Rice Global E&C Forum
Engineering & Construction

RICE GLOBAL ENGINEERING & CONSTRUCTION FORUM

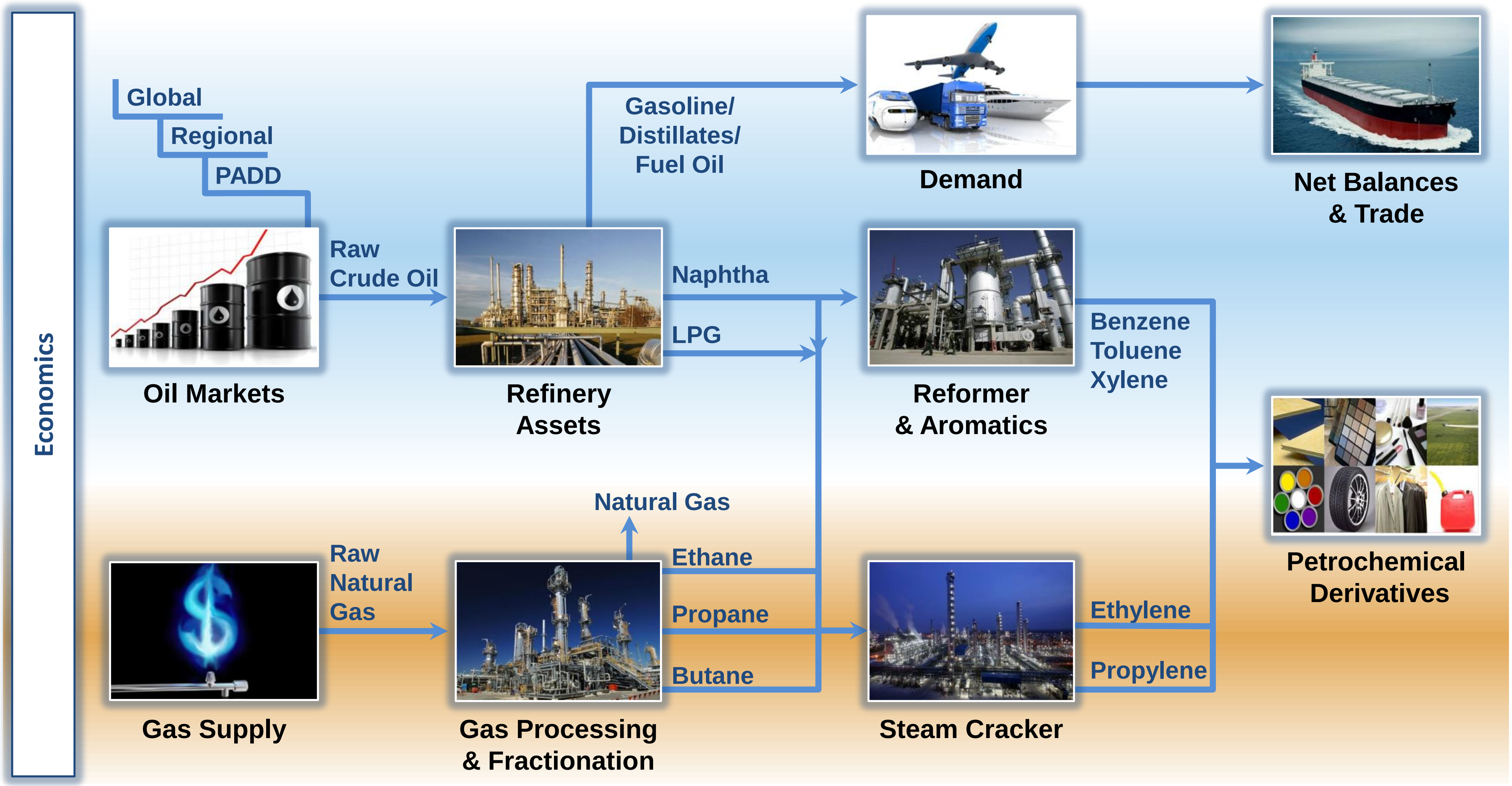
RICE

Skip York, *Principal Analyst – Oils Research*

Wood Mackenzie

"Evolving Dynamics in North American Oil & Gas Production"

North America's hydrocarbon renaissance is impacting the integrated Oil & Gas value chains

