

De-mystifying price differentials: A return to market fundamentals

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Canadian crude differentials explained

- Crude Quality
- Transportation
- Market Factors

Canadian crude price outlook

- Key international drivers
- Fundamentals underpinning WCS differentials going forward

Canadian natural gas differentials explained

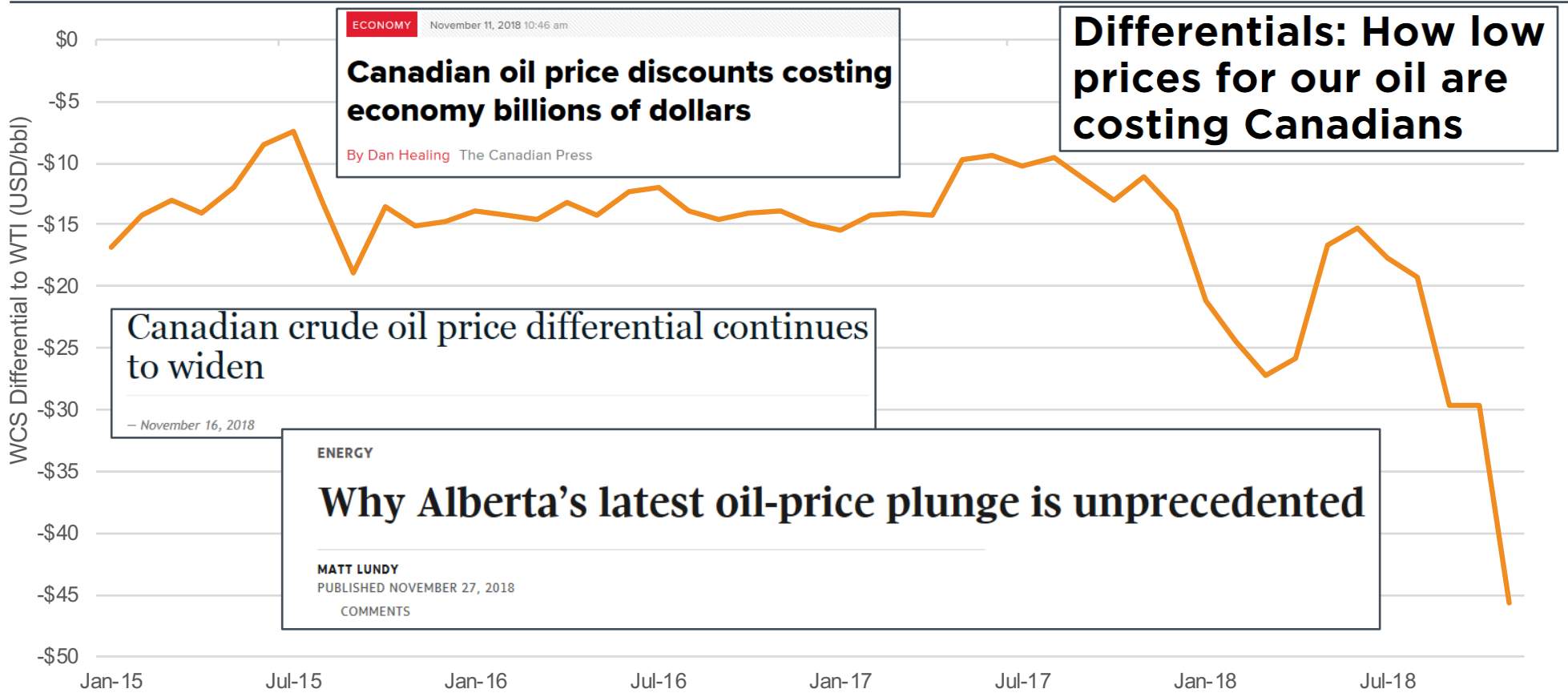
- Gas Quality
- Transportation
- Market Factors

Canadian natural gas price outlook

- Fundamentals affecting pricing at AECO in the near-medium term
- Canada's place in an evolving global natural gas marketplace

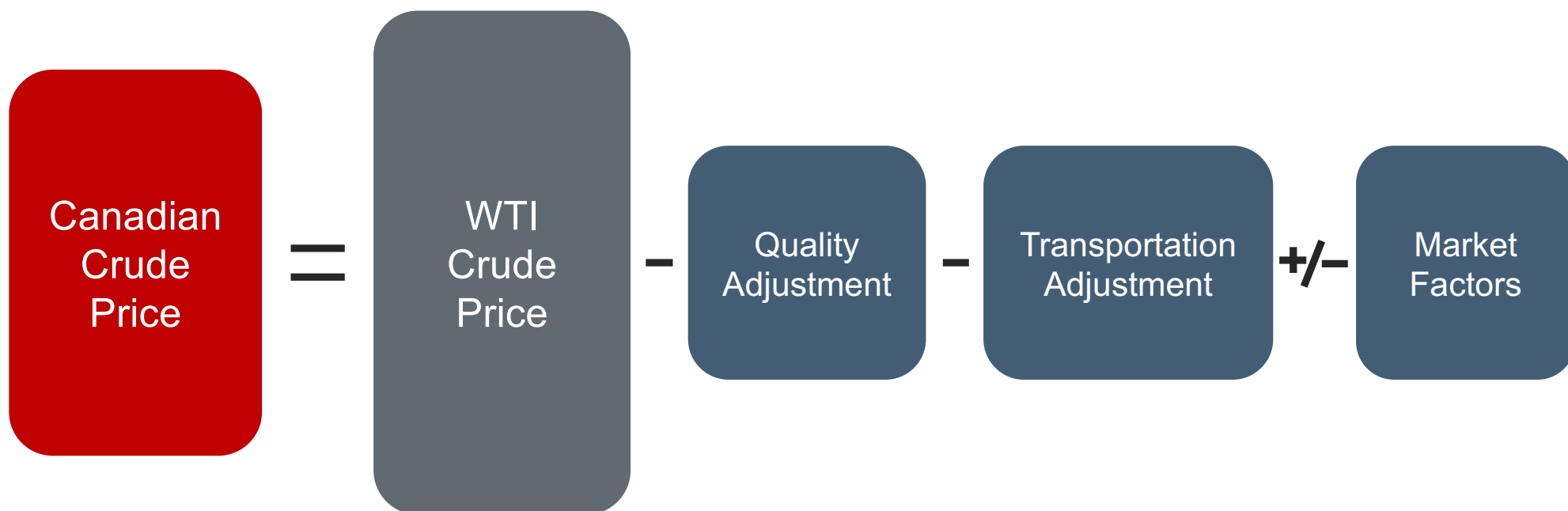
WCS Differentials to WTI

Sproule



What creates price differentials?

- Underpinned by the law of one price
- Three main factors influencing Canadian crude price differentials to WTI



Density

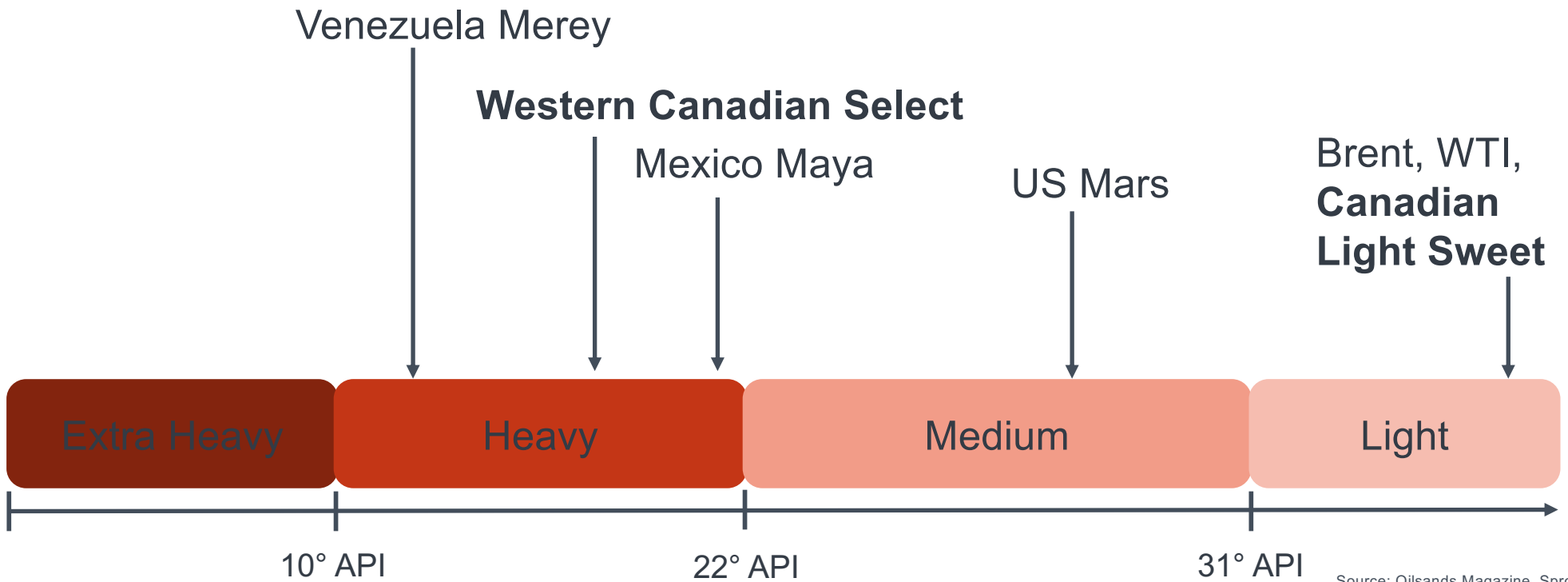
- measured in API Gravity
- ranges from light to ultra-heavy

Sulfur Content

- measured as a %
- Sweet crude = low sulfur content
- Sour crude = higher sulfur content

Canadian crude quality

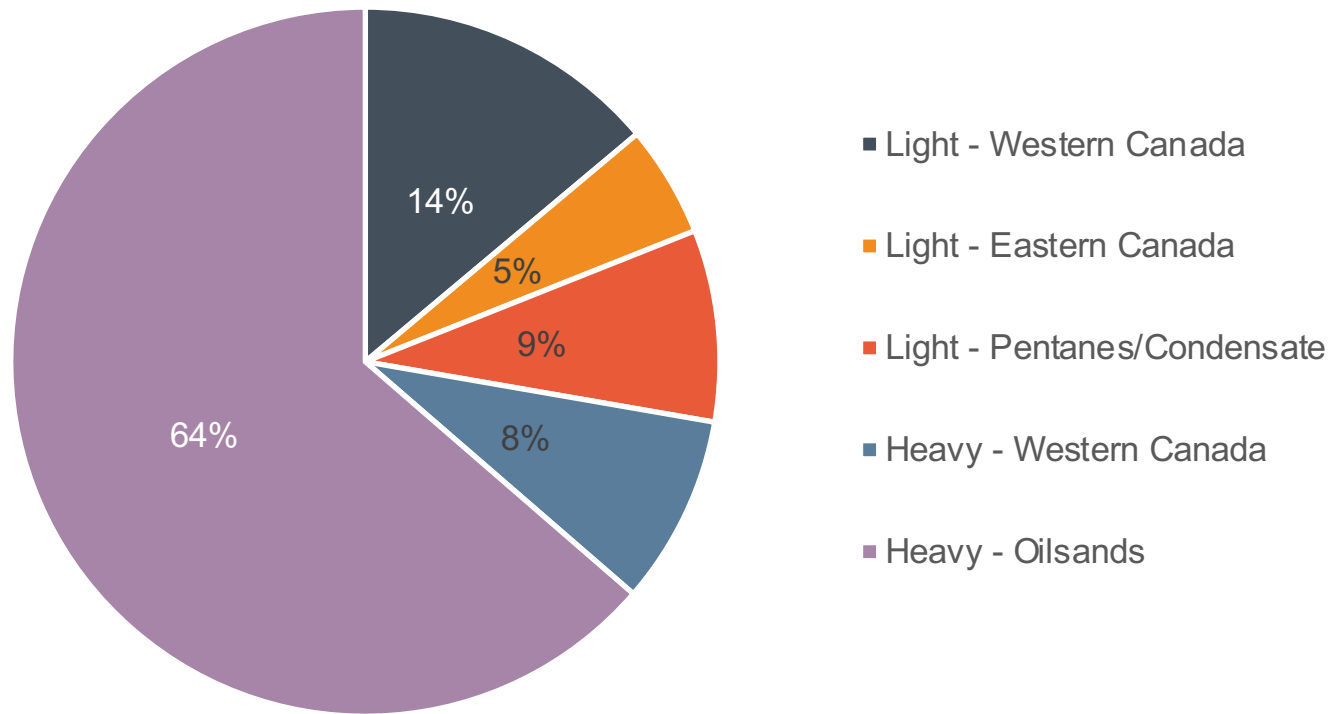
- West Texas Intermediate - 40° API, 0.25% Sulfur
- Western Canadian Select - 20° API, 3.25% Sulfur



