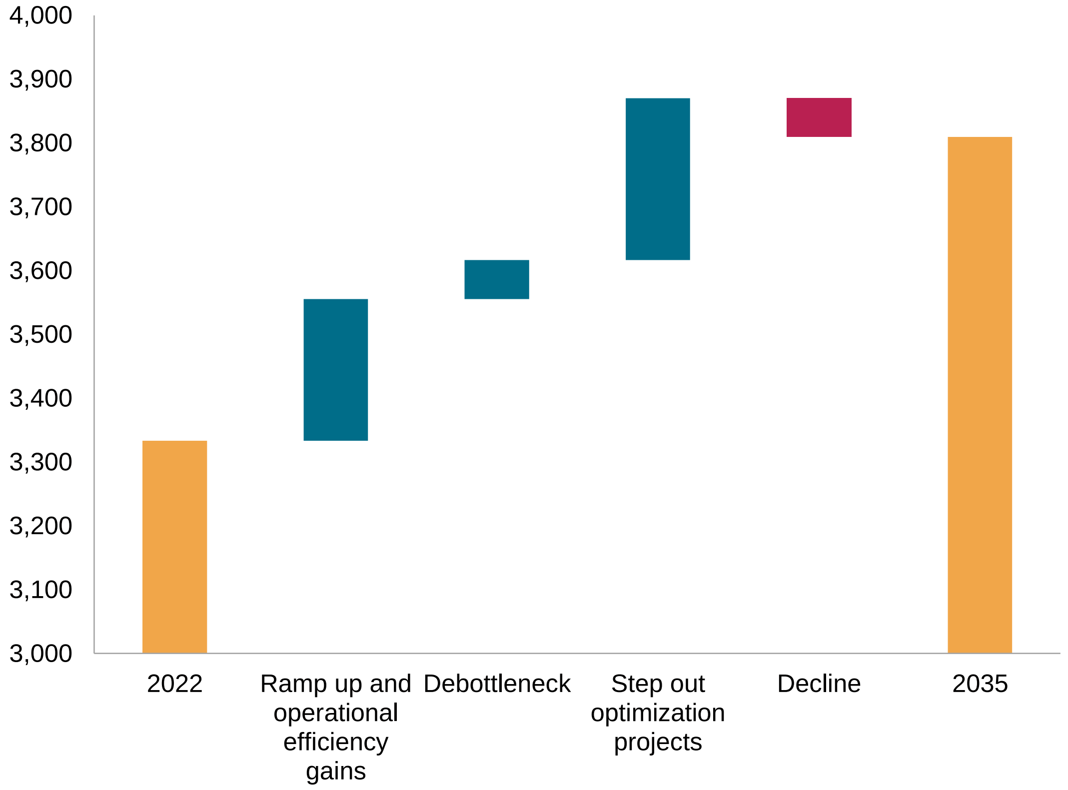
Sources: S&P Global Commodity Insights, various producer financial reports.

Stronger balance sheets are supporting more transparency in future plans and contributed to first upward revision in our oil sands outlook in over half a decade

Commodity Insights oil sands 10-year production outlook (thousand b/d)



Composition of oil sands growth 2022–35 (thousand b/d)



Data compiled May 10, 2023.
Source: S&P Global Commodity Insights.

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Canadian oil sands emission performance – past, future

S&P Global Commodity Insights Canadian Oil Sands Dialogue, Ottawa

Presented June 2023.

Kevin Birn, Center of Emissions Excellence

Eleonor Kramarz, Energy Transition Consulting & Strategy

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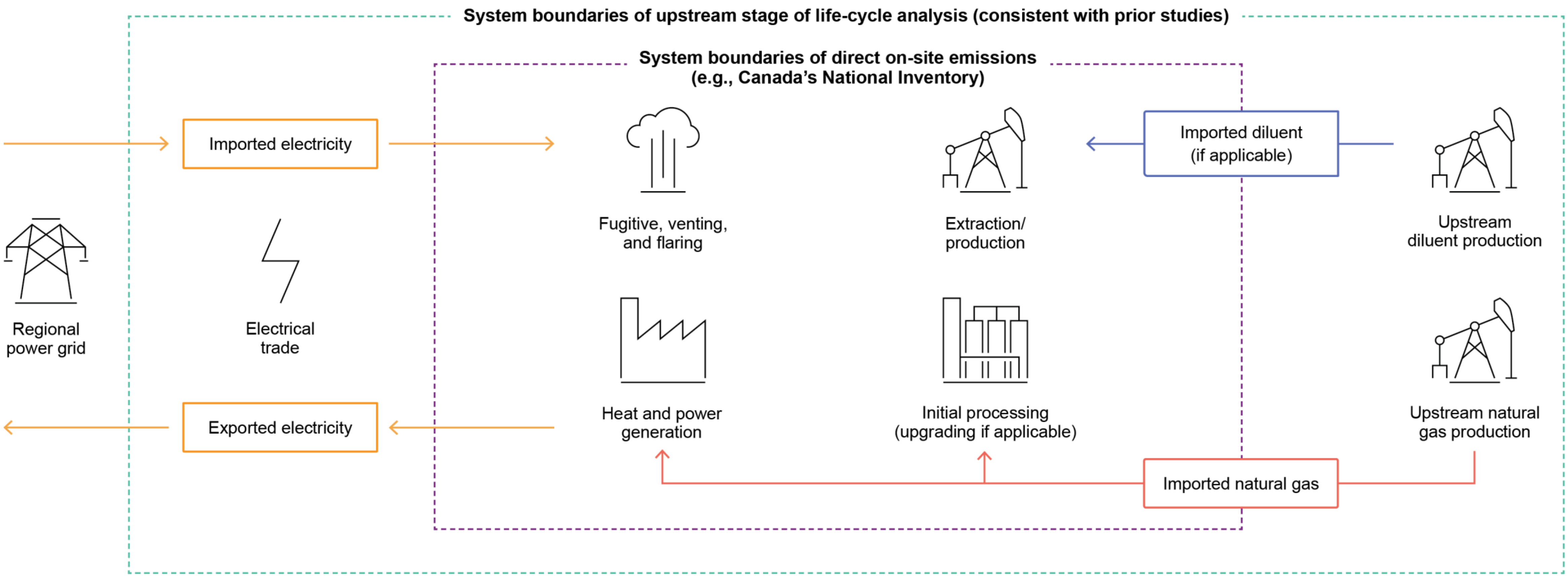
S&P Global and its predecessor companies have a long and extensive history in estimating GHG emissions associated with the Canadian oil sands

Source: S&P Global Commodity Insights.

Emission boundaries matter

Illustration of system boundries



As of January 2024.
Source: S&P Global Commodity Insights.

Past oil sands GHG emissions: 2009–22

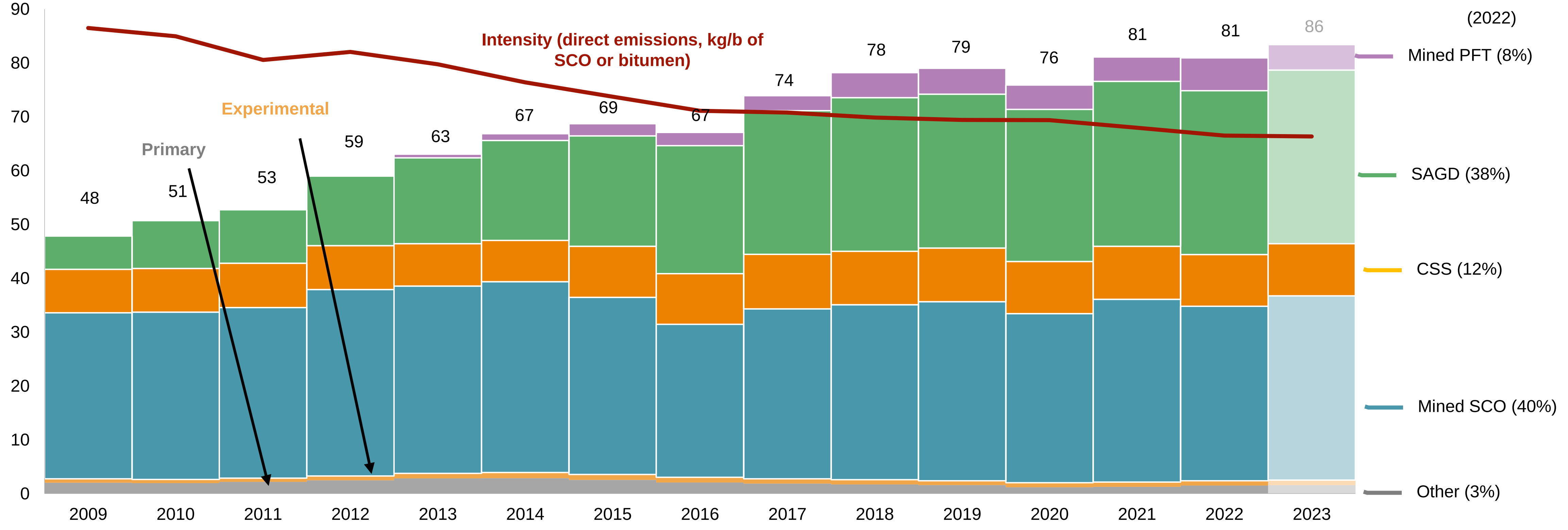
- **Over the past 13 years (2009–22), the oil sands GHG intensity declined by 23% while supply more than doubled, leading to a 70% rise in absolute emissions.*** The average GHG intensity of oil sands crude fell 20 kilograms of CO_2 equivalent per barrel ($kgCO_2e/b$), to 67 $kgCO_2e/b$ in 2022. Meanwhile supply rose 2.2 million b/d, leading to a rise of 33 million metric tons of carbon dioxide equivalent ($MMtCO_2e$) in absolute emissions to 81 $MMtCO_2e$.
- **The majority of the improvements came from mining improvements.** GHG intensity of oil sands mining fell 39% or 46 $kgCO_2e/b$ from 2009–22. Improvements in legacy integrated mined SCO operations coupled with newer, less GHG-intensive mined dilbit facilities contributed to most of the intensity reductions.
- **The expansion of comparatively lower intensity SAGD also worked to pull down the industry average.** SAGD emission intensity fell 5% from about 64 $kgCO_2e/b$ to 61 $kgCO_2e/b$ in 2022. Meanwhile, the GHG intensity of cyclic steam stimulation (CSS) rose by 12 $kgCO_2e/b$ to 108 $kgCO_2e/b$ in 2022.
- **There is great variability in oil sands GHG intensity, spanning roughly 116 $kgCO_2e/b$ — from 42 $kgCO_2e/b$ to 158 $kgCO_2e/b$ in 2022.** This result means that the most GHG-intensive operation was nearly fourfold greater than the least intensive operation.

* The recent study titled “Greenhouse gas intensity of western Canadian condensate” by Commodity Insights suggests the GHG intensity of oil sands marketable product declined 25%, or 2% more than previously reported as a result of changes in the GHG intensity of condensate diluent used in the oil sands.

Source: S&P Global Commodity Insights.

Although GHG intensity has fallen over time, production growth has outstripped performance improvements

Composition of absolute oil sands emissions vs. intensity (MMtCO_2e per year and kgCO_2e/b)



Date compiled May 12, 2023.

The Commodity Insights 2023 estimate is a projection based on historical performance, including data up to 2022.