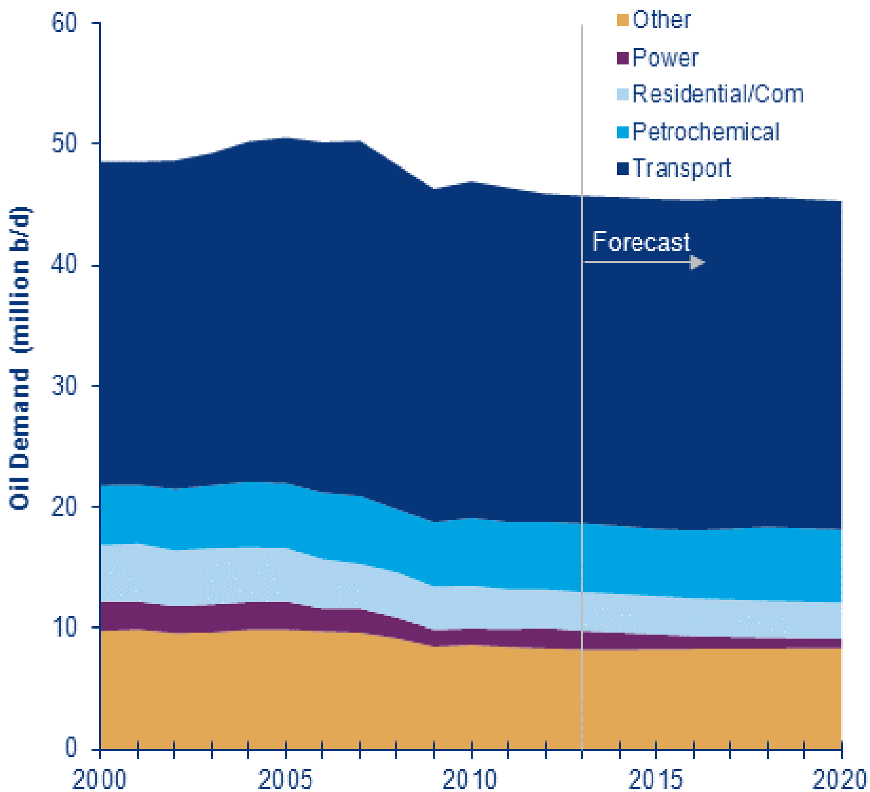


Agenda

- **A brief global perspective**
- North America production profiles
- Key drivers to capturing value by play
- What this means for construction activity