Source: Oilsands Magazine, Sproule

Canadian crude production by quality

- Over 70% of Canada's crude production in 2018 was heavy oil from Western Canada



- To estimate how much of the WCS-WTI differential is caused by quality differences, we must eliminate transportation and supply/demand effects
- Pricing at Houston – key crude trading hub in Gulf Coast
 - 50% of US refining capacity is on the Gulf Coast
 - 80% of those refineries have cokers (can refine heavy oil)
 - Comparing historical WCS and WTI prices at Houston eliminates transportation effects, and gives us roughly \$3 to \$5 US/bbl differential during normalized market conditions

Two main methods of transportation

Pipelines

- Enbridge system
- Keystone
- Trans Mountain

Crude-by-Rail

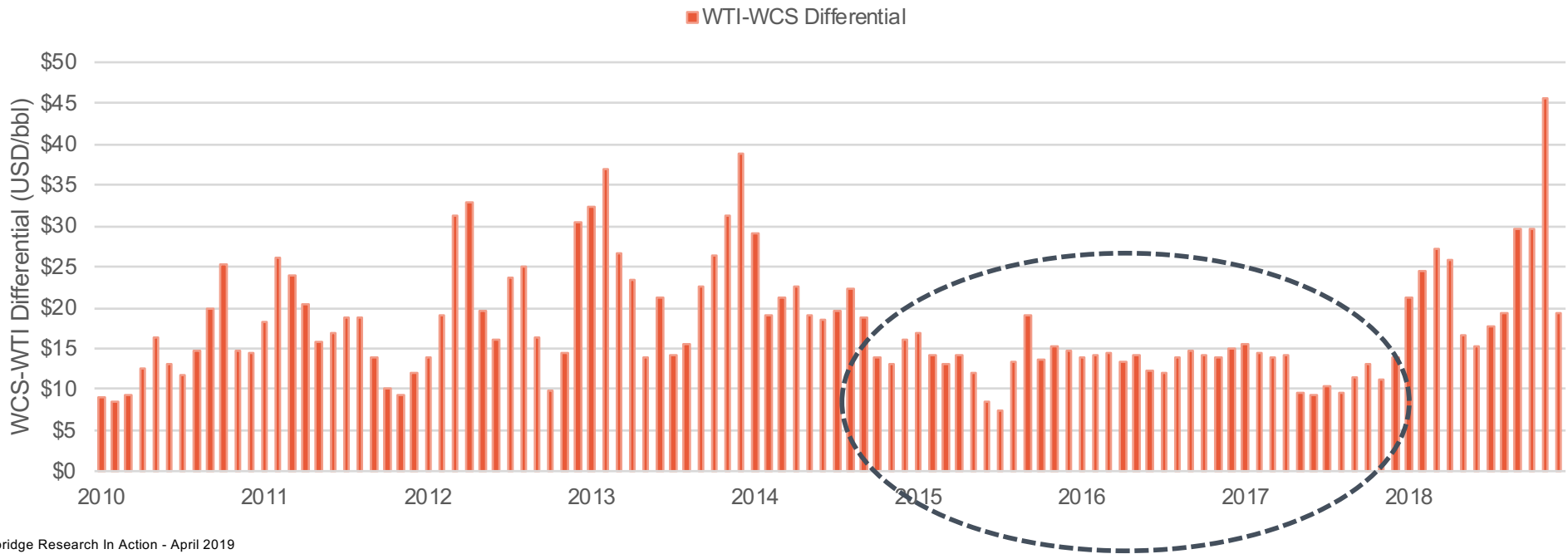
- Becoming increasingly important means to support production growth as pipeline capacity growth stagnates



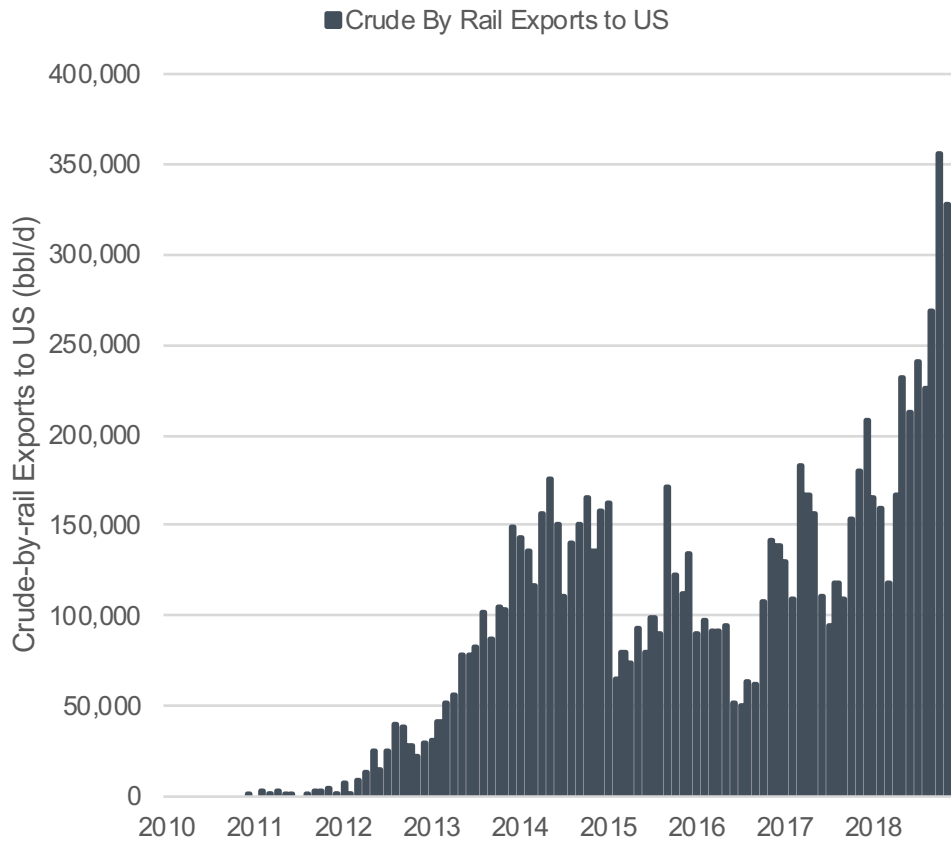
- Enbridge Mainline
 - 2,700 Mbbbl/d
 - Services US Midwest refineries
- Keystone Pipeline
 - 590 Mbbbl/d
 - Services US Gulf Coast refineries
- Trans Mountain Pipeline
 - 300 Mbbbl/d
 - Exports oil off Canada's West Coast

Transportation – Pipeline Historical Cost Adjustment

- From 2015 through to end of 2017, WCS-WTI differentials were relatively flat, averaging roughly \$14 – \$15 US/bbl with minimal disruption due to market forces
- With a \$3 – \$5 US/bbl quality adjustment, our pipeline transportation cost is \$9 – \$12 US/bbl



Transportation – Crude by Rail



- Crude by rail capacity has grown considerably in recent years to close the gap between oilsands production growth and flatlined pipeline capacity
- More expensive option than pipelines
- Gives producers flexibility in the location of their delivery point, given outtages, localized disruptions, etc
- Sproule estimates that transportation adjustment lands in the \$15 – \$25 US/bbl for crude by rail

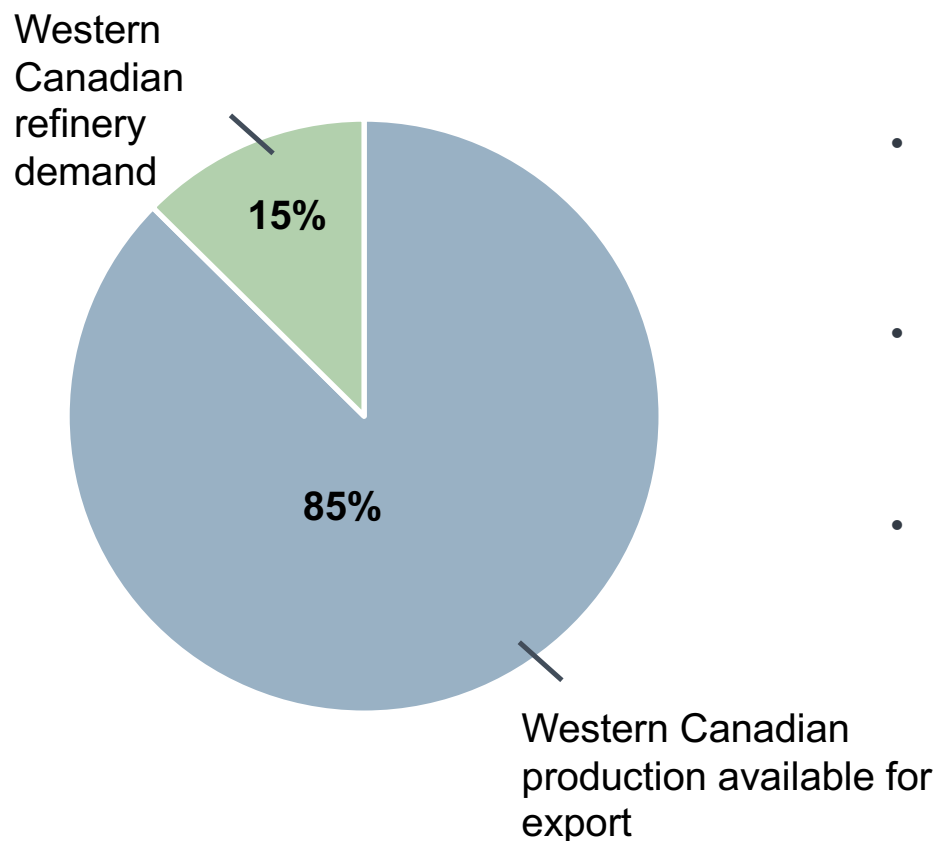
Market factors influencing Canadian crude prices



Key market factors affecting Western Canadian crude differentials to WTI

- Domestic demand vs exports – how dependent is Canadian crude pricing on foreign market demand?
- Export capacity – how does pipeline and crude-by-rail capacity affect Canadian crude pricing?