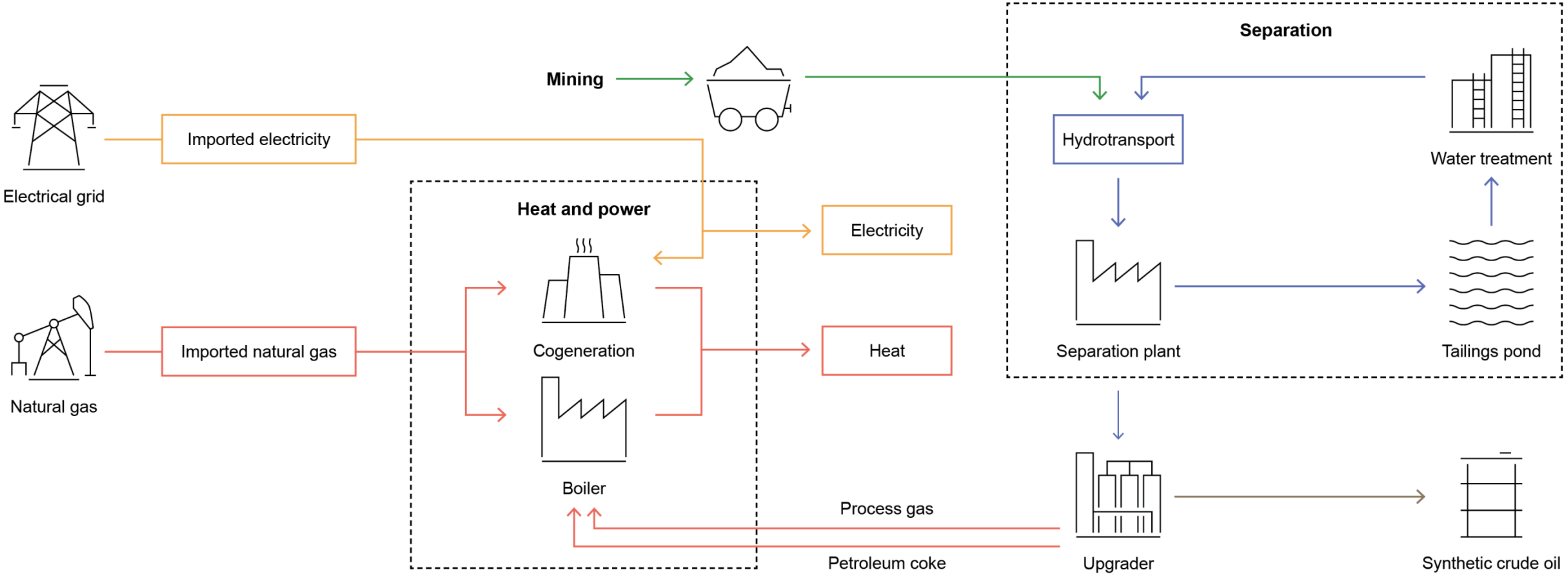
Source: S&P Global Commodity Insights.

S&P Global Commodity Insights

Canadian oil sands mining extraction

Visual depiction of an integrated oil sands mine (mined SCO)

Integrated oil sands mining schematic

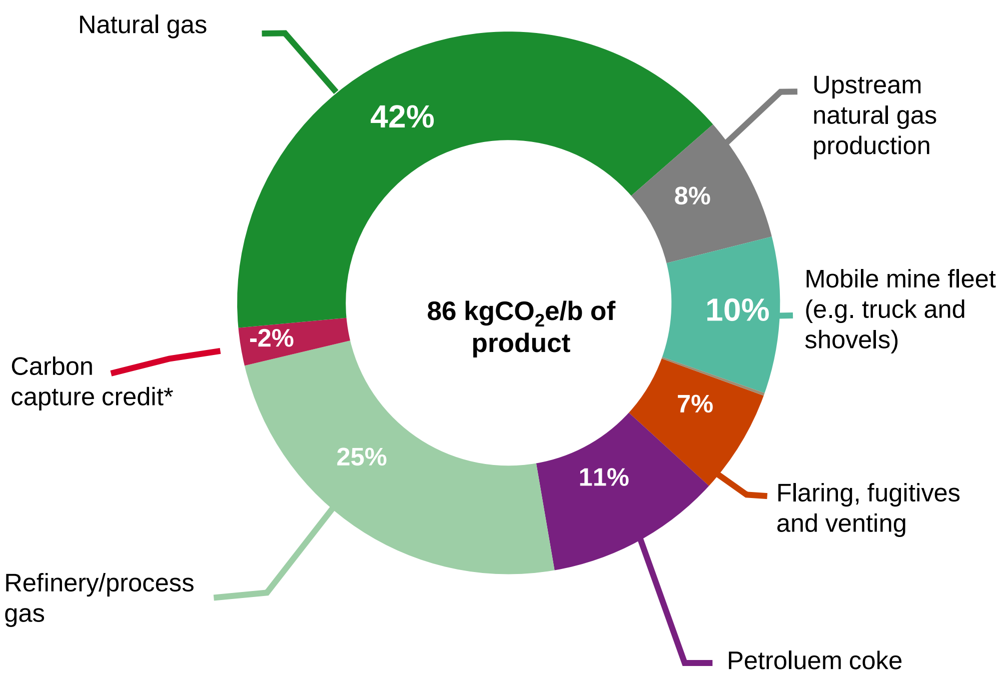


As of January 2024.
Source: S&P Global Commodity Insights.

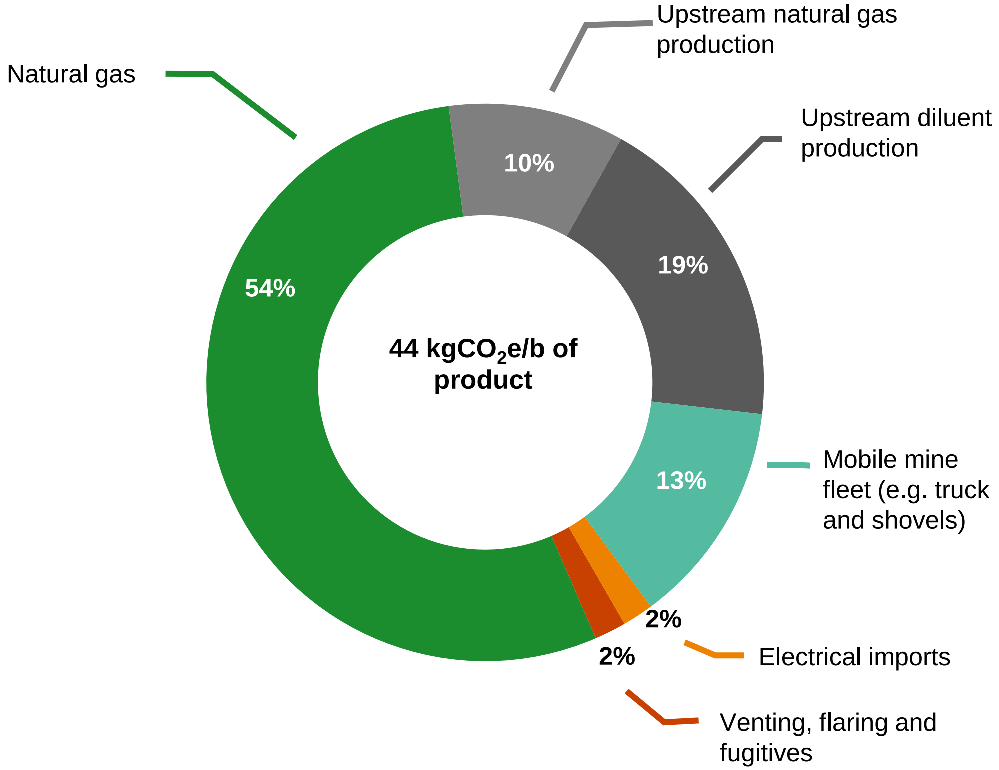
S&P Global Commodity Insights

Sources of oil sands mining emissions

Sources of average oil sands mined SCO GHG emissions in 2022 (86 $kgCO_2e/b$ of SCO)



Sources of average oil sands mined dilbit GHG emissions in 2022 (44 $kgCO_2e/b$ of SCO)



Date compiled April 2023.

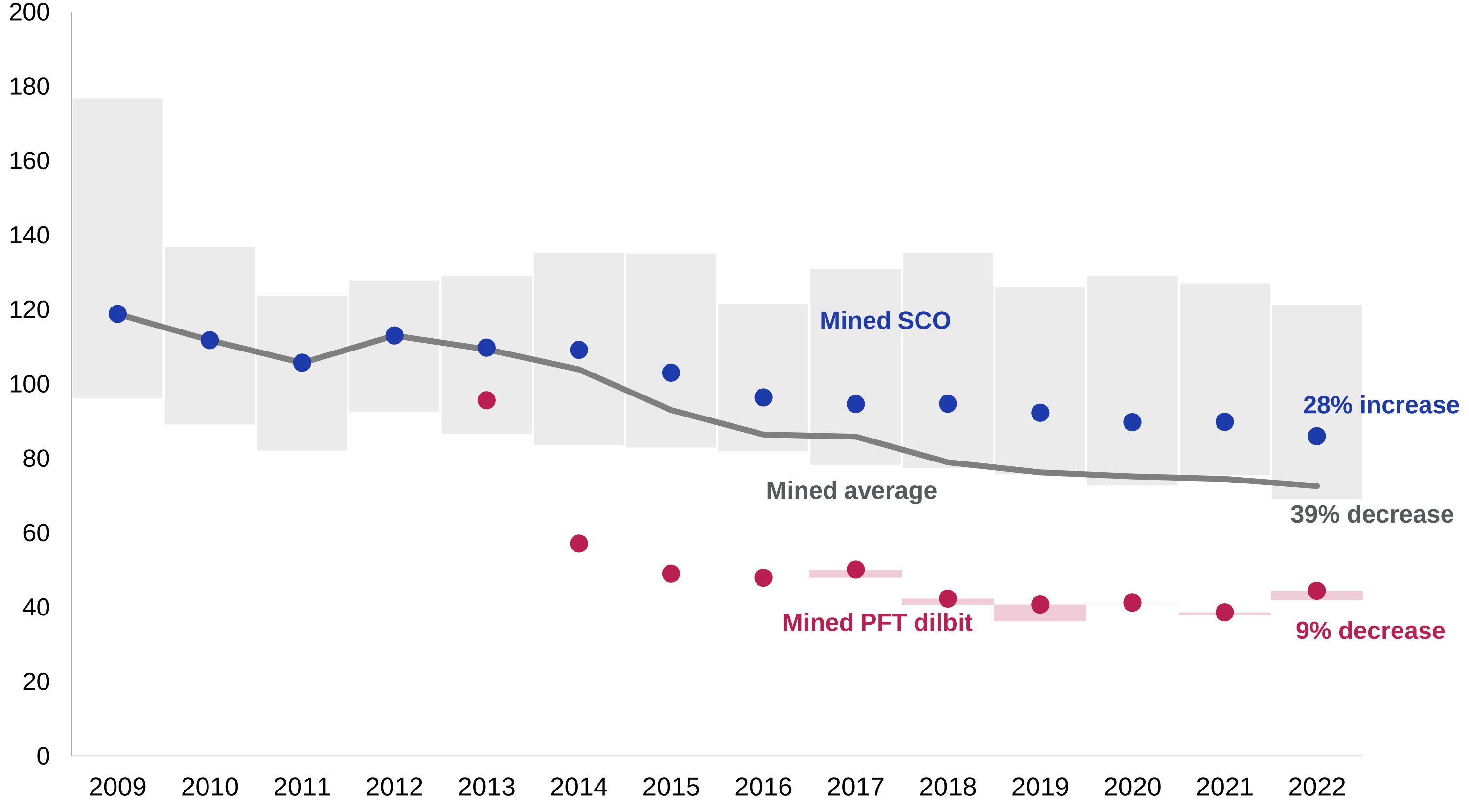
* In 2015, the Quest Project commenced operations, which captures and sequesters CO_2 emissions from an oil sands upgrader. This results in a credit against SCO emissions using the Commodity Insights system boundary conditions. This credit is applied to natural gas.

Source: S&P Global Commodity Insights.

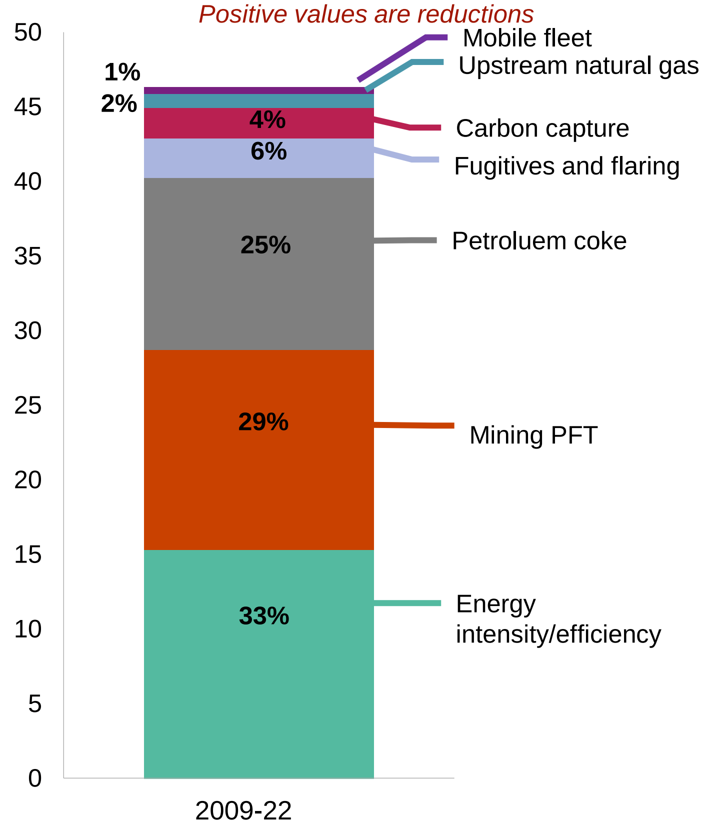
Oil sands mines saw the greatest reduction, declining 39% or 46 $kgCO_2e/boe$

Operational efficiency gains and expansion of newer, less GHG-intensive operations were the main drivers

Historical GHG intensity of mined oil sands marketable product (2009–20, in 73 $kgCO_2e/b$ of SCO or dilbit)



Source of oil sands mining GHG intensity improvement (2009–22, 46 $kgCO_2e/b$ of product)



Date compiled: May 12, 2023.