Growth trajectories in transport set the trend for OECD vs non-OECD

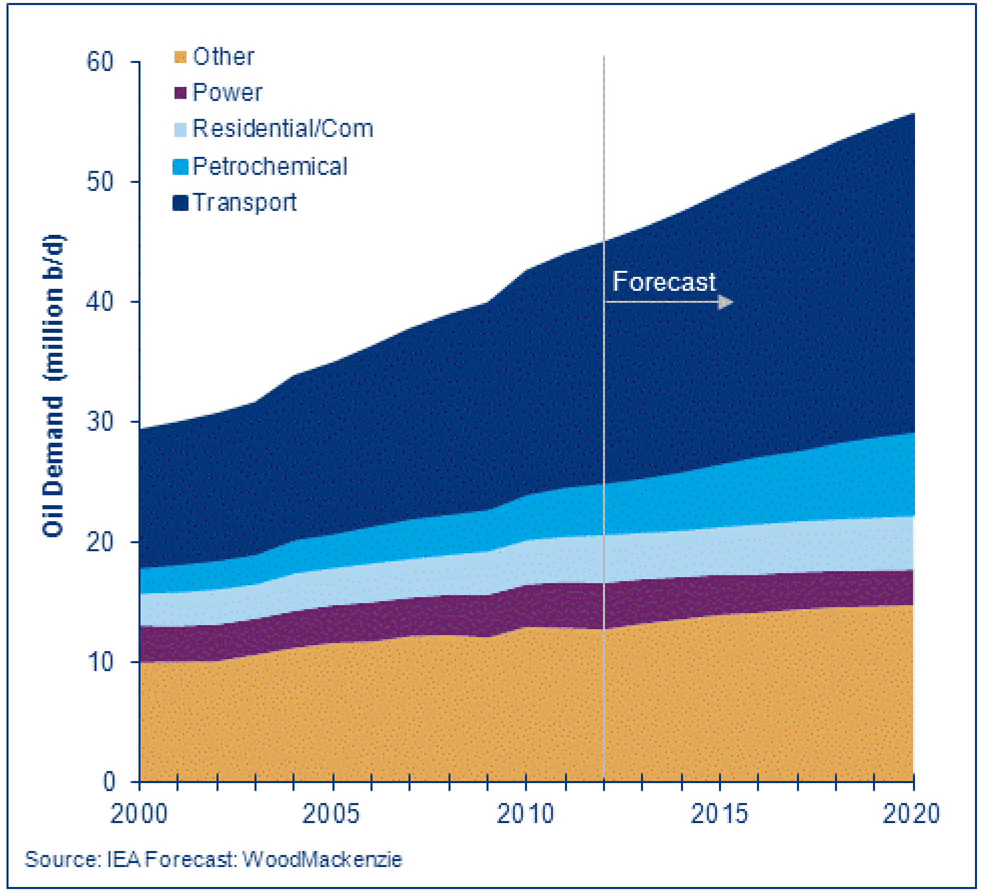
OECD Demand



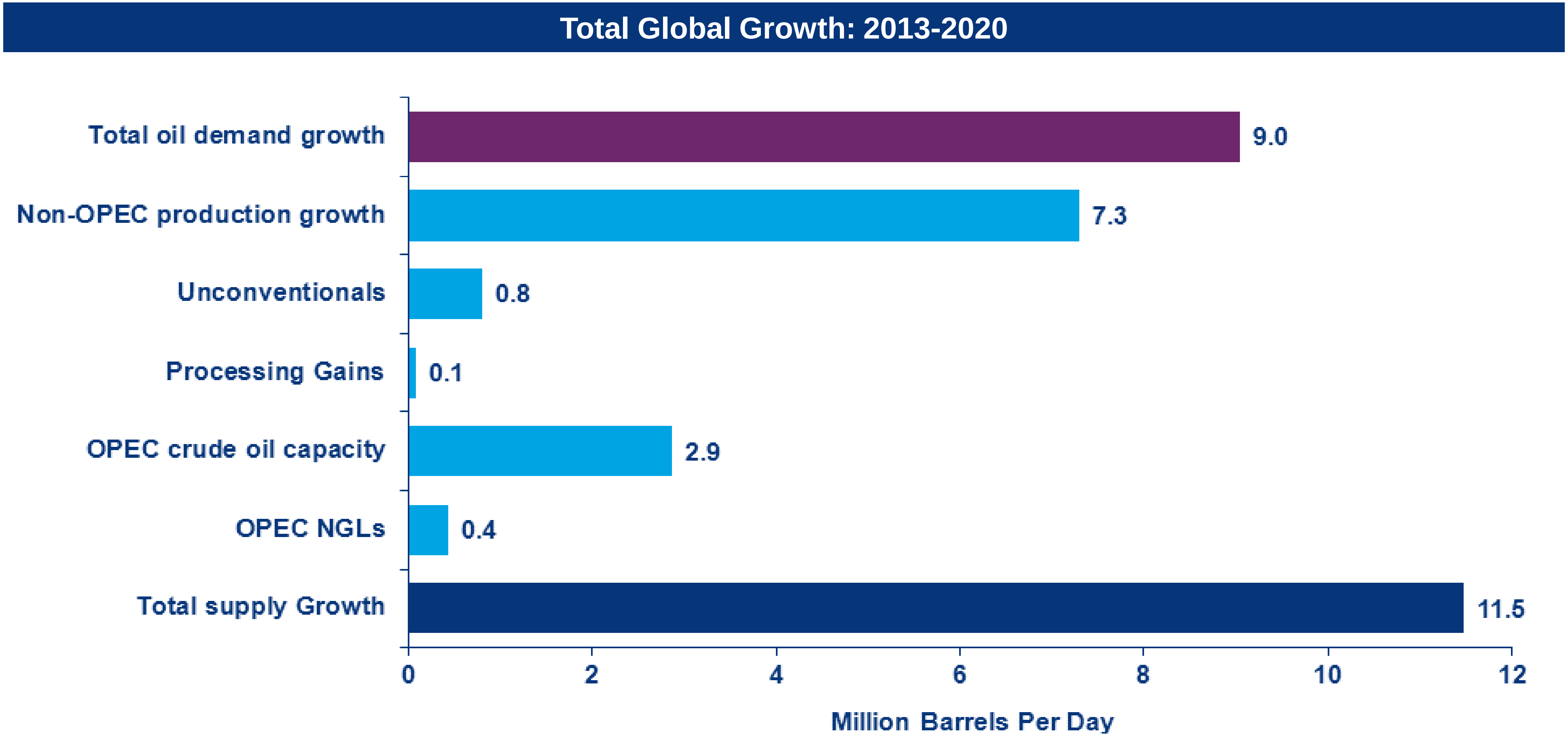
Source: IEA Forecast Wood Mackenzie