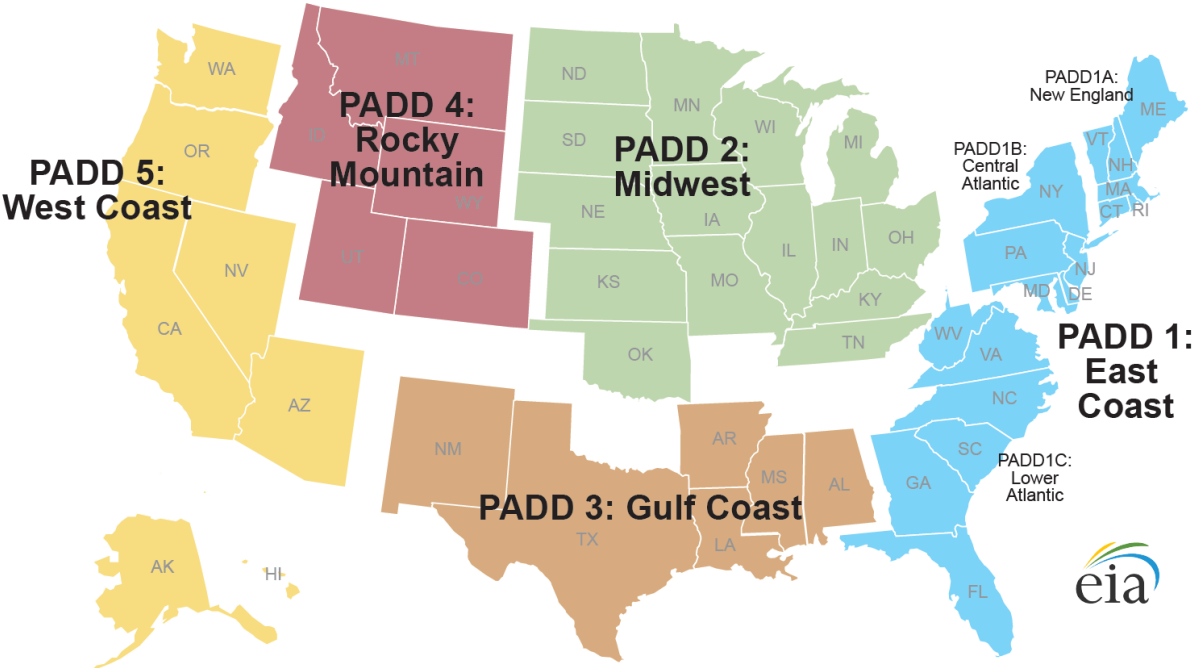
Domestic demand vs exports



- Roughly 600,000bbl/d of demand by Western Canadian refineries, with minimal growth in refining capacity on the horizon
- Majority of production in Western Canada is exported to the US, with some volumes heading to the west coast via Trans Mountain
- Canadian crude prices are highly sensitive to disruptions in the US market

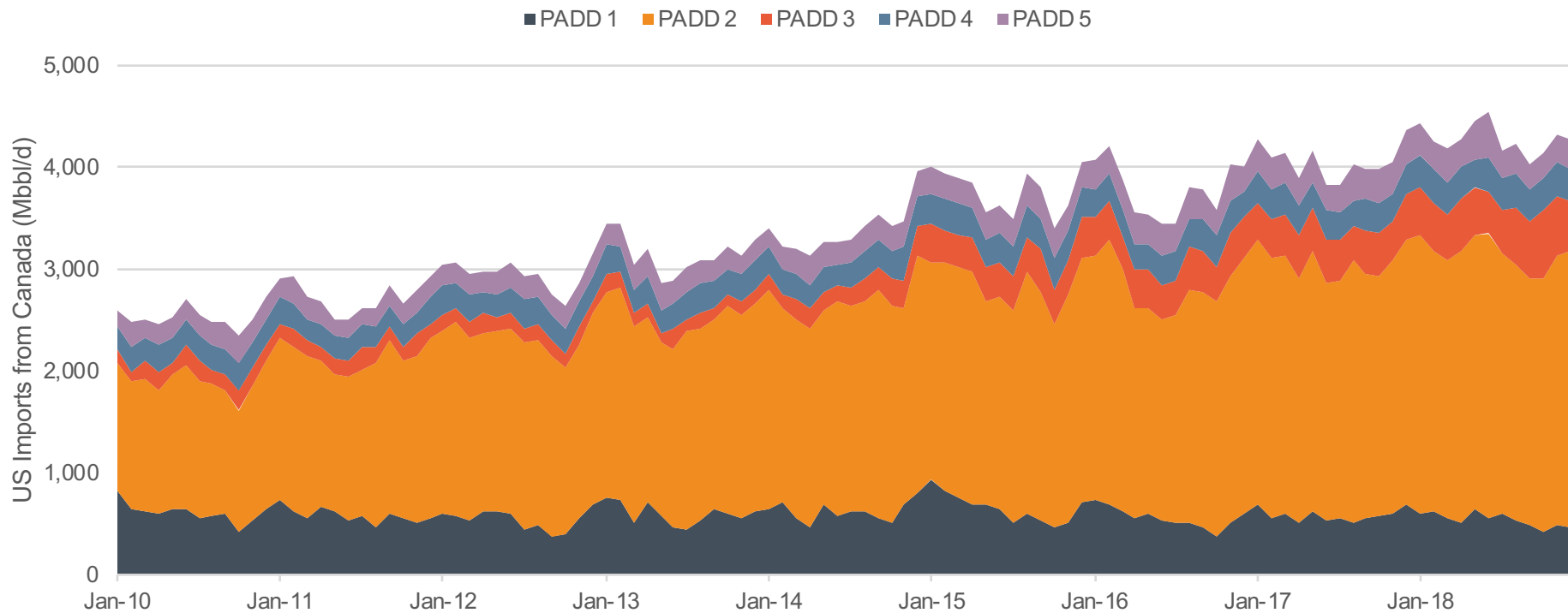
85%? Where is all our crude going?

- The US is divided into 5 Petroleum Administration for Defense Districts (PADDs)



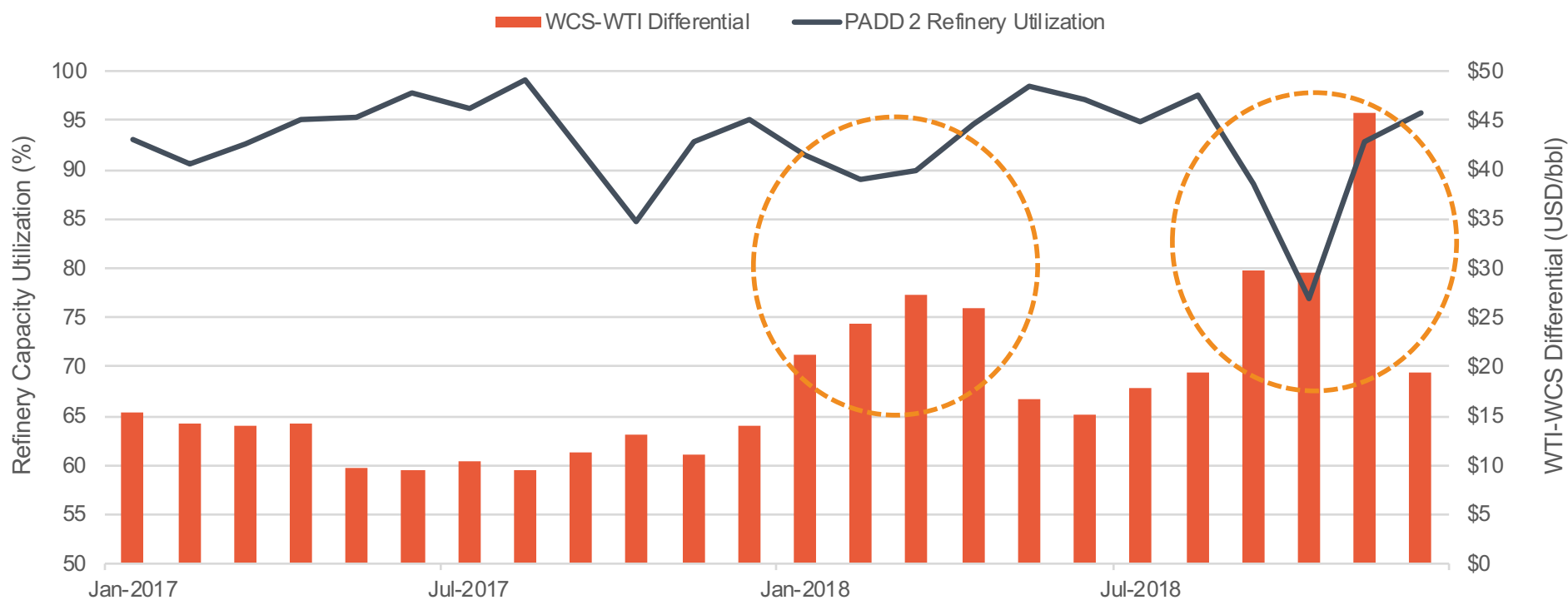
Canadian crude exports to US by PADD

- US Midwestern refineries import the majority of Canadian crude via Enbridge system
- Growing exports to PADD 3, US Gulf Coast, as demand for Canadian heavies from Gulf Coast refineries increases



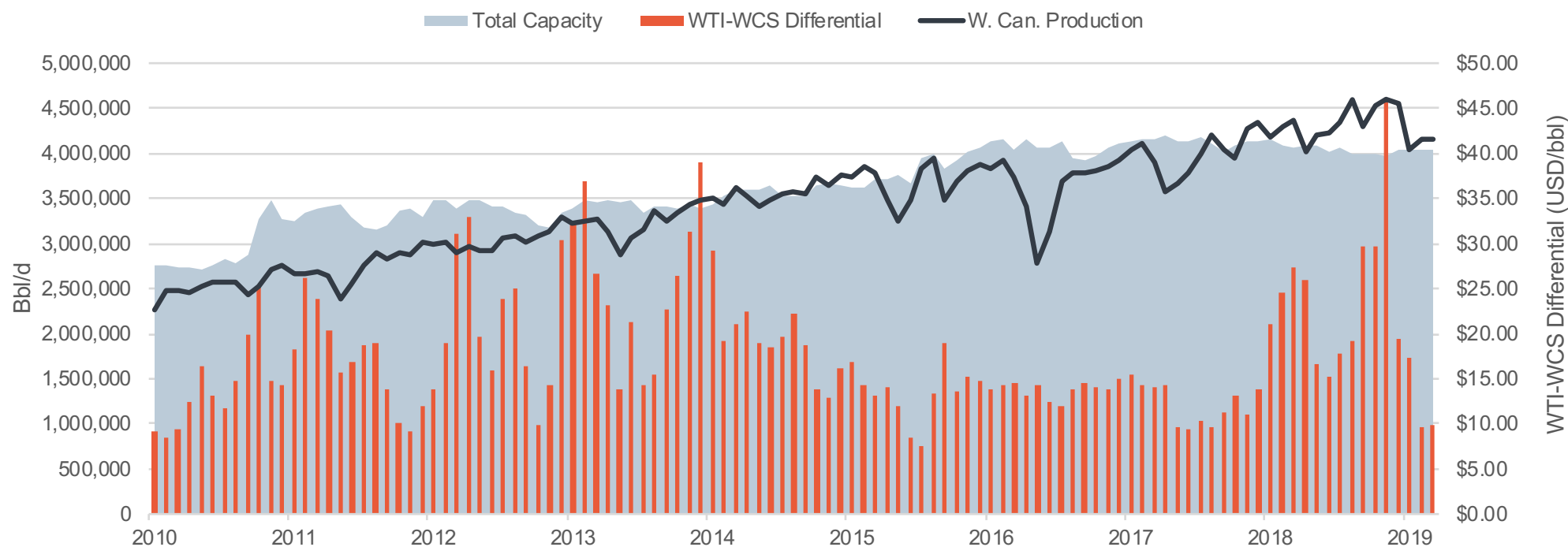
PADD 2 Refinery Demand and WCS Differentials

- Roughly 60% of Canadian crude exports to the US goes to Midwestern refineries
- WCS differentials are highly sensitive to short-term disruptions in US refinery demand