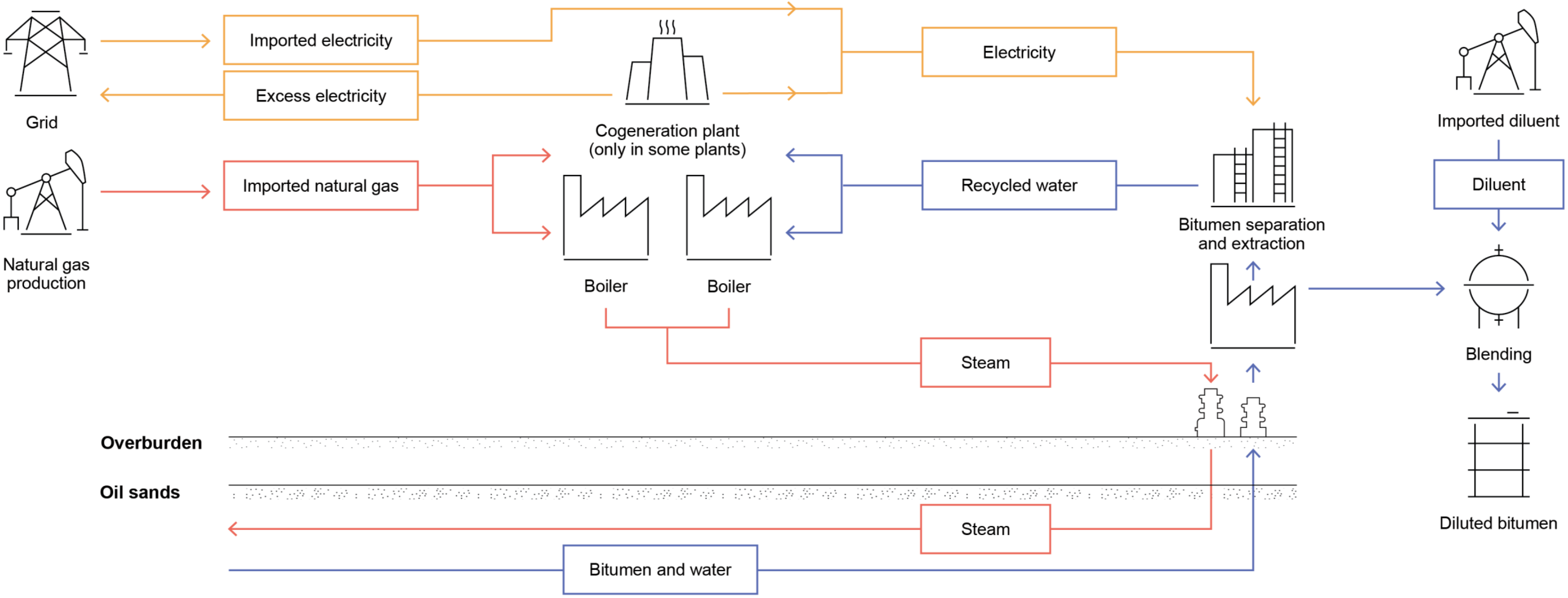
$kgCO_2e/boe$ = kilograms of CO_2 equivalent per barrel of oil equivalent.

Source: S&P Global Commodity Insights.

S&P Global Commodity Insights

Canadian oil sands thermal extraction

Thermal oil sands operations schematic



As of January 2024.
Source: S&P Global Commodity Insights.

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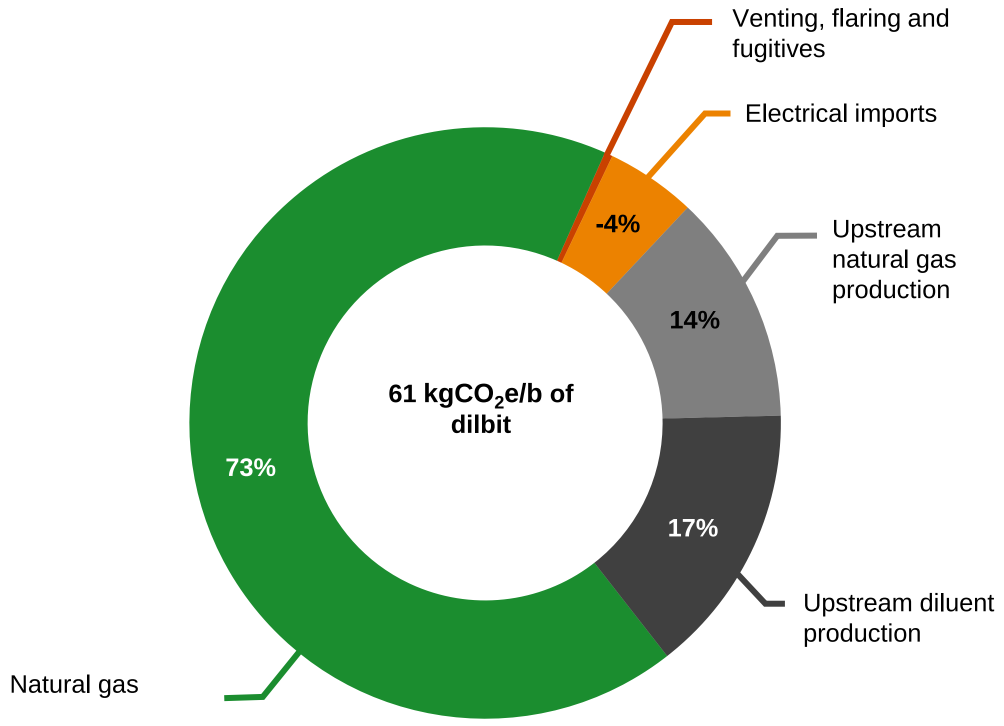
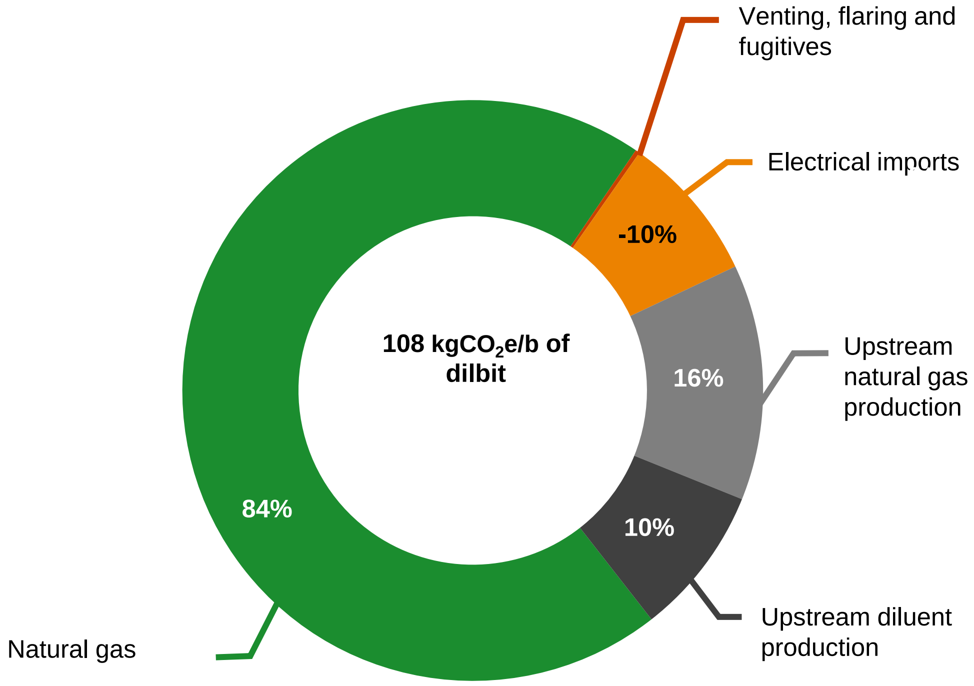
Commodity Insights

Sources of oil sands thermal extraction emissions

Sources of average SAGD dilbit GHG emissions in 2022 (61 kgCO_2e/b of dilbit)



Sources of average CSS dilbit GHG emissions in 2022 (108 kgCO_2e/b of SCO)



Data compiled April 2023.
Source: S&P Global Commodity Insights.

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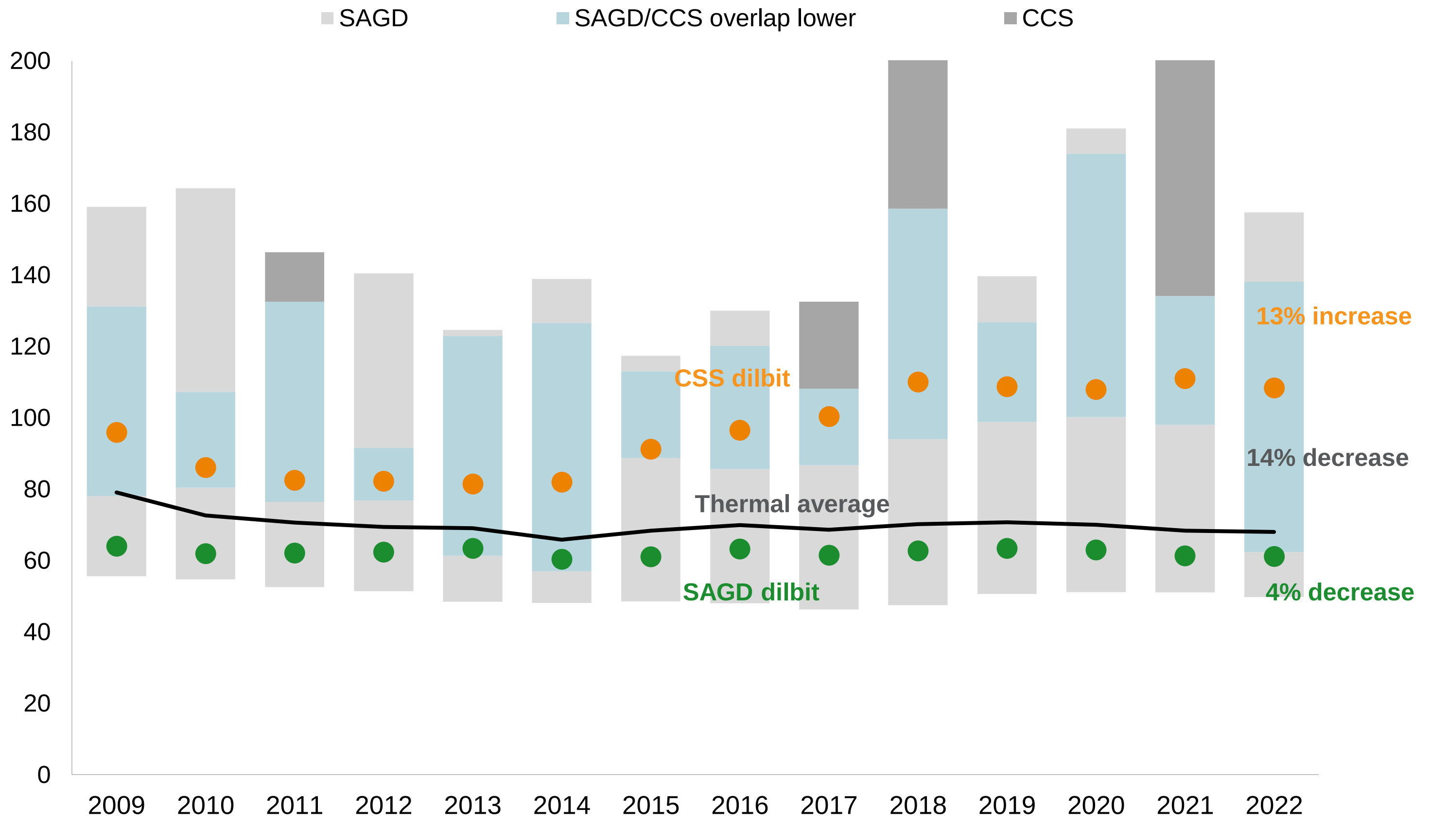
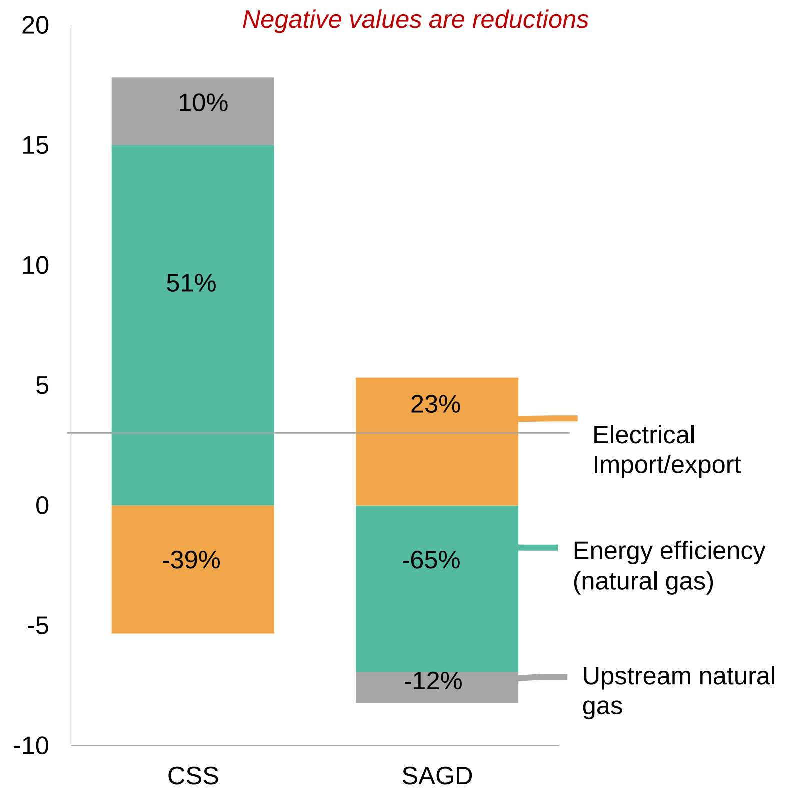
Commodity Insights