Non-OECD Demand

Non-OECD > OECD by 10 mbd in 2020



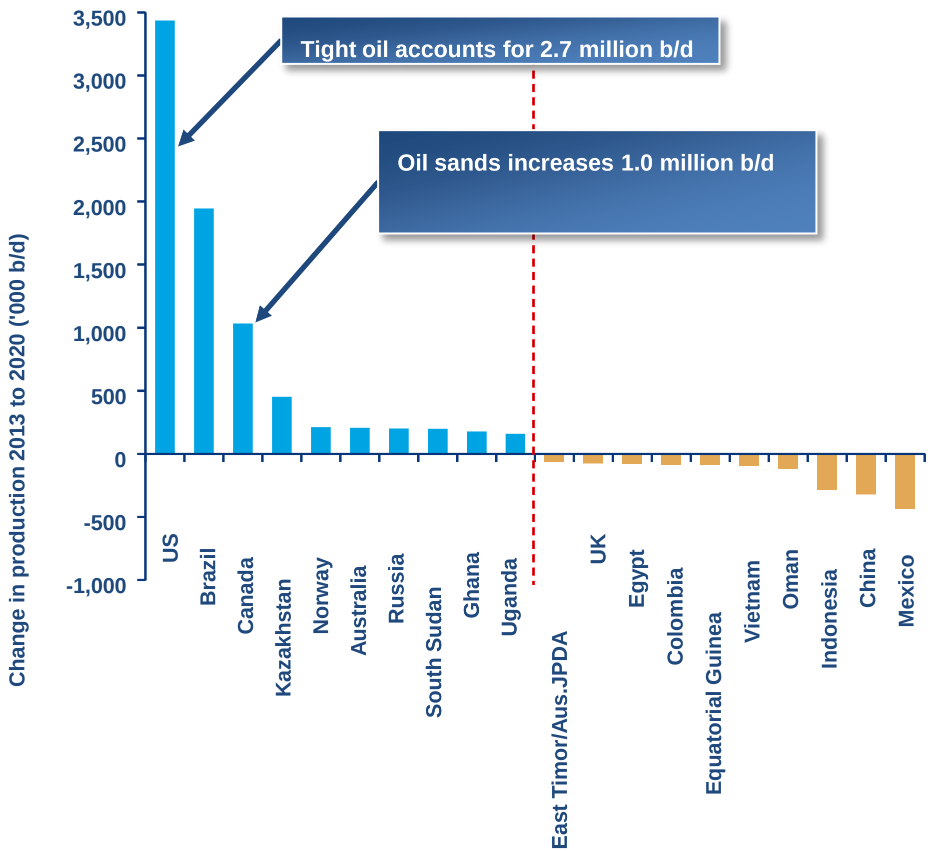
Global oil fundamentals to 2020 shows rising supply and steady oil demand growth