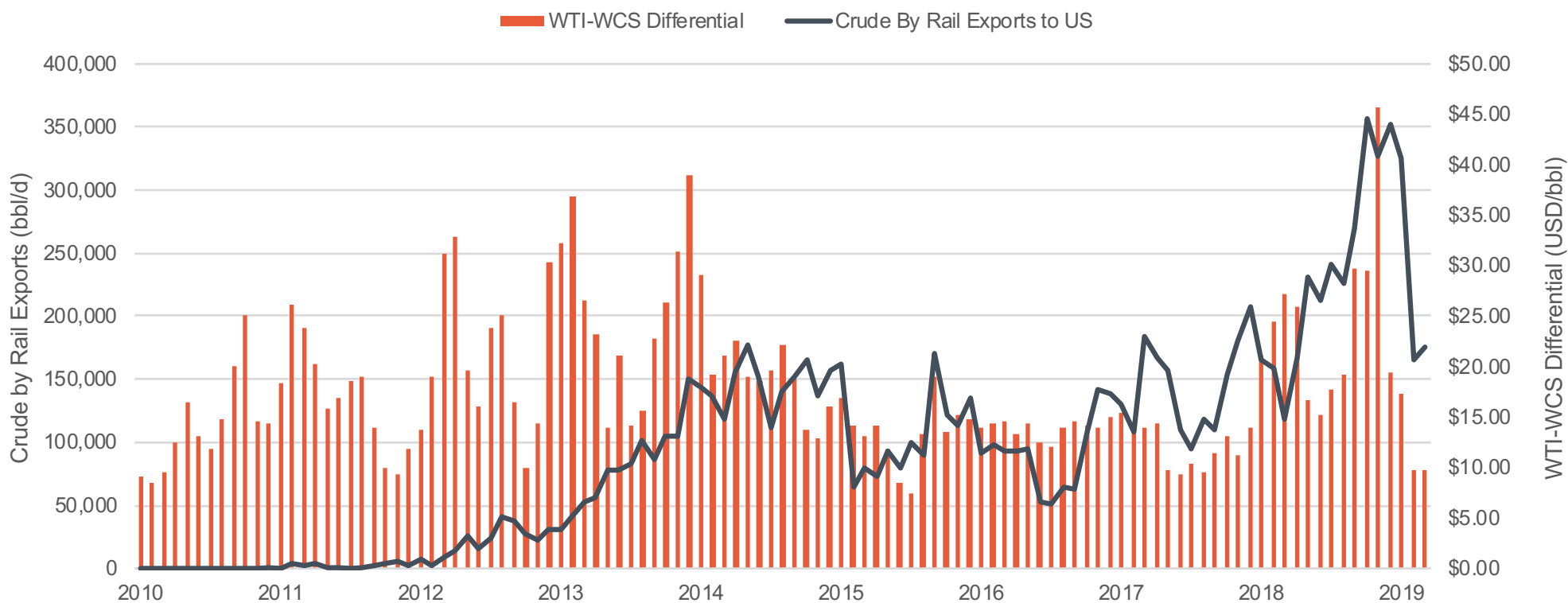
Pipeline capacity and WCS differentials

- No capacity expansions since 2015
- Production overtook capacity in 2018
- Near-term spikes in WCS prices often associated with tightening between production and pipeline capacity



Crude-by-rail capacity and WCS Differentials

- Crude-by-rail has become an important means to transport Canadian crude to the US
- Often crude-by-rail exports increase in tight market conditions, when differentials are high

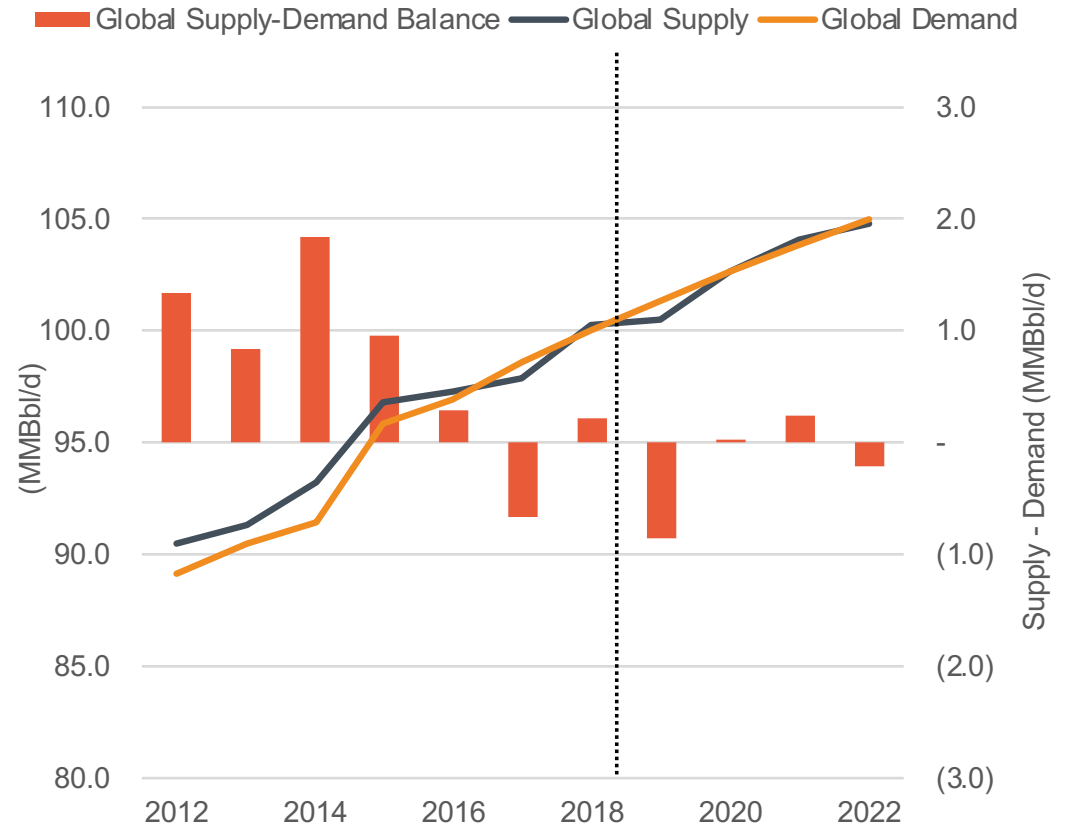


Crude Oil Outlook

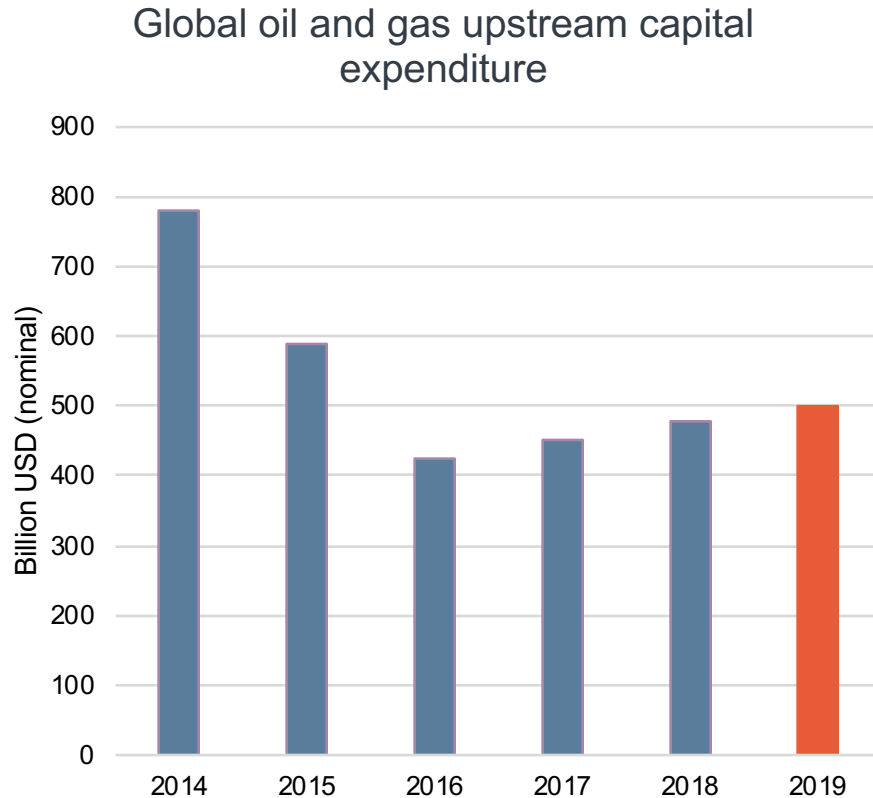
What are the key global drivers, and how does Canada fit into the picture?

Key themes

- OPEC+1 desire pricing above \$70US/bbl – production cuts of 1.2mmbbl/d announced in December 2018. We expect continued compliance over 2019
- US LTO rapid growth continues. Permian bottleneck constraints to be overcome by the end of 2019
- Beyond 2022, growth from US LTO and OPEC+1 may not be enough to sustain global demand. Additional sources of supply likely needed
- Investment decisions are needed now for long-lead sources of supply to fill the gap



Need for investment outside of US LTO



- 2019 upstream investment is expected to be above 2018, but the pace of growth is slowing compared to 2018
- A number of pure shale producers have announced 2019 capex plans below 2018 actual spends due to increased demands for capital discipline and investor returns
- Production from 2014 and 2015 investment is now essentially all on-stream
- Investment growth in oilsands, offshore, and conventional onshore development required to sustain demand growth beyond 2020

Source: EIA, IEA, Sproule Estimates

Note: 2019 capex numbers are estimates

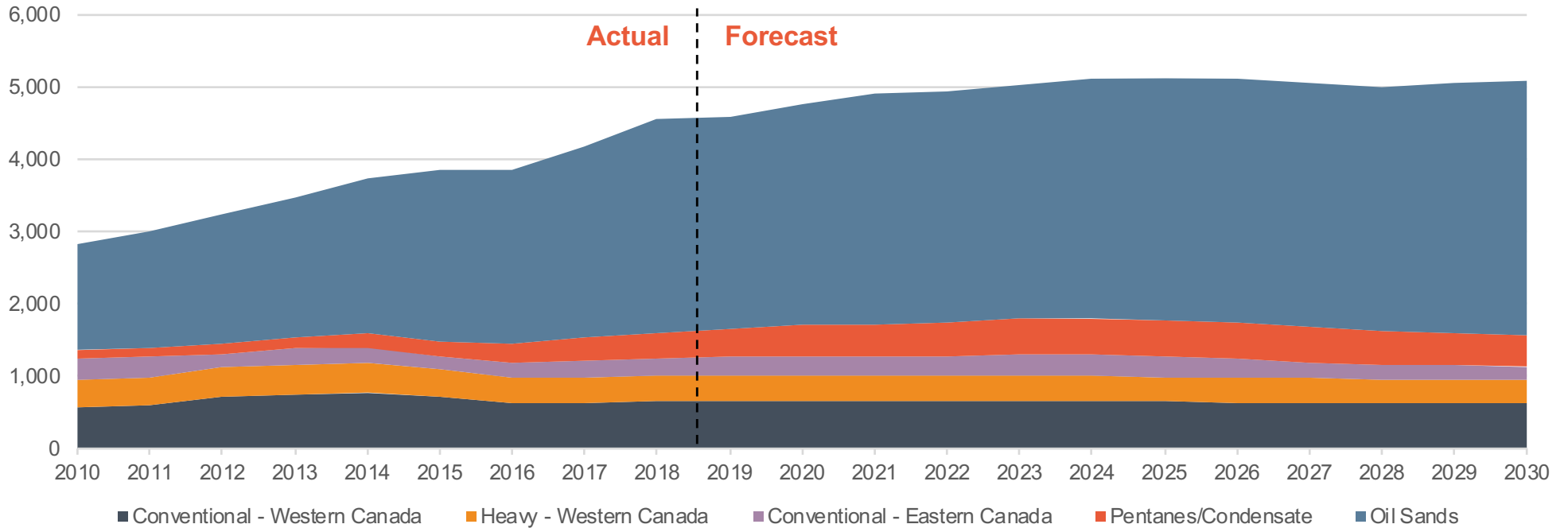
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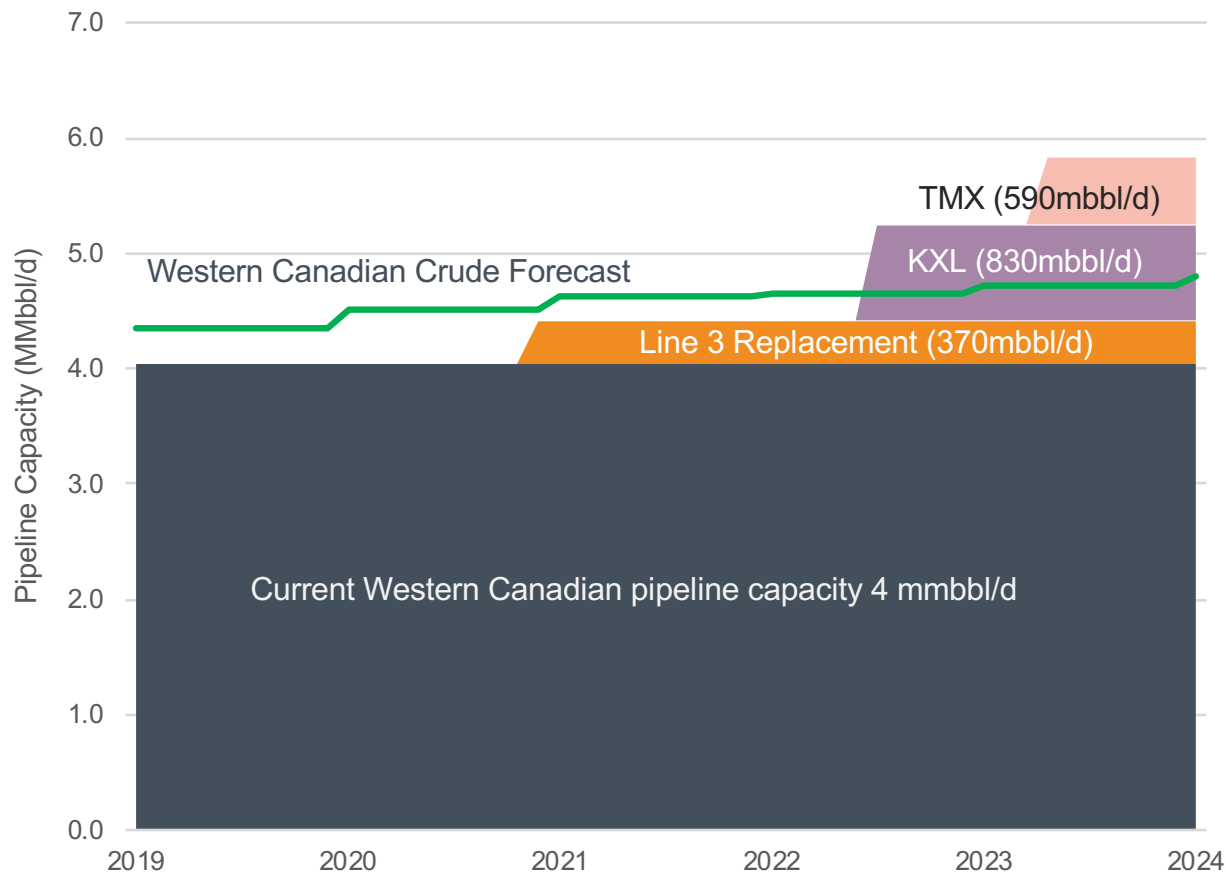
Canadian crude forecast – Oilsands driving growth