The GHG intensity of thermal operations also declined, falling 14% or about 11 $kgCO_2e$/boe principally from the ramp-up of relatively lower intensity SAGD

Historical GHG intensity of thermal in situ dilbit (2009–22 in $kgCO_2e$/b)



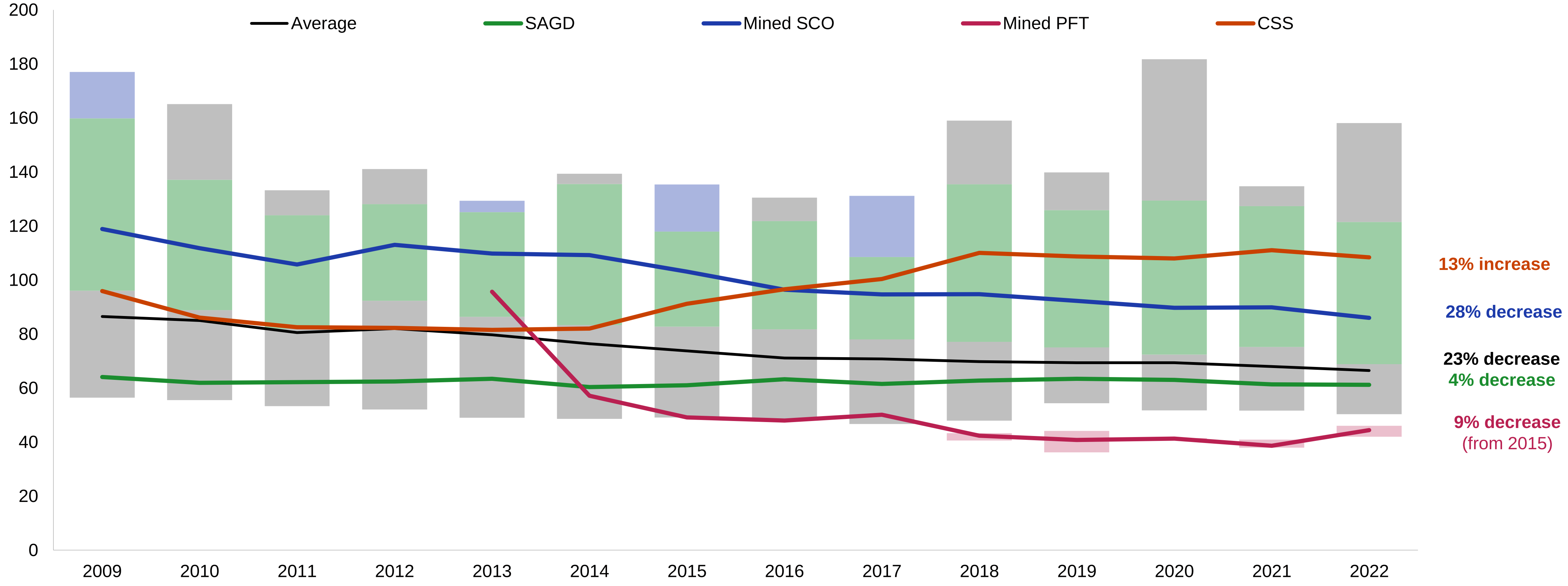
Change in SAGD dilbit and CSS dilbit GHG intensity (2009–22, -3 and +13 $kgCO_2e$/b of dilbit, respectively)



Data compiled May 24, 2023.
Thermal average includes CCS and SAGD only.
Source: S&P Global Commodity Insights.

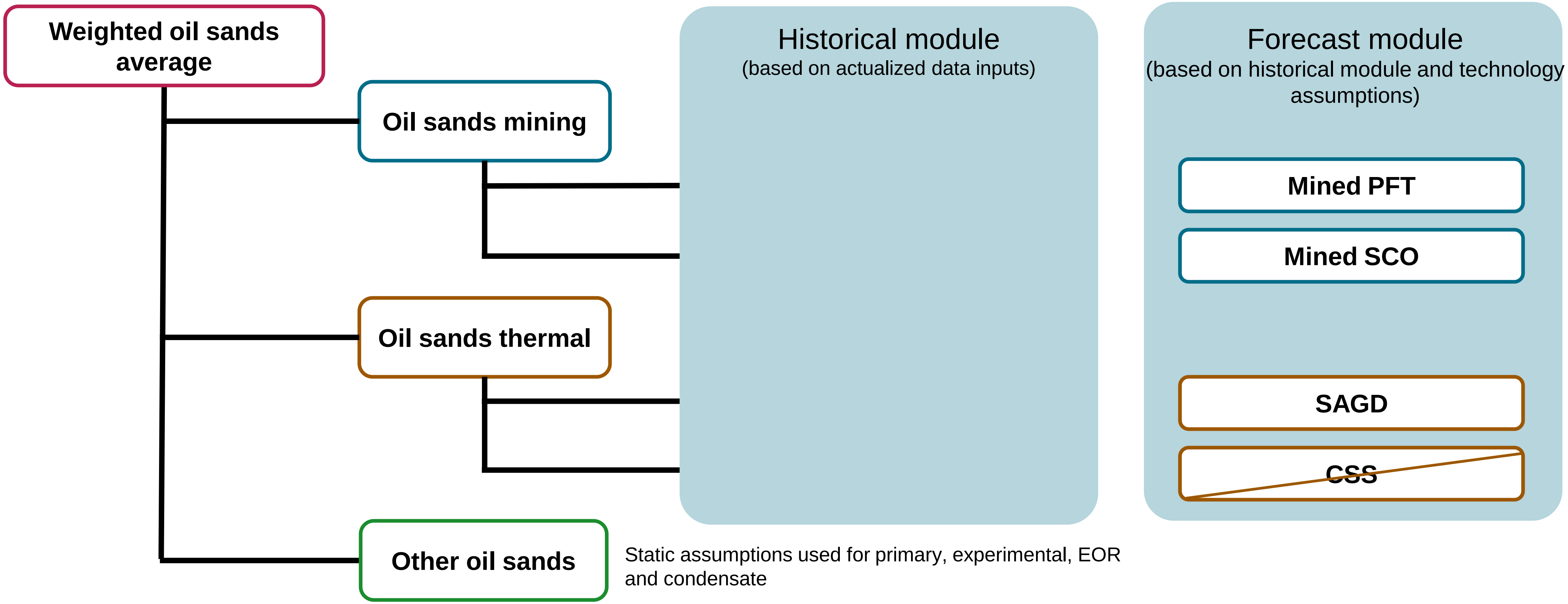
The Canadian oil sands have an established trend of GHG intensity reductions falling 23% since 2009 or about 1.5 kgCO2e/boe on average

Range and average of GHG intensity of oil sands extraction by year and by technology (2009–22 in kgCO_2e/b of marketed product)



Data compiled May 10, 2023.
Source: S&P Global Commodity Insights.

The oil sands emission model is composed of two separate models, with both a historical and forecasting component (really four-plus models)



Source: S&P Global Commodity Insights.

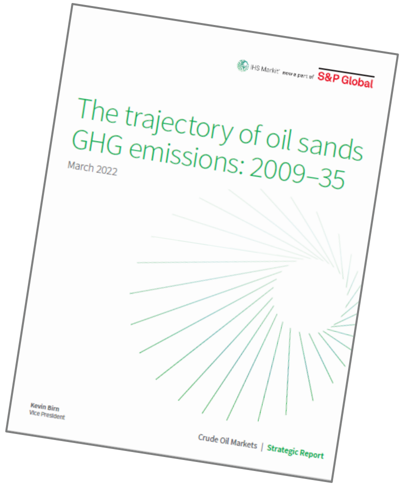
To explore future oil sands emissions, four scenarios were considered

- **Key question:** How could oil sands' GHG emissions intensity and absolute emissions evolve to 2035?
- **Production outlook:**
  All scenarios based on 2020 base case: production growth of approximately 1 million b/d to about 4 million b/d by 2035
- **Efficiency improvement and technology deployment:**
  - **Case 1 —** Conservative efficiency and technology gains
  - **Case 2 —** More aggressive efficiency and technology gains

  When in doubt, biased to conservative outcome and combined together form the Existing Trends pathway

  - **No improvement** (current operating intensity held constant again production)
  - **Optimization case** – Essentially, the S&P Global forecasting model runs off of existing historical facility baselines. Over the past half decade, this baseline has been unstable. This case attempts to correct for market instability.

Guiding principals: Includes only near-commercial and commercially available technology with relatively low abatement cost, except for CCS



Source: S&P Global Commodity Insights.

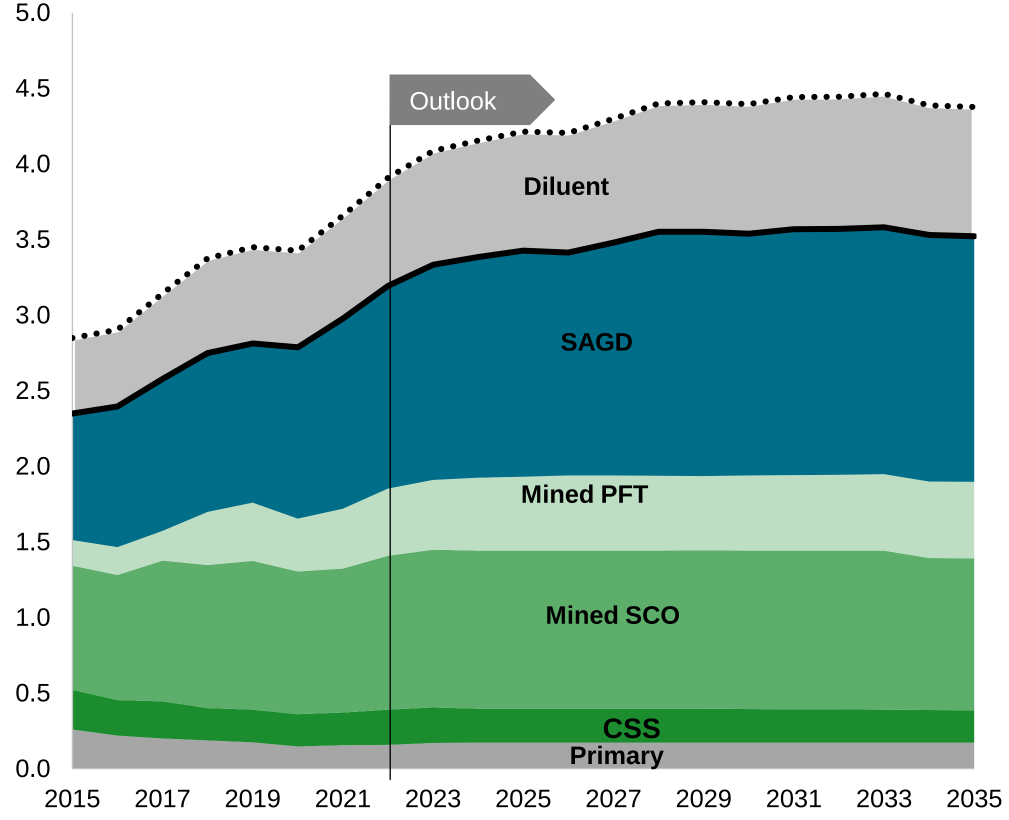
Forecasting emissions requires considering multiple factors

- **Production growth.** An understanding or view about where and what will grow.
- **Facility and operational baselines.** Historical GHG intensity performance of fuel, energy and emission sources within a facility or operation.
- **Potential emission reduction technologies.** An understanding of how proposed technologies work, but also how they may impact operations is critical as technologies often add and subtract emissions.
- **Operational characteristics.** Understanding of any market limitations, instabilities or future considerations such as reservoir quality.