- 100mmbbl/d oil sands projects currently under construction with on-stream 2019-2022
- Additional 100mmbll/d oil sands production expected on-stream by 2023
- Producers need assurance of increased market access to ensure approved projects are actually completed

Canadian Production History and CAPP Forecast



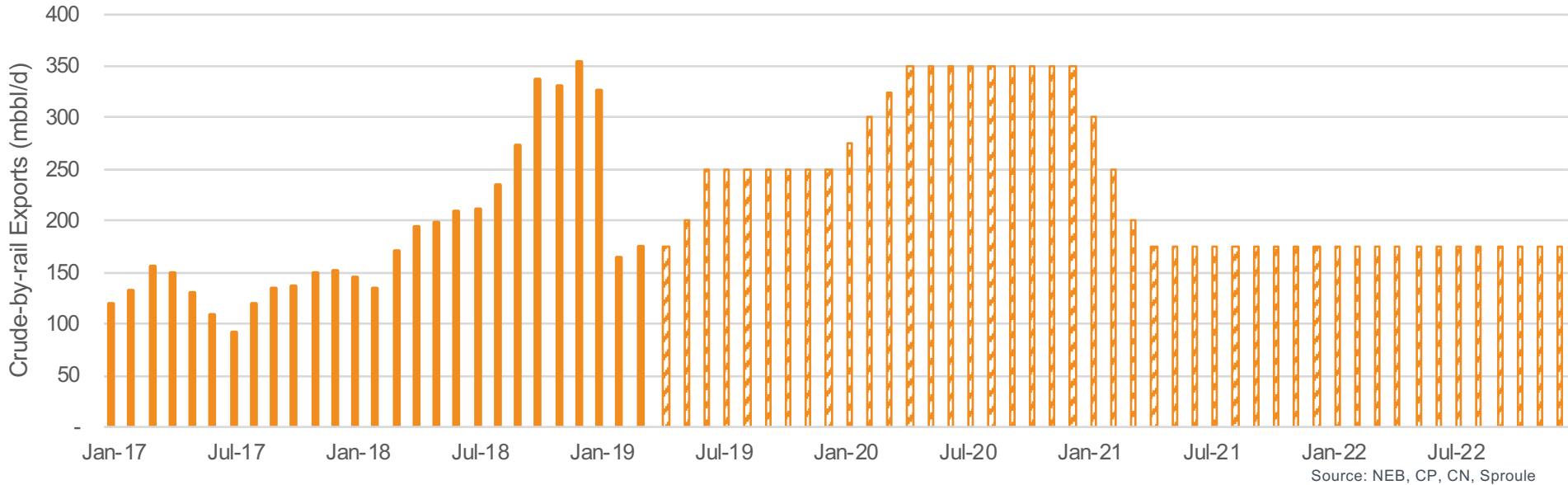
Western Canadian crude pipeline capacity – relief to come



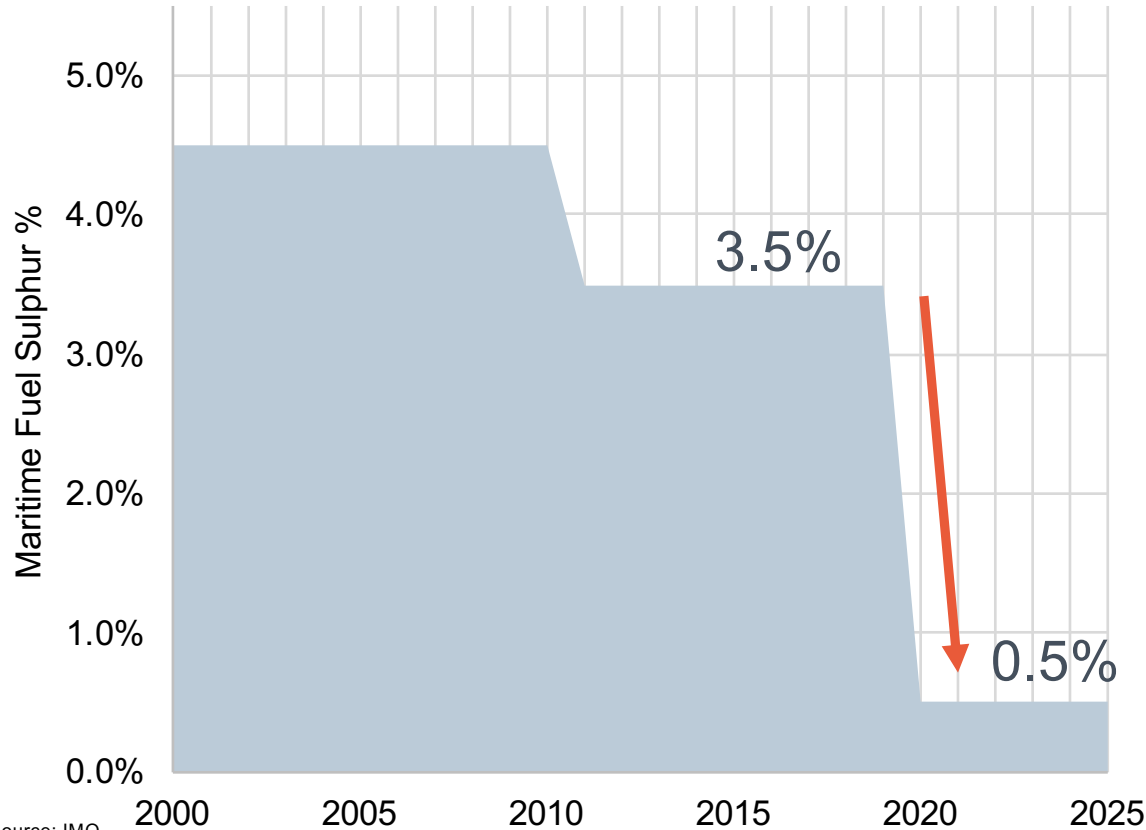
- The three major pipeline projects currently planned will relieve bottlenecks in western Canada by 2023
- Rail will continue to move barrels between now and then
- Long-term rail contracts may allow for further spare capacity going into the 2022+ timeframe
- Western Canada will not have spare crude pipeline capacity until Keystone XL, or TMX, or both are built.

In the meantime, rail is picking up the slack

- Shippers require producers to sign minimum one-year agreements before they agree to make rail capacity available
- Crude-by-rail exports reached record highs in December 2018, but have since fallen with mandated Alberta government production curtailment
- Crude-by-rail exports will begin to increase again once production curtailments are reversed



International Maritime Organization sulphur regulations



Source: IMO

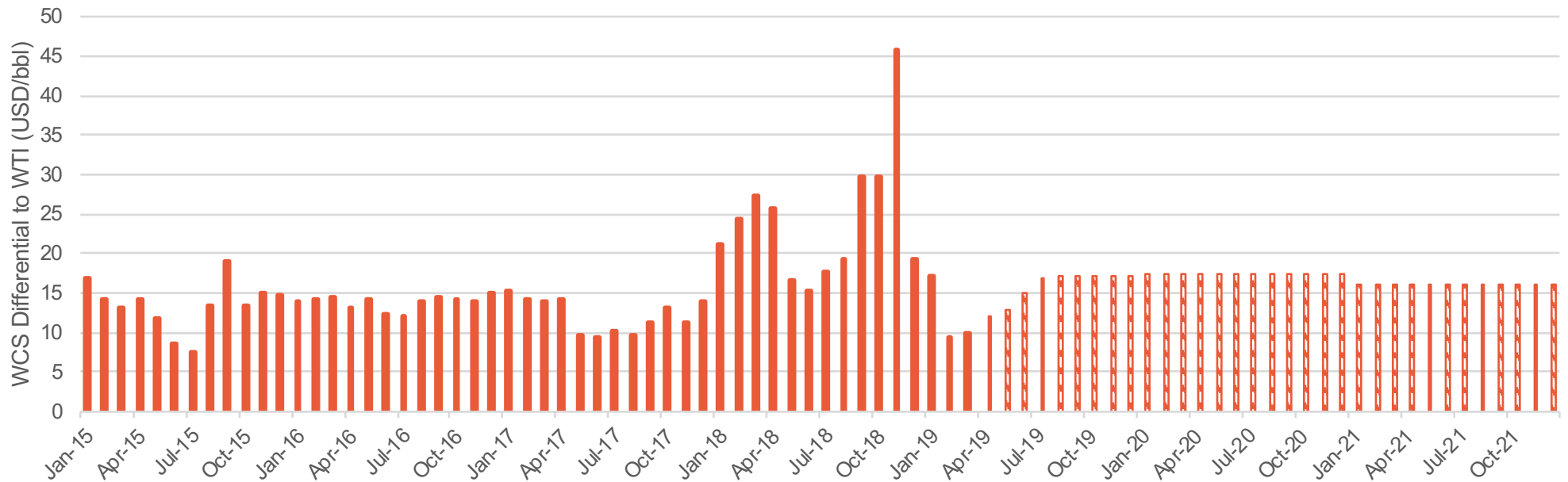
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- IMO 2020 decreases allowable sulphur content in maritime fuel from 3.5% to 0.5% effective January 2020
- Shippers have 3 options:
 - 1) Install scrubbers to reduce SOx emissions when burning high sulphur fuel
 - 2) Purchase more expensive low sulphur fuel
 - 3) Don't comply to the regulations, and continue with status quo
- Significance of \$1.00-3.00 US/bbl widening of WCS-WTI differential
- High level of uncertainty still remains

WCS to WTI 2019 outlook – disruptions don't last forever

- Record-wide differentials in Q4 2018 have shrunk to ~\$10US/bbl in March 2019, lowest since 2015
- Current tight differentials driven by Alberta production curtailments and US sanctions on Venezuelan heavy crude
- Sproule estimates market will adjust, with Gulf Coast refiners finding additional sources for heavies, and the WCS differential will normalize between \$15 and \$20 US/bbl driven by crude-by-rail economics

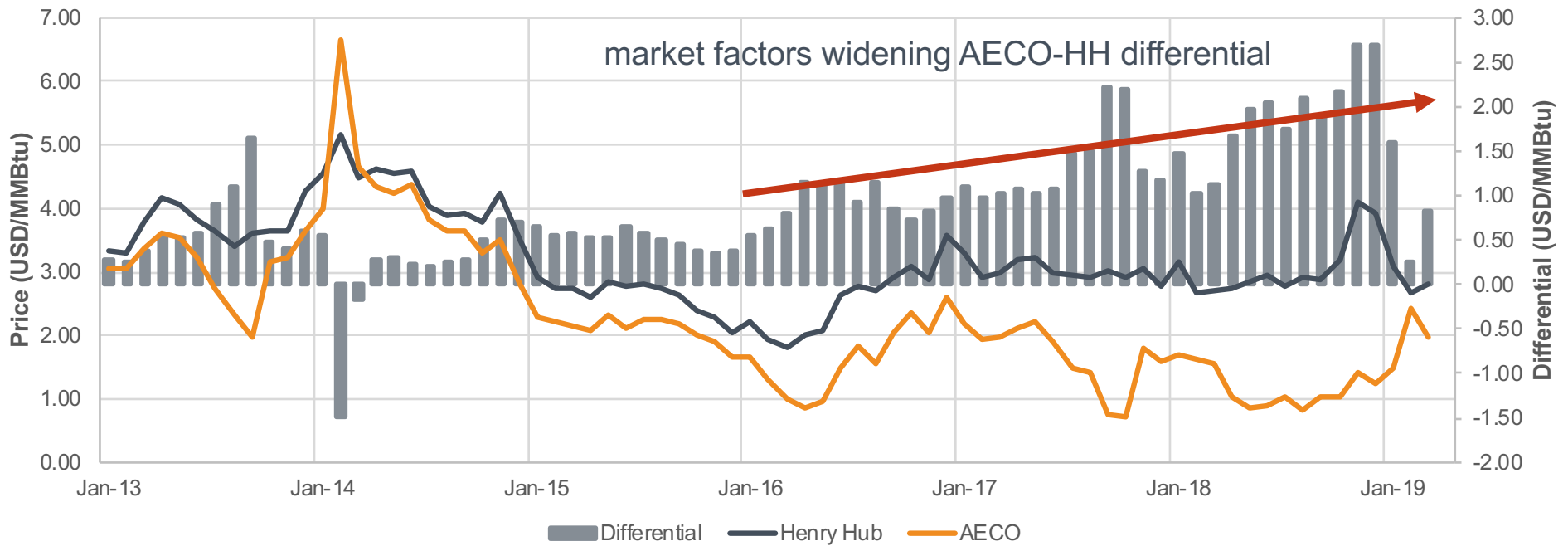


Canadian gas differential fundamentals

What factors impact AECO to Henry Hub gas differentials?

AECO differential to Henry Hub – Same rules apply

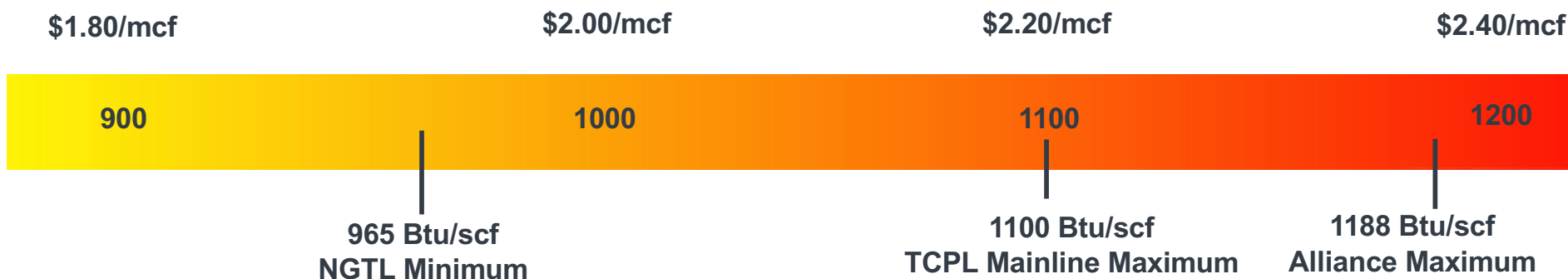
- Similar differential equation applies to gas:
 - $\text{AECO price} = \text{Henry Hub price} - \text{transportation adjustment} \pm \text{market factors}$
 - Quality adjustment built into the price
- Volatility in recent months demonstrate market disruption influences on the AECO-HH price differential



Gas Quality – Heating Value

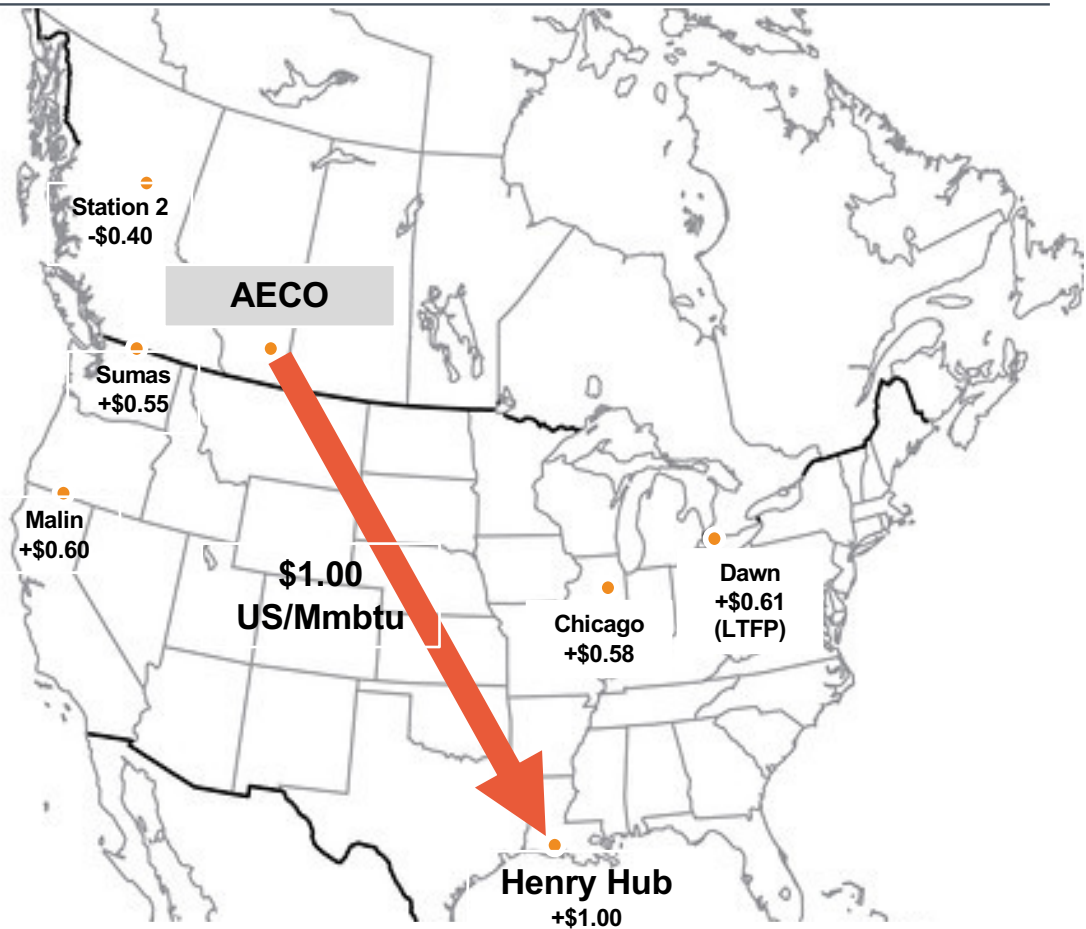
- Natural gas is a mixture of various components
 - Methane (C1)
 - Ethane (C2)
 - Propane (C3)
 - Butane (C4)
 - Pentanes+ (C5+)
- typically measured in Btu/scf

Price received depends on heating value. With a \$2.00/MMBtu gas price, price received is:



AECO Transportation

- AECO in southern Alberta, vs Henry Hub on southern coast of Louisiana, there is a cost to get it there – typically in the \$0.80-\$1.00US/MMBtu range historically
- Transportation cost will depend on whether producer is signed up for firm or interruptible service with pipeline company





US gas production surge

- The US' decreasing reliance on Canadian gas

Pipeline bottlenecks in Western Canada

- NGTL bottlenecks widening AECO to Henry Hub differentials

LNG exports

- Paradigm shift in North American gas markets – what was once land locked is no longer thanks to LNG

Canadian natural gas market drivers and outlook

What are the key drivers impacting Canadian gas prices, and how does Canadian gas fit into the evolving global gas market?

Paradigm shift in North American gas markets

2007

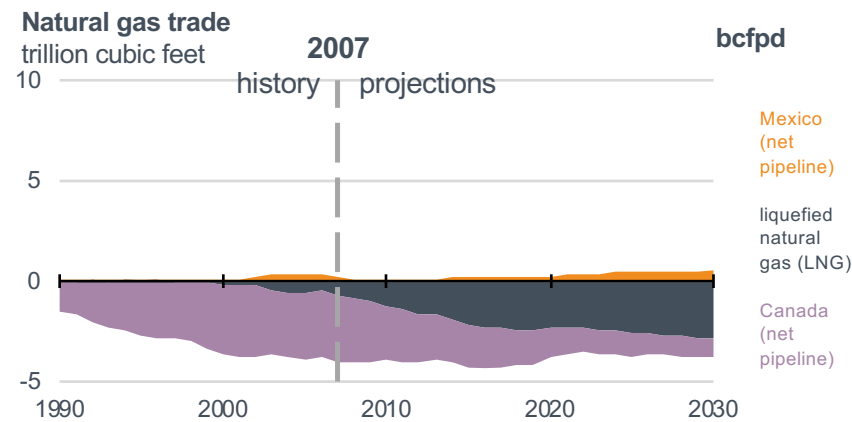
- US is world's largest importer of natural gas
- Predicted to grow LNG imports with no significant production gains



2019

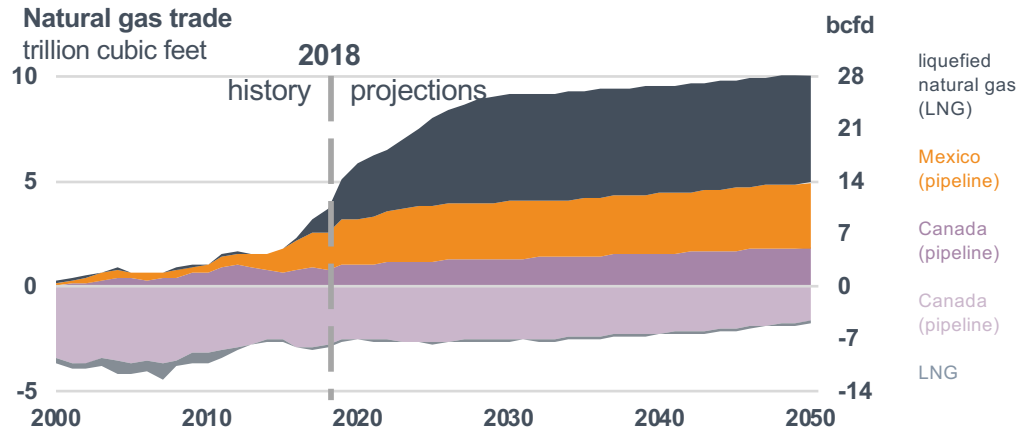
- US is now a net exporter of natural gas
- Predicted to become the world's largest exporter over the next 5-10 years

Net Natural Gas Exports (EIA Reference Case)