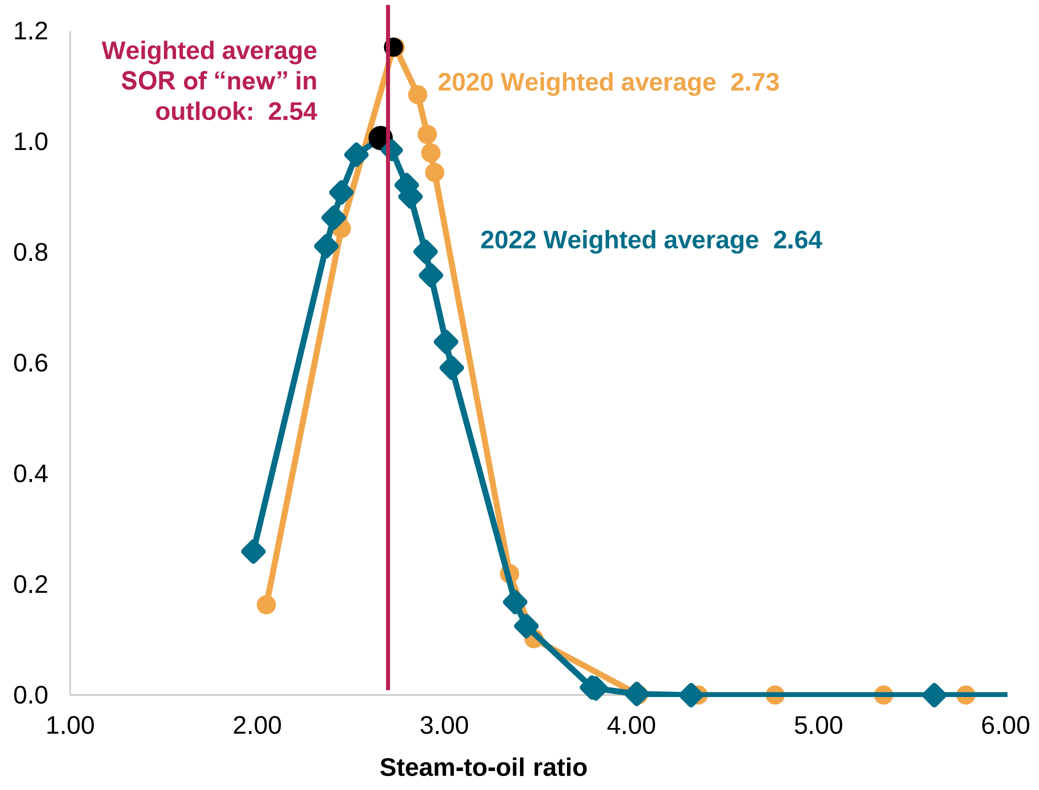
Source: S&P Global Commodity Insights.

What and when it grows can be material to future emissions, not only as it relates to volume but also the efficiency of future output

Sources of oil sands supply growth (past 2015–20, and future 2021–35)



Distribution of SAGD SOR compared with weighted average SOR of projects in outlook



Data compiled May 23, 2023.

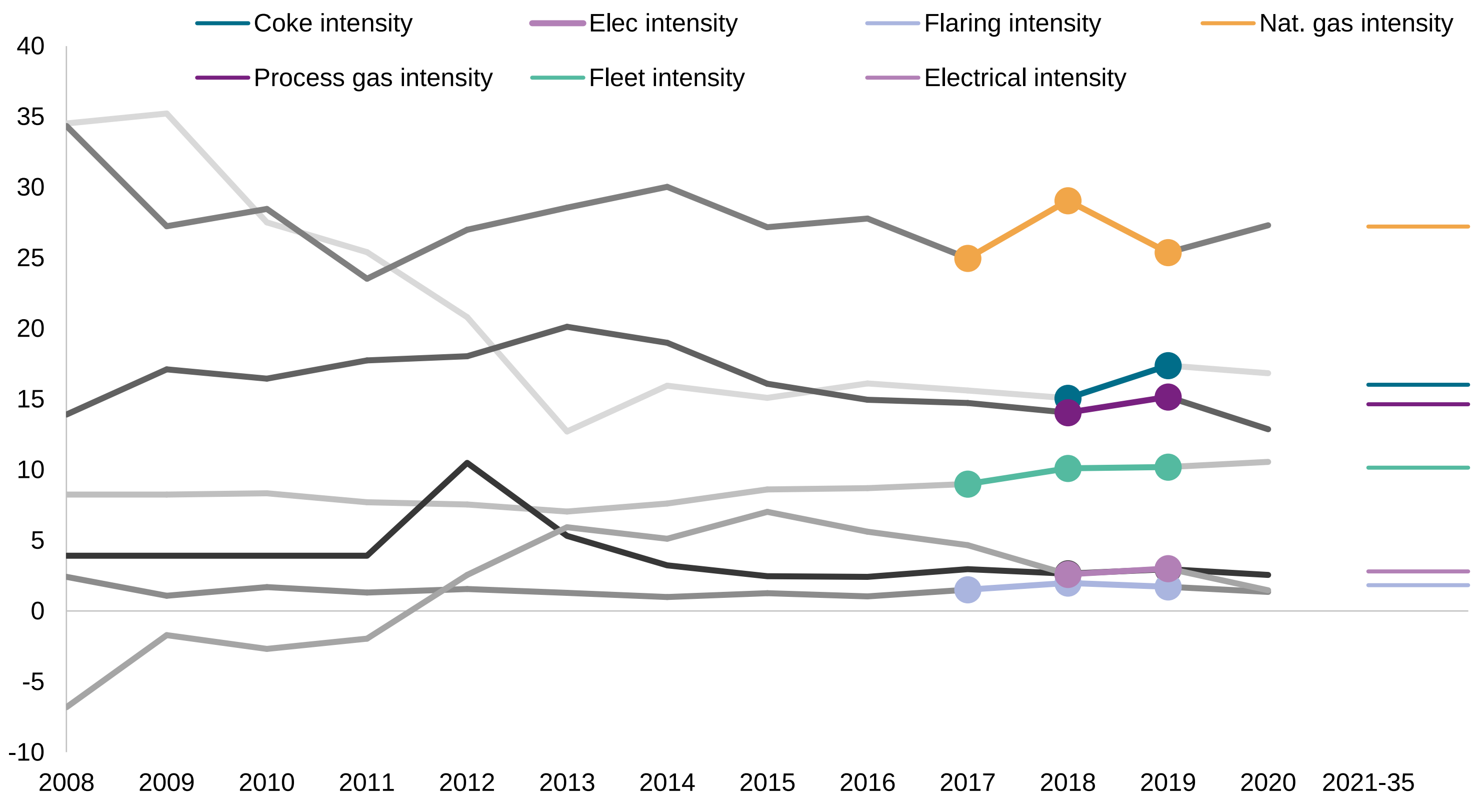
SOR = steam-to-oil ratio.

Source: S&P Global Commodity Insights.

S&P Global Commodity Insights

GHG emission forecasting requires understanding historical performance by emissions source

Historical Suncor Energy Inc. mine intensity (kgCO_2e/b by source)



- Within a given country, region, field or play, performance will vary down to individual fuels.
- Technologies and efficiencies will impact how individual fuels are used, along with the overall operations energy balance.
- Over time, facilities will evolve, making prior behavior less reflective of current reality.
- For each oil sands operation, a unique baseline for each source of emissions was established.

Data compiled 2022.
Source: S&P Global Commodity Insights.

S&P Global sought to model the implication of commercial and near commercial technologies on oil sands GHG emissions

MINING

	Existing trends (higher)	Existing trends (lower)
Process temperature	• Mined SCO -6 degrees C • Mined PFT -3.25 degrees C	• Mined SCO -10 degrees C • Mined PFT -4.5 degrees C
Cogeneration	• 998 MW	• 1,133 MW
Fuel switching (coke to gas)	• 50% reduction (50,000 metric ton per year reduction)	
Mine fleet	• Biodiesel: 3.5% blend • Autonomous: approximately 1% productivity improvement	
CCS	• 4.5 MMt (net 3.6)	• 6.9 MMt (net 5.5)

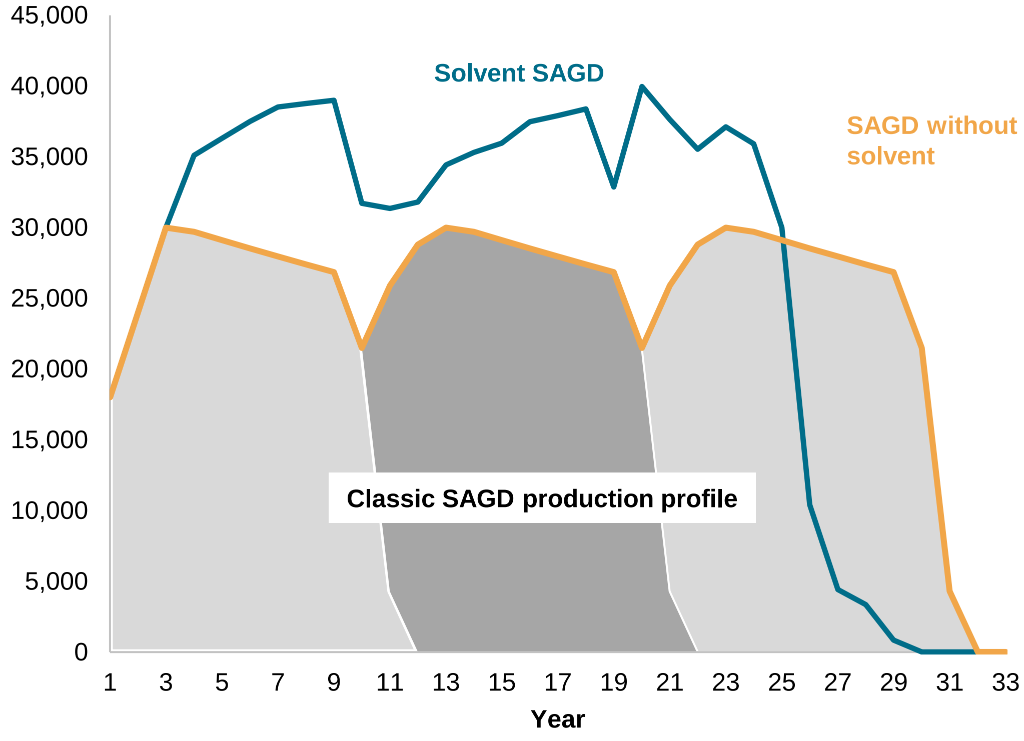
SAGD

	Existing trends (higher)	Existing trends (lower)
Steam generation efficiency	• 6% improvement in stream generation efficiency	
Cogeneration	• 0 (One 85 MW unit per 125,000 b/d capacity)	• 2 x 85 MW units (One 85 MW unit per 80,000 b/d capacity)
Well productivity	• 10.5% increase (9% weighted)	• 14% increase (11% weighted)
Steam displacement technologies	• 25% displacement of steam (weighted 22%)	• 40% displacement of stream (weighted 35%)
CCS	• 0.7 MMt (net 0.6)	• 1.4 MMt (net 1.1)
New project performance	• Average SOR of new projects estimated to be 2.57 vs. 2.74 average of industry in 2020	