Source: EIA Annual Outlook 2008

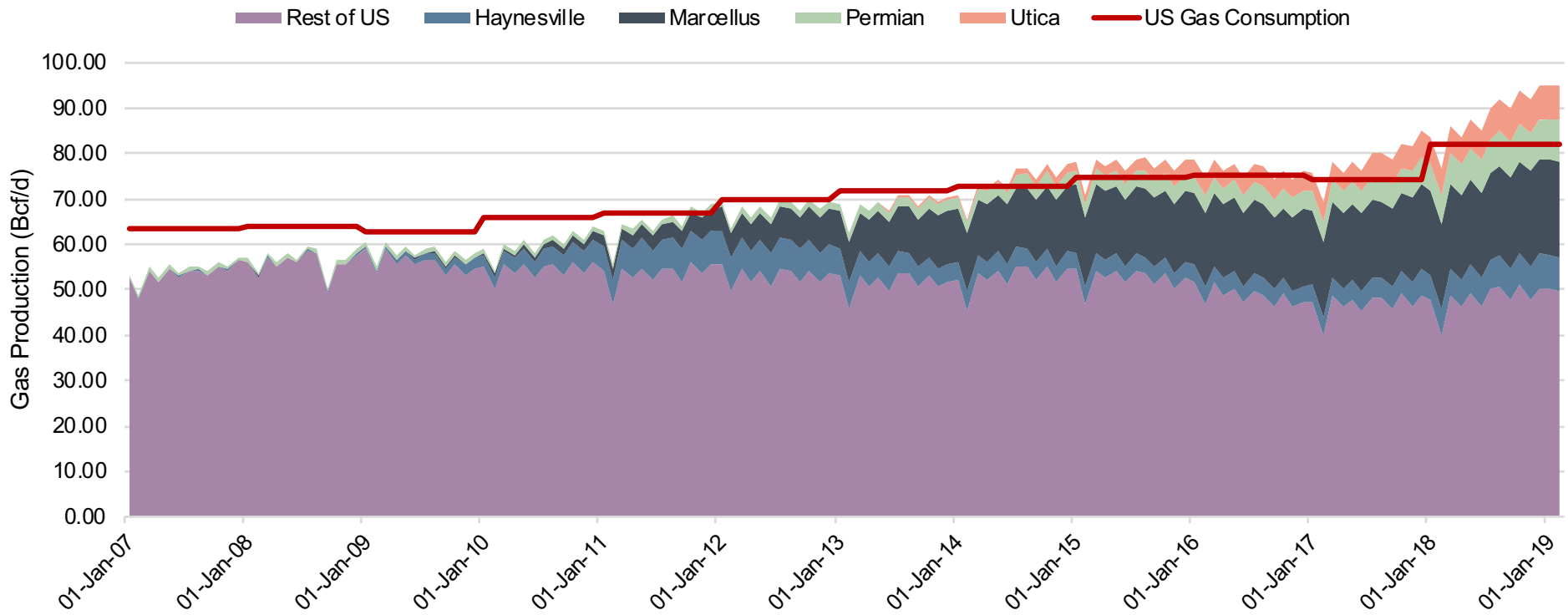
Net Natural Gas Exports (EIA Reference Case)



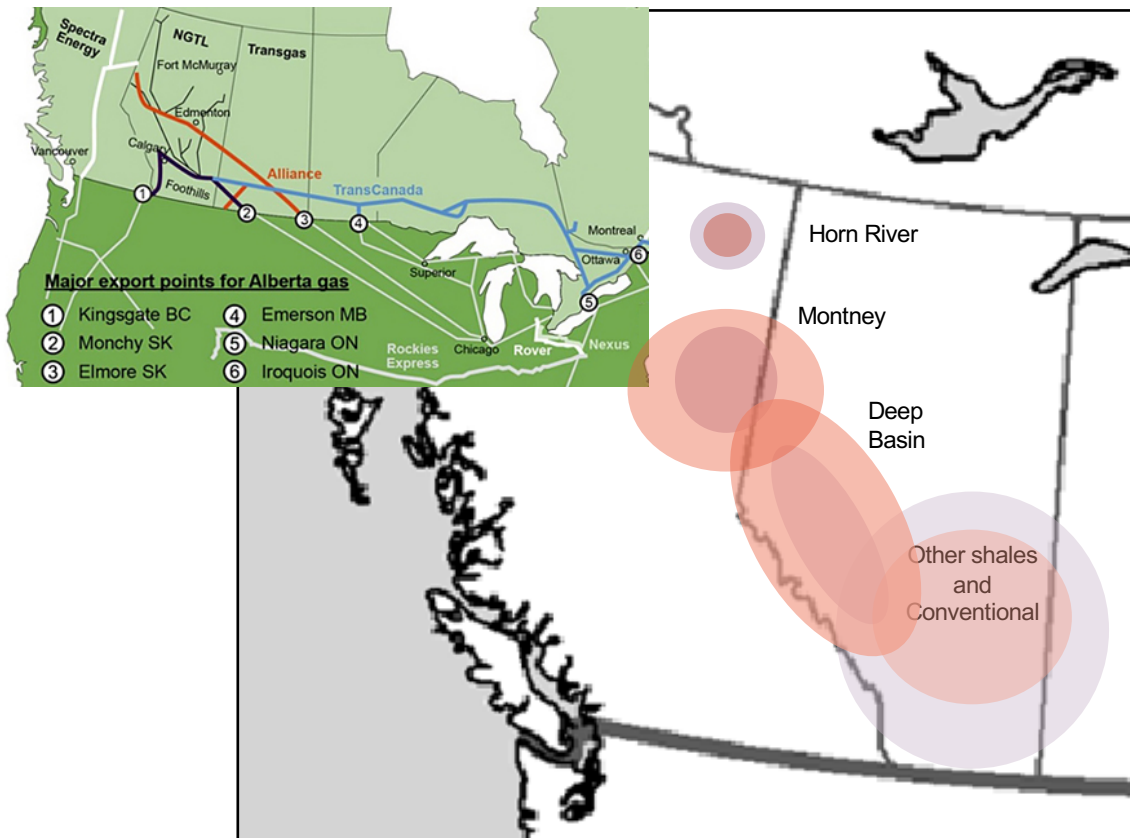
Source: EIA Annual Outlook 2019

US gas production surging

- US gas production increased ~15% in 2018
- US increasingly self-reliant for their natural gas needs

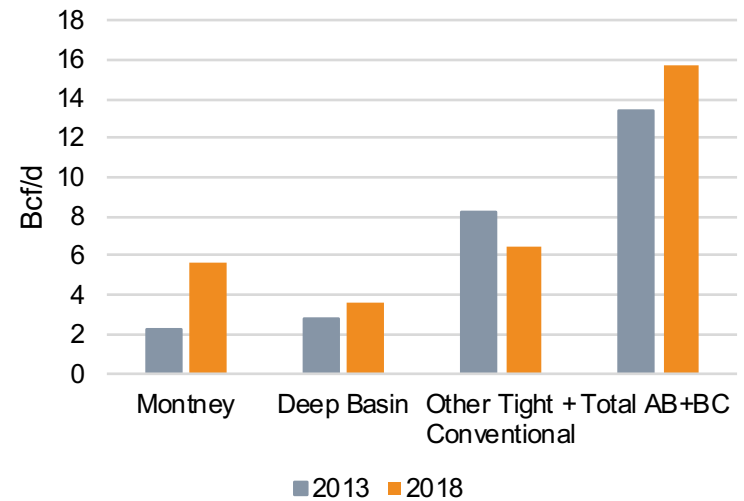


Pipeline bottlenecks: New production hubs

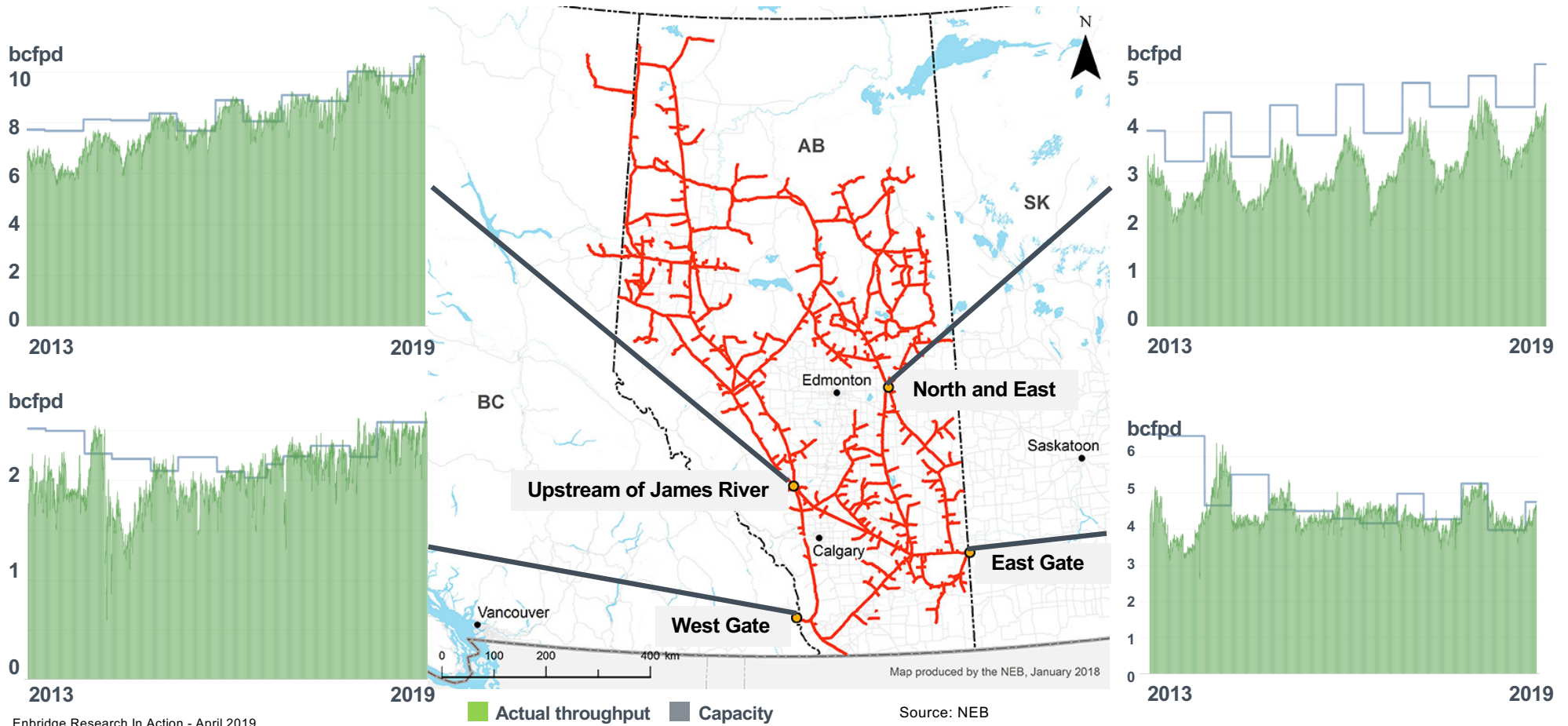


Source: NEB

- Majority of gas production growth from NW AB and NE BC over last 5 years
- Gas production growth upstream of James River causing bottleneck issues on NGTL system