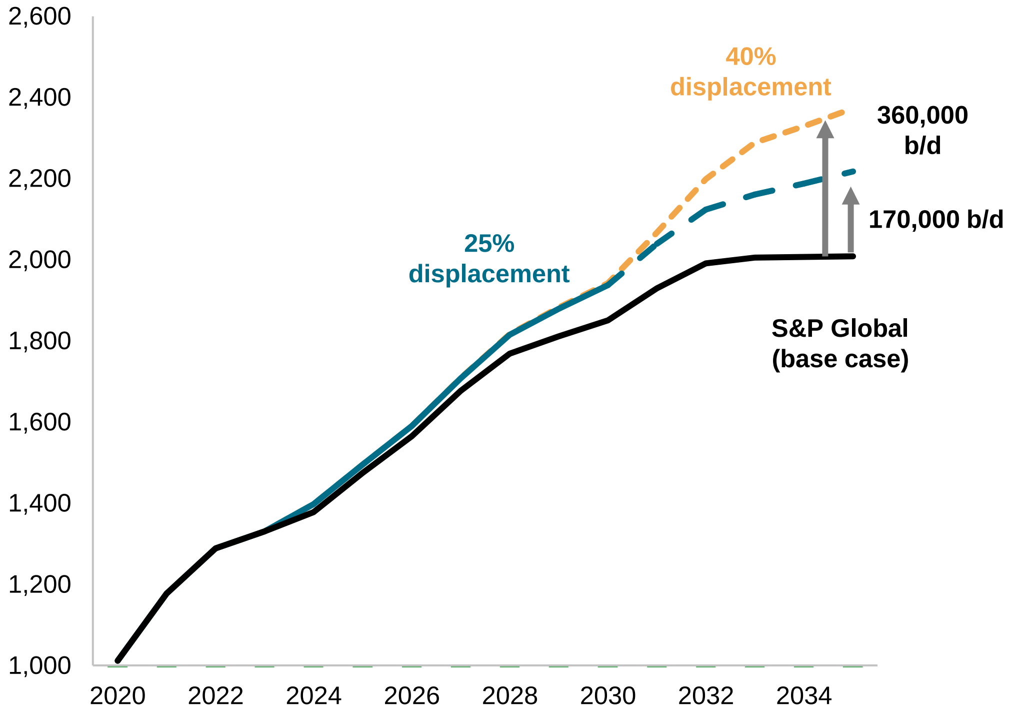
Source: S&P Global Commodity Insights.

Some technologies influence multiple aspects of operations; for example, stream displacements impact not only natural gas intensity but production

Hypothetical production comparison of traditional 30,000 b/d SAGD versus SAGD with 20% co-injection beginning in year three (thousand b/d)



Comparison of effect of displacement assumptions on oil sands production outlook (thousand b/d)

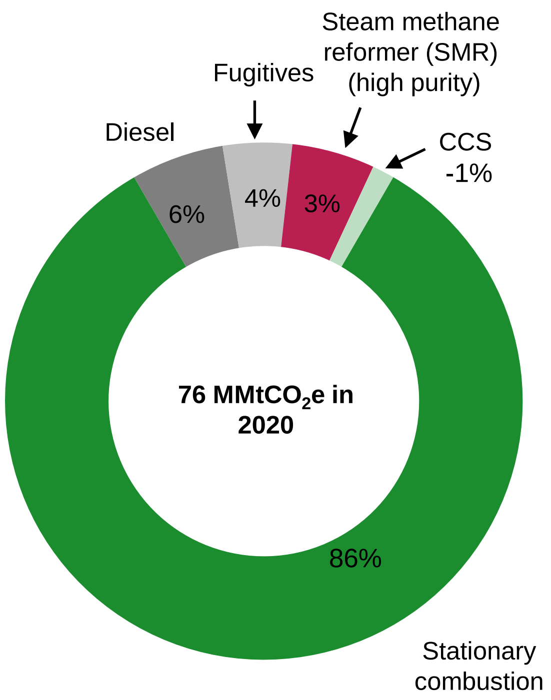


Data compiled 2022.

Source: S&P Global Commodity Insights.

Some technologies have technical limitations to the pace at which they can be deployed — cost, labor and prerequisites

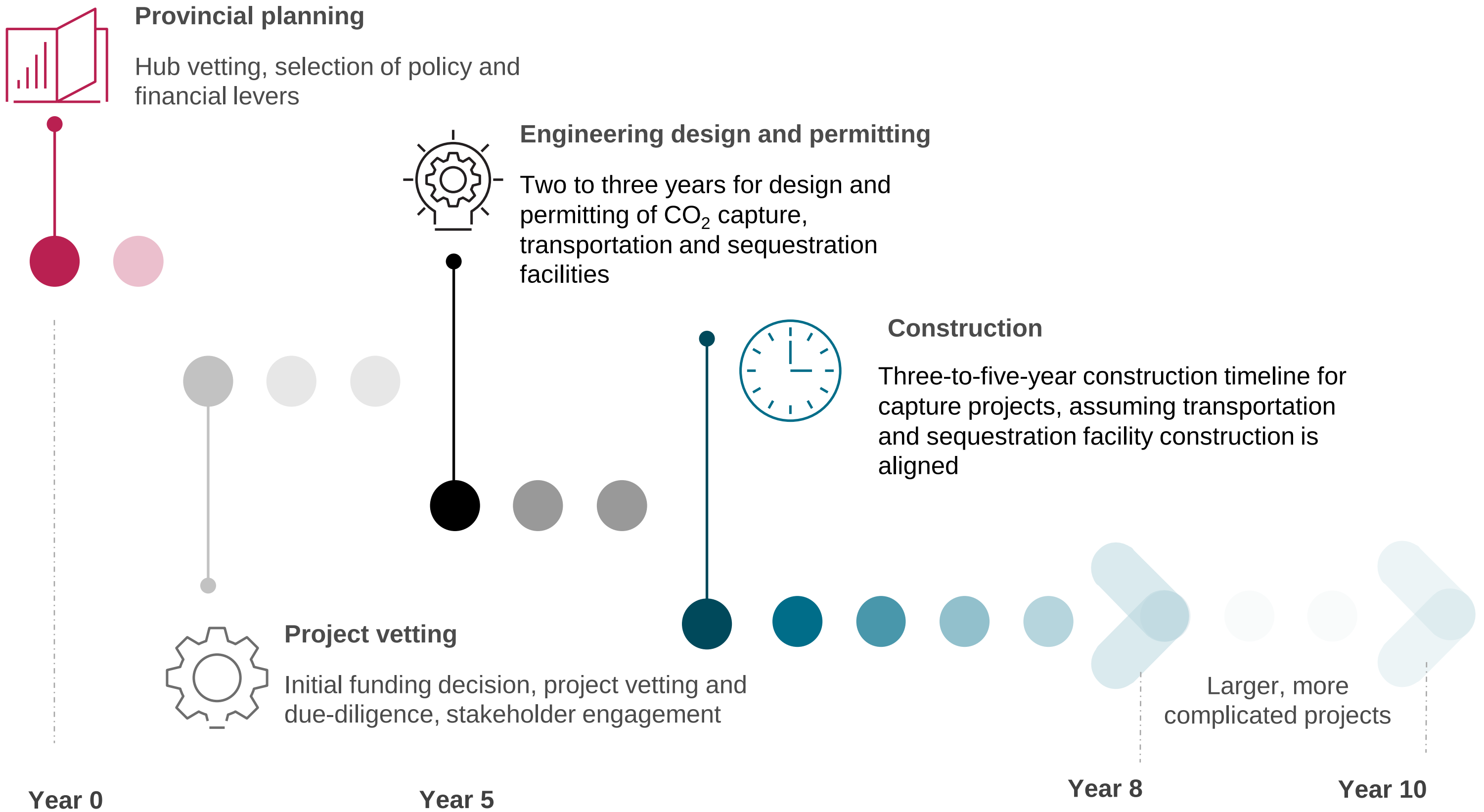
Oil sands GHG emissions by source in 2020



Data compiled 2022.

Source: S&P Global Commodity Insights.

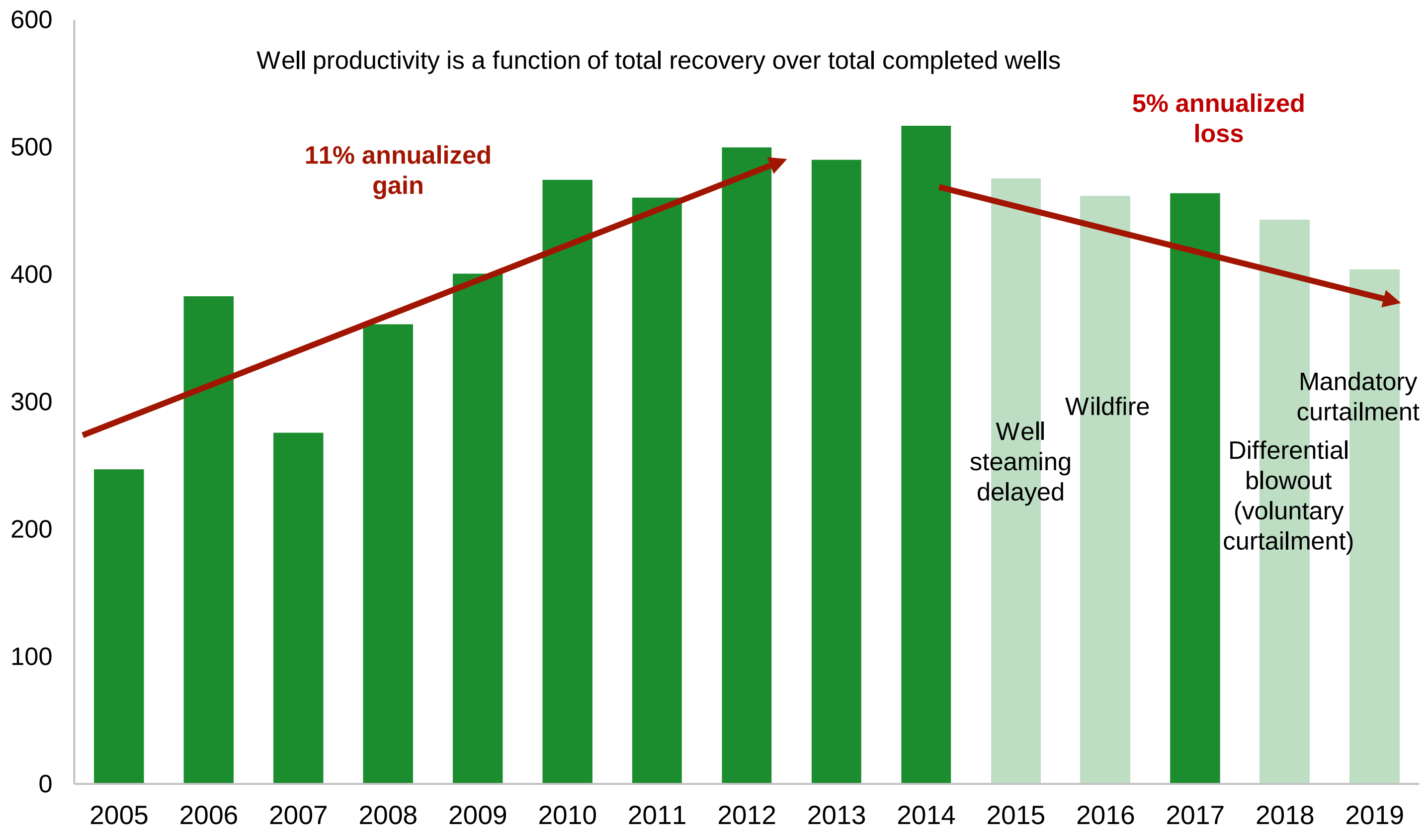
High-level development timeline — CCS project example



Market factors can influence past and future operations in unpredictable ways

Well productivity is a function of total recovery over total completed wells. Market factors may have contributed to recent productivity losses, and we expect some losses may be recouped (which we are seeing)

Annual productivity of SAGD well pairs (b/d)



Data Compiled 2021.

Data excludes well cumulative production less than 1,000 barrels.

Source: S&P Global Commodity Insights.

From 2005 to 2014, well productivity nearly always increased.

From 2015 to 2019, well productivity nearly always decreased.

Except for 2017, every year from 2015 to 2019 there was a market disruption that materially impacted operations.