Pipeline bottlenecks: NGTL constraints



The arrival of a new Dawn

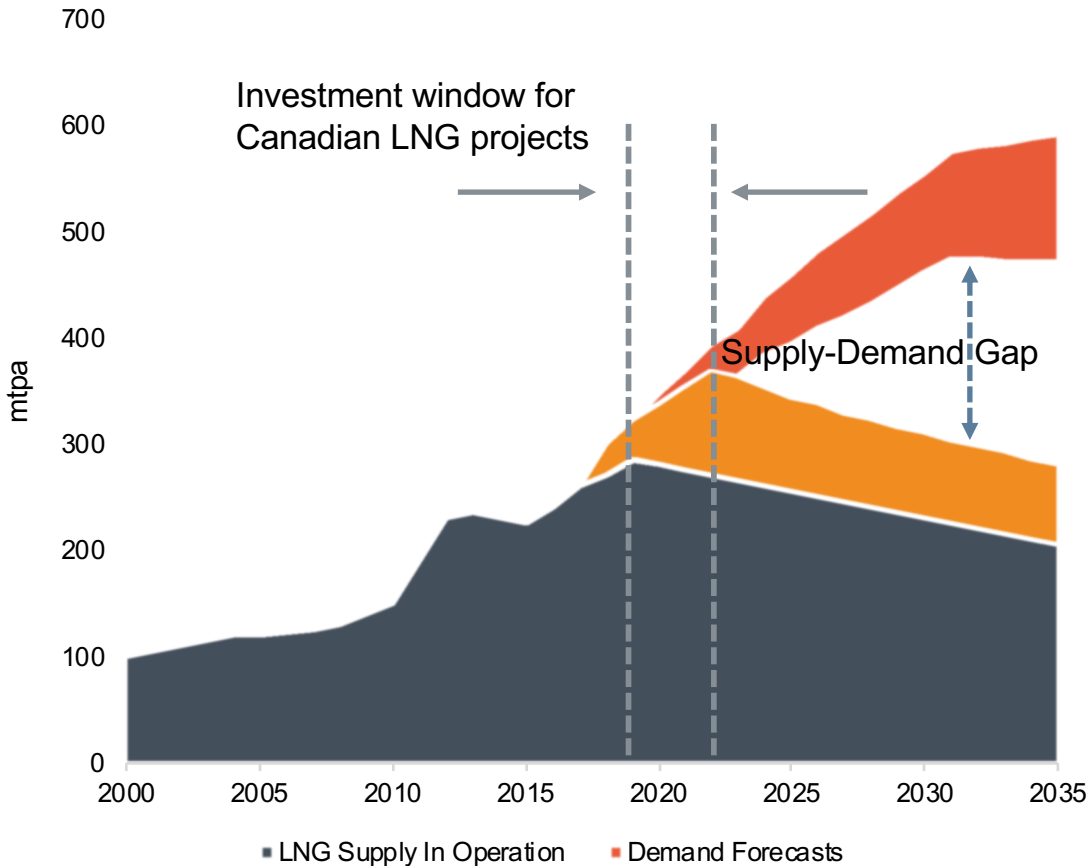


Source: NEB

Structural change driving new reality

- Dawn market historically captive demand centre for WCSB gas
- Firm transportation tolls have generally been high (C\$2.00/mcf+) but borne by Ontario consumers
- Opportunity to import cheap gas from Appalachia has fundamentally altered Dawn market into a liquid hub with gas-on-gas competition
- Mainline toll of C\$0.77 for 1.4 bcfpd of long-term capacity reflecting new reality

Canadian LNG opportunity – window briefly reopened



- Global LNG demand surging - call on LNG investment now to close supply-demand gap beyond 2023
- With a ~5 year lead time on LNG projects from FID to first shipment, the race is on globally to fill the supply-demand gap beyond 2023

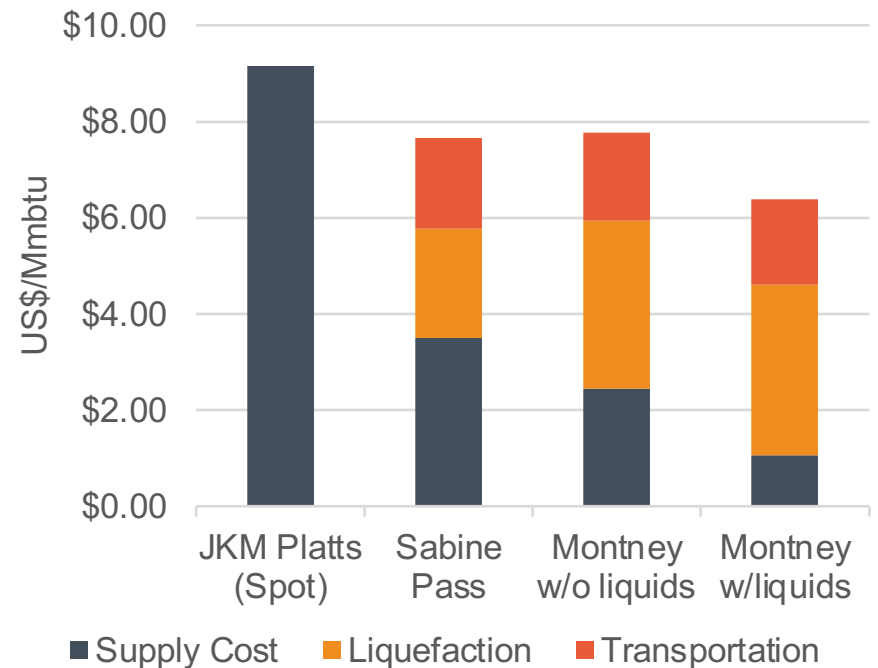
West Coast Canadian LNG – Competitive Advantage

- BC’s northwest coast is an ideal location for LNG export terminals to help fill the global need for LNG
 - Canadian LNG competitive relative to US tolling projects when considering supply, transportation and liquefaction costs
 - Opportunity for liquids-rich gas within Montney to mitigate risk for integrated LNG players

- LNG Canada Specifics (reached FID 2018)
 - ~2 bcf/d first 2 trains by 2023-2025
 - Economics will favour further trains

- Coastal Gas Link Pipeline
 - ~\$6bn for initial 2 bcf/d capacity
 - Can add an additional 3 bcf/d for trains 3 and 4 by adding compression, at minimal capital cost (~\$1bn)

Indicative competitiveness of Canadian LNG supply

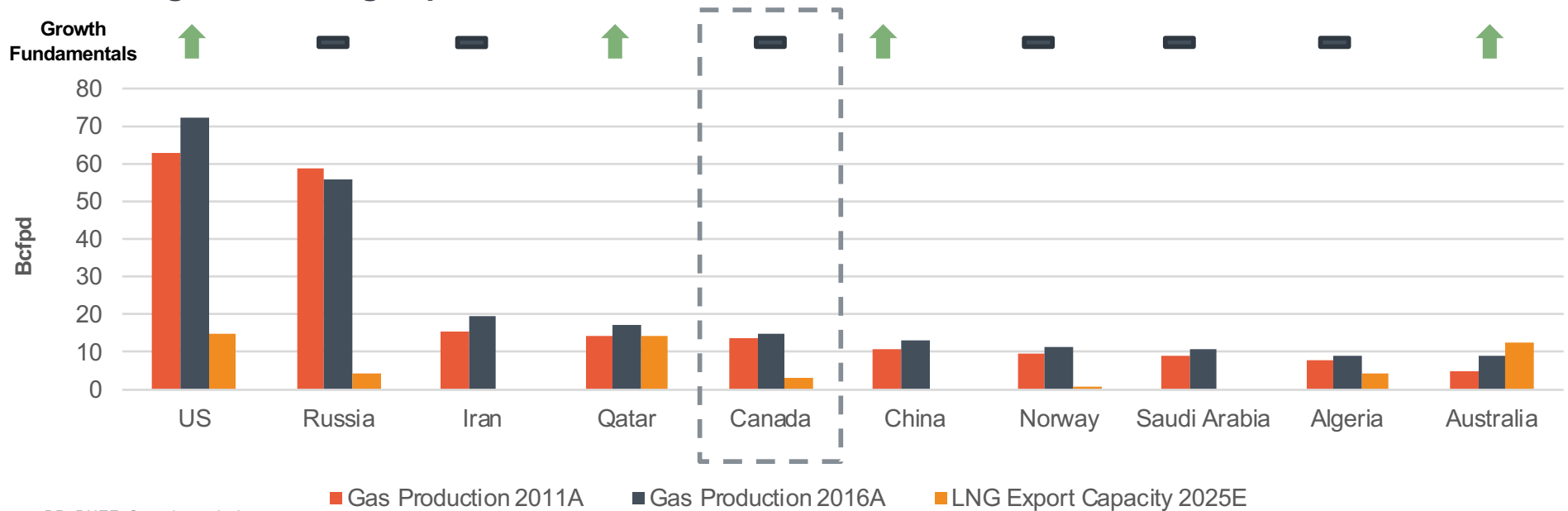


Source: Sproule, Bloomberg
 Note: Sabine Pass based on 115% HH plus liquefaction (\$2.25) and shipping (\$1.13); Montney transportation includes pipeline cost (\$1.00) and shipping (\$0.42). JKM and HH pricing based on LTM average.

The Big Picture: Canada still a natural gas powerhouse

- Canada remains a major natural gas powerhouse and is the world's 5th largest natural gas producer
- Only opportunity to unlock shale and tight resource plays for LNG outside of the US
- Established industry with best practices and cutting edge technology

World's largest natural gas producers



Source: BP, BNEF, Sproule analysis

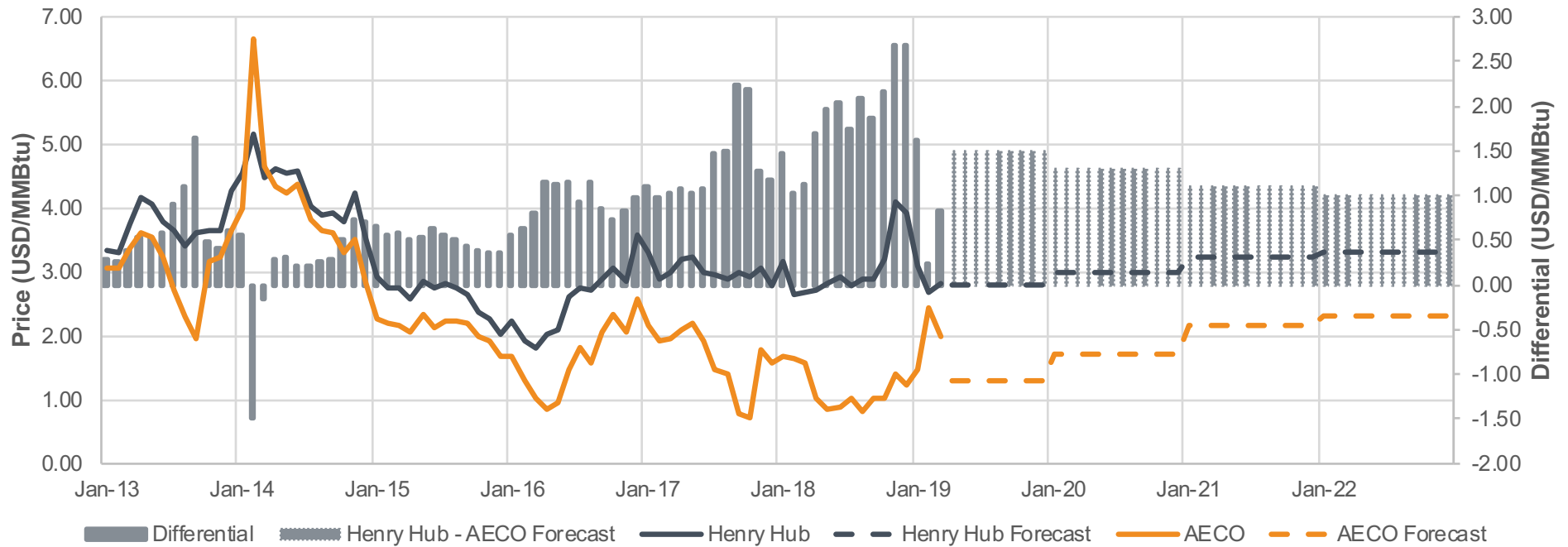
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Sproule natural gas price outlook

- Market fundamentals will return to AECO over time with a new stabilized differential to Henry Hub
- Henry Hub will get a lift over time with LNG exports and increased demand from Mexico

Sproule Henry Hub history and forecast as of March 31, 2019





- As US gas production increases, Canadian gas is losing market share and competitiveness in historically stable markets
- With the recent surge of US natural gas production driven by the shale revolution, combined with increasing LNG exports, the US is now a net exporter of natural gas
- Canada has the resource, the location, and the expertise to be a major player in meeting global LNG demand, but investment window of opportunity is narrow and closing
- Short to medium term, AECO differentials should stabilize as TCPL completes debottlenecking capital projects on NGTL
- Long-term, growth of Canadian natural gas production depends on LNG projects on Canada's west coast

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