- 2015 — Dramatic price deflation caused some operations to throttle output. Others shut-down temporarily and some permanently.
- 2016 — The Fort McMurray wildfire caused several facilities to undertake controlled, and in some instances, emergency shut-downs.
- 2018 — The Western Canadian differential blowout caused several operations to throttle output and/or temporarily shut-in.
- 2019 — Alberta Curtailment mandated production quotas that impacted operations.

Future oil sands emissions (existing trends): 2020–35 key messages

Early in 2022, S&P Global released its Existing Trends outlook to 2035, which considered a reasonable pace of commercially available or near-commercial technologies based on emissions data to 2020.

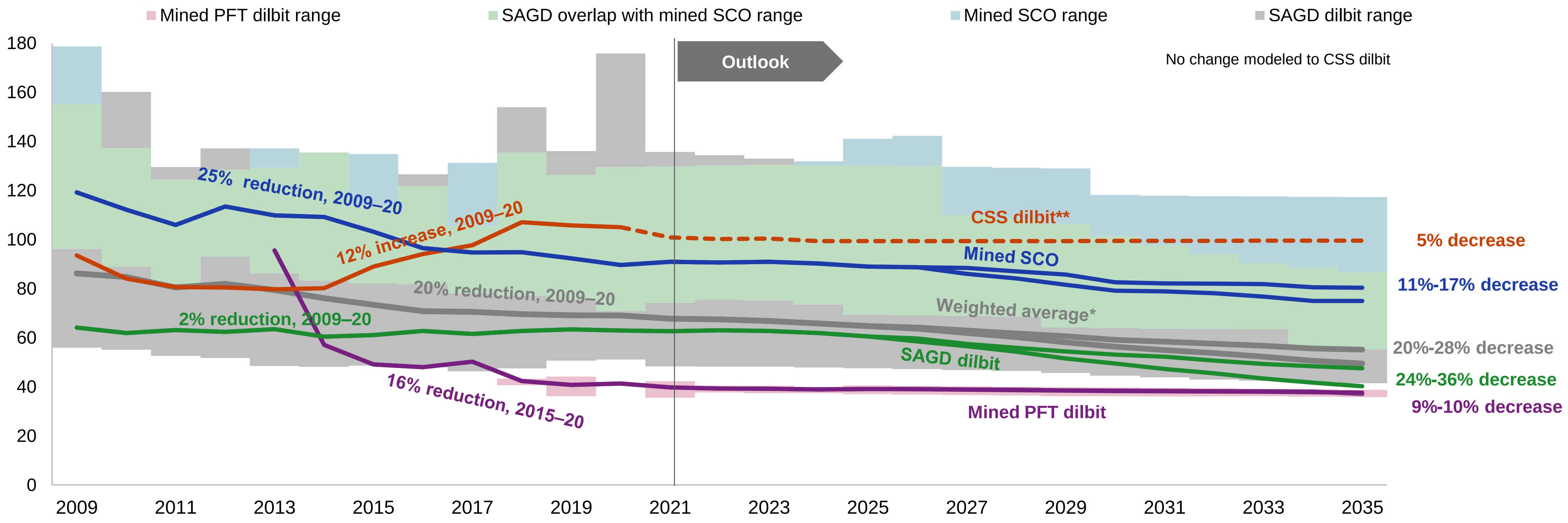
Key findings included:

- **The anticipated rise in oil sands production leads to a peak in absolute oil sands emissions around 2025–26 between 88-89 MMtCO_2e, 7–8 more than today.**
- **The level of oil sands abatement required by a future date is greater than historical baselines will indicate.** Production growth will contribute to lower GHG intensity, but higher levels of absolute emissions.
- **It was difficult to see material changes in oil sands emissions prior to 2030 — the level of absolute emissions reductions by 2030 was relatively modest, with more material reductions possible by 2035.** Albeit based on a relatively conservative set of assumptions, the study found a high degree of alignment in trajectories to 2030, and that it was only after this point that different pathways materially begin to emerge.
- **Although GHG intensity reductions will come from a variety of sources, CCS and steam displacement technologies were found to be pivotal in future oil sands.**

Source: S&P Global Commodity Insights.

Existing Trends recorded a 20% decline in GHG intensity over last 10 years, and potential additional reduction of 20%-28% more from 2020–35

Average and range of oil sands GHG intensity by year ($kgCO_2e/b$ of marketed product)



Data compiled 2023.

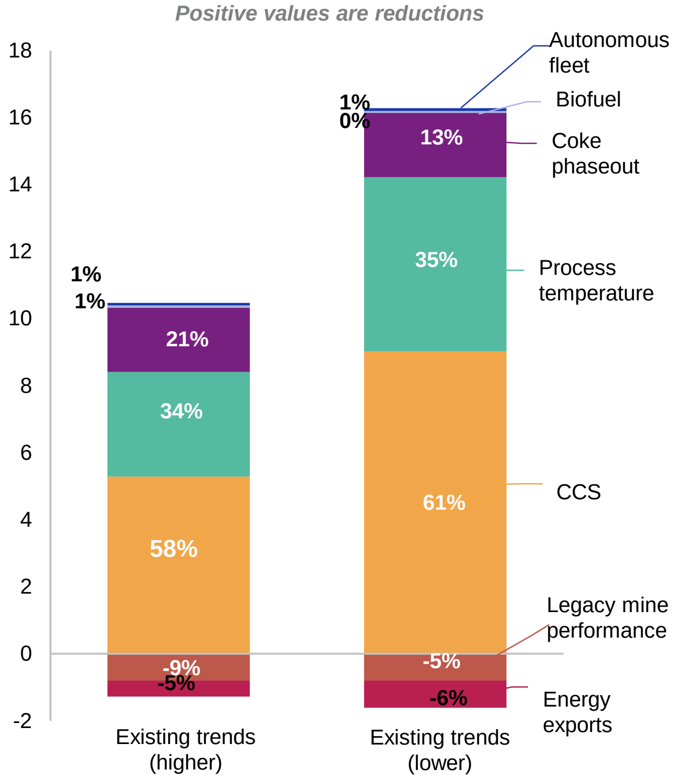
* Estimate of weighted average includes oil sands CSS; SAGD; mined SCO; mined dilbit; and primary, experimental and EOR.

** Historical estimates for CSS were included with no modeled improvement in outlook, which is why the outlook is presented as a dashed line in the figure. Estimates for primary were taken from a prior S&P Global report (cited at the end of this note), with the same values being applied to experimental and EOR. Primary, experimental and EOR accounted for about 5% of oil sands production in 2021, where it is expected to remain through 2035. Ranges shown for mined PFT dilbit, SAGD dilbit and mined SCO are from a more conservative existing pathway case. Note that prior to 2018, there was only one operating mined dilbit (PFT) facility and thus no range. Source of prior estimates: S&P Global Strategic Report *Comparing GHG Intensity of the Oil Sands and the Average US Crude Oil*.

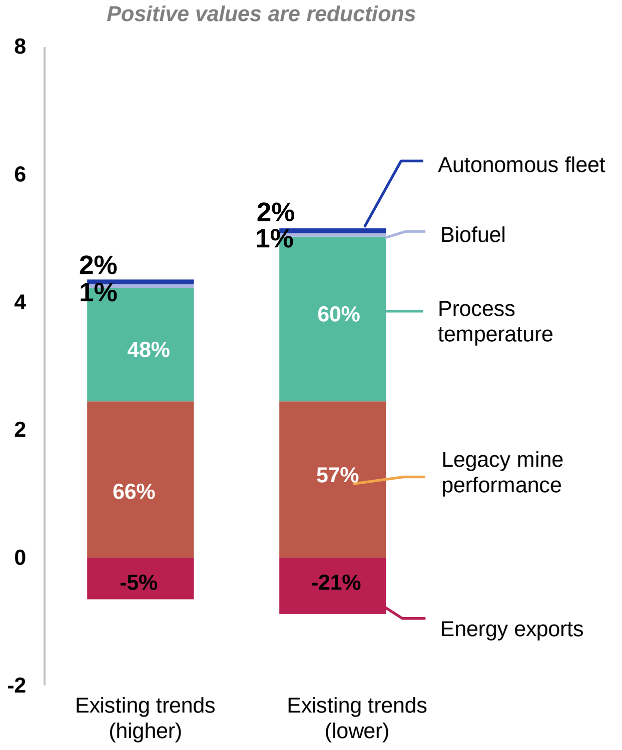
Source: S&P Global Commodity Insights.

The ramp-up of lower GHG intensity operations and the deployment of CCS as well as steam displacement technologies dominate emission reductions

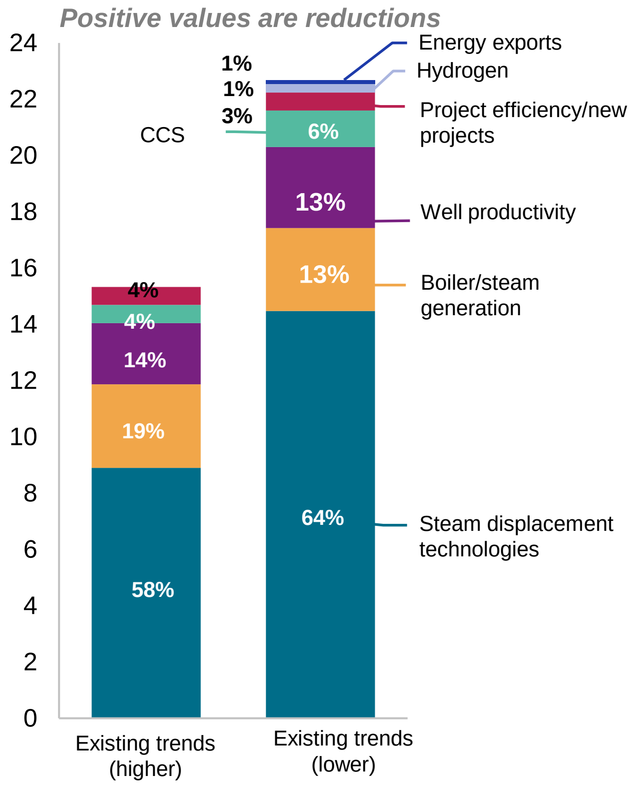
Existing trends sources of change in mined SCO GHG intensity, 2020–35 (9-15 kgCO_2e/b of SCO)



Existing Trends sources of change in mined PFT dilbit GHG intensity 2020–35 (4-5 kgCO_2e/b of dilbit)



Existing trends sources of change in SAGD GHG intensity, 2020–35 (15-23 kgCO_2e/b of dilbit)



Data compiled: 2022.

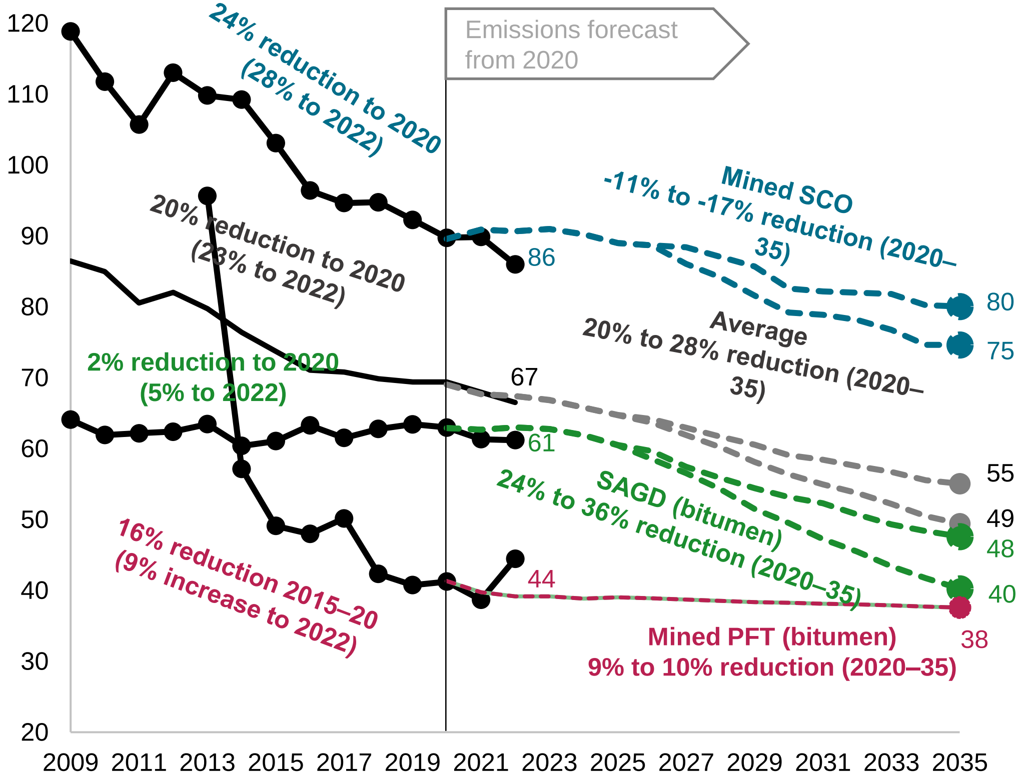
Source: S&P Global Commodity Insights.

S&P Global Commodity Insights

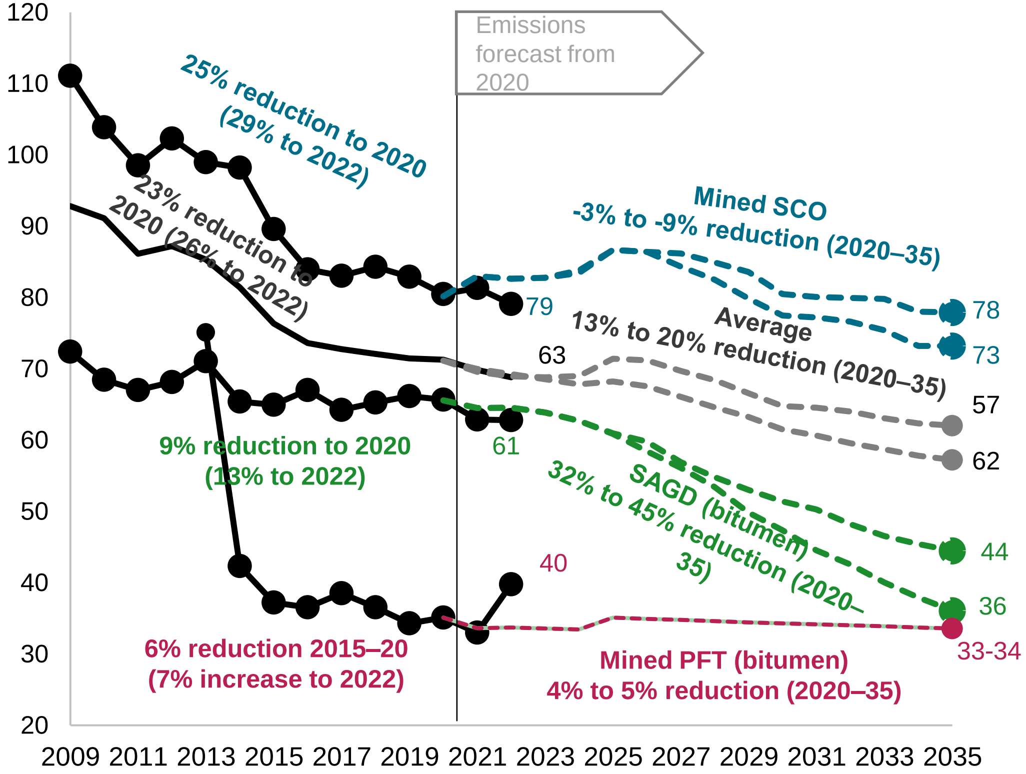
GHG intensity of oil sands under emission boundaries consistent with upstream state of life-cycle analysis versus direct emissions.

Past projections based on 2020 actualized data compared with recent actuals up to 2022

GHG intensity of oil sands production consistent with upstream stage of life-cycle system boundaries (kgCO_2e/b of output SCO or dilbit)



GHG intensity of oil sands production consistent with direct on-site (scope 1) system boundaries (kgCO_2e/b of output SCO or bitumen)



Data compiled May 28, 2023.

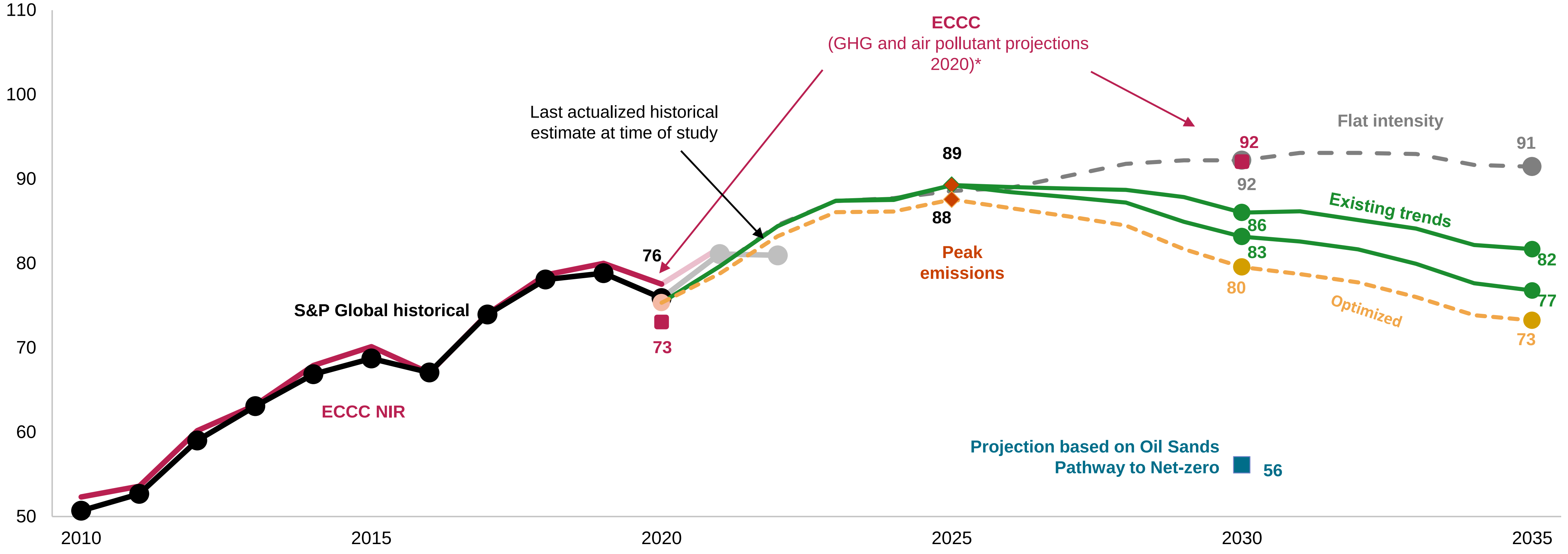
Solid black lines denote actualized historical estimates. Hash lines denote projections.

Source: S&P Global Commodity Insights.

S&P Global Commodity Insights

Our analysis points to a peak and gradual decline in oil sands emissions within the next few years, but also makes clear the level of industry ambition

Absolute oil sands GHG emissions projections to 2035 compared against other announcements and outlooks (MMtCO_2e per year)



Data compiled 2022.

ECCC = Environment and Climate Change Canada.

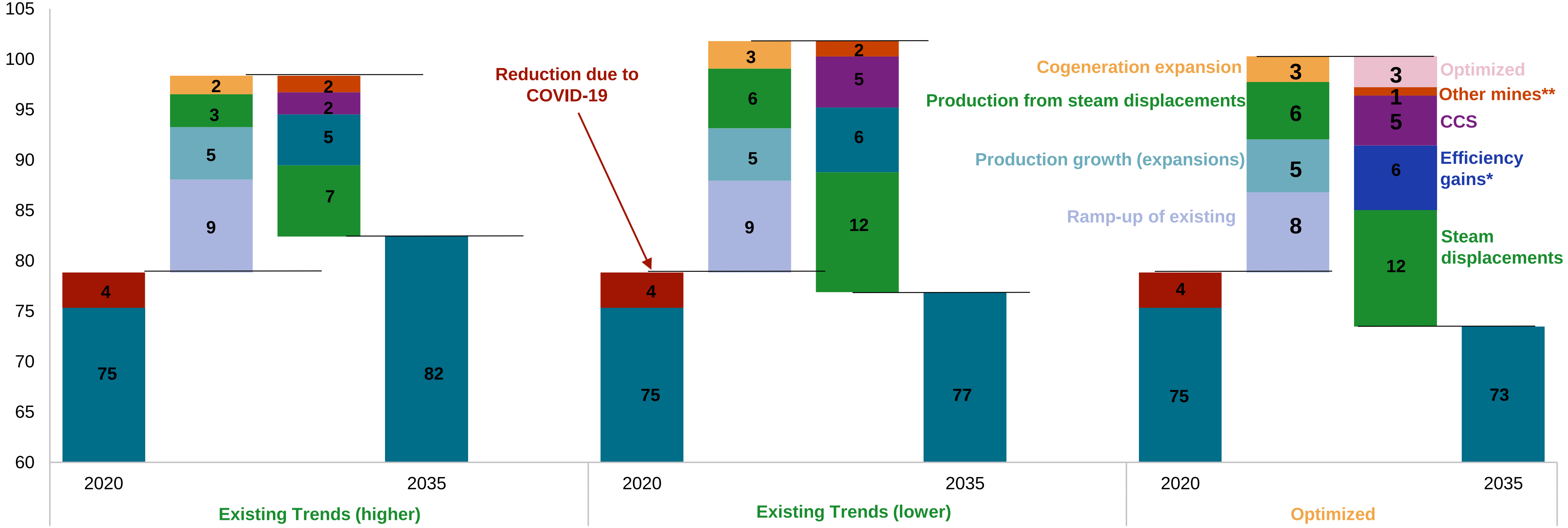
* ECCC NIR and projections have been adjusted to align to same facilities as S&P Global outlook.

S&P Global Commodity Insights projection of announced ambition only considers announcements made at the time of publication. This is further complicated by companies' use of different target dates, target basis (intensity vs. absolute) and scope (corporate portfolio vs. oil sands only). S&P Global also made use of its own production and intensity expectations to develop this estimate.

Source: S&P Global Commodity Insights.

Production growth will push absolute emissions higher in the short-term, but longer-term steam displacements and CCS will overtake growth, leading to emission declines

Sources of change in Commodity Insights cases on absolute oil sands GHG emissions from 2020 to 2035 ($MMtCO_2e$)



Data compiled 2022.

* Efficiencies include mining process temperature and thermal well productivity and boiler efficiency.

** Other mines include changes in production and mobile mine fleet.

Technology improvements modeled do have cross implications. For example, in more aggressive technology assumption cases, production growth would be less GHG intensive, reducing the absolute GHG emissions.

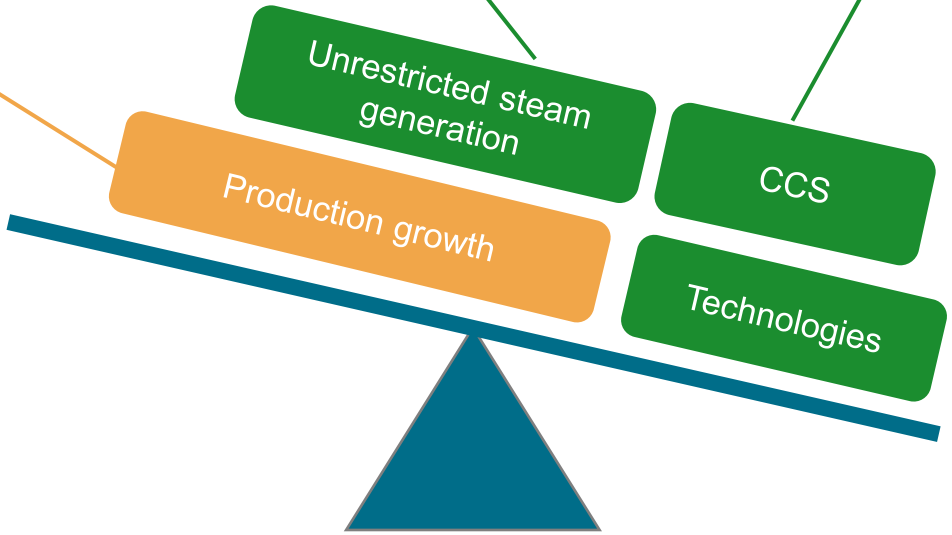
Source: S&P Global Commodity Insights.

When in doubt, conservative assumptions were made to bias the risk down and not up

Thermal oil sands facilities have limitations to steam generation. Our model solves for the steam required without limits. In some instances, this could result in over estimation of emissions or production.

Our highest case assumes gross capture of 7.9 $MMtCO_2e$ per year, whereas industry is talking about 8.5 $MMtCO_2e$.

Based on our current outlook there may be more upside production potential than down.



New technologies and efficiency gains were deployed gradually, not universally, and limited to near commercial and commercially available today and likely biased to greater improvements.

Source: S&P Global Commodity Insights.

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