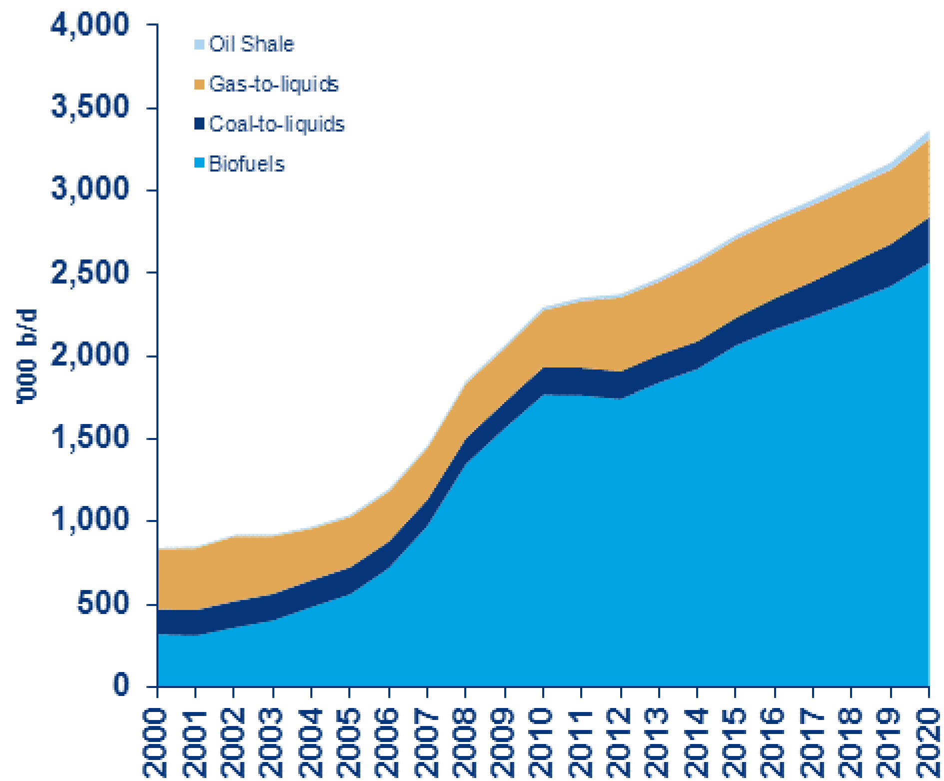
Source: Wood Mackenzie

US shows massive growth with Brazil and Canada also strong for non-OPEC supply; biofuels drives unconventionals

Non-OPEC production change from 2013 to 2020



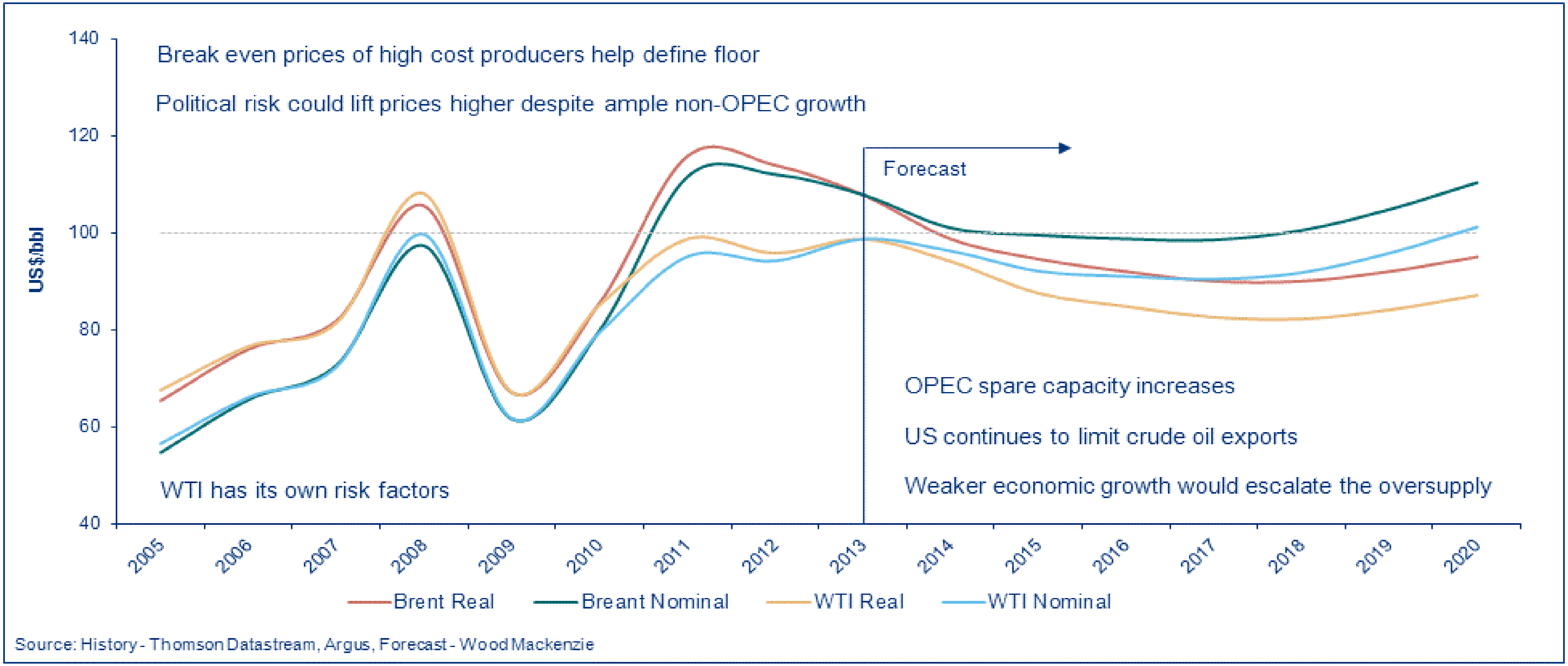
Forecast of Unconventionals to 2020



Source: Wood Mackenzie

Wood Mackenzie's forecast shows moderate downward pressure to 2017 with Brent at $90 per barrel real

Annual average for Brent and WTI in real and nominal terms to 2020



Source: History – Thomson Datastream, Argus, Forecast – Wood Mackenzie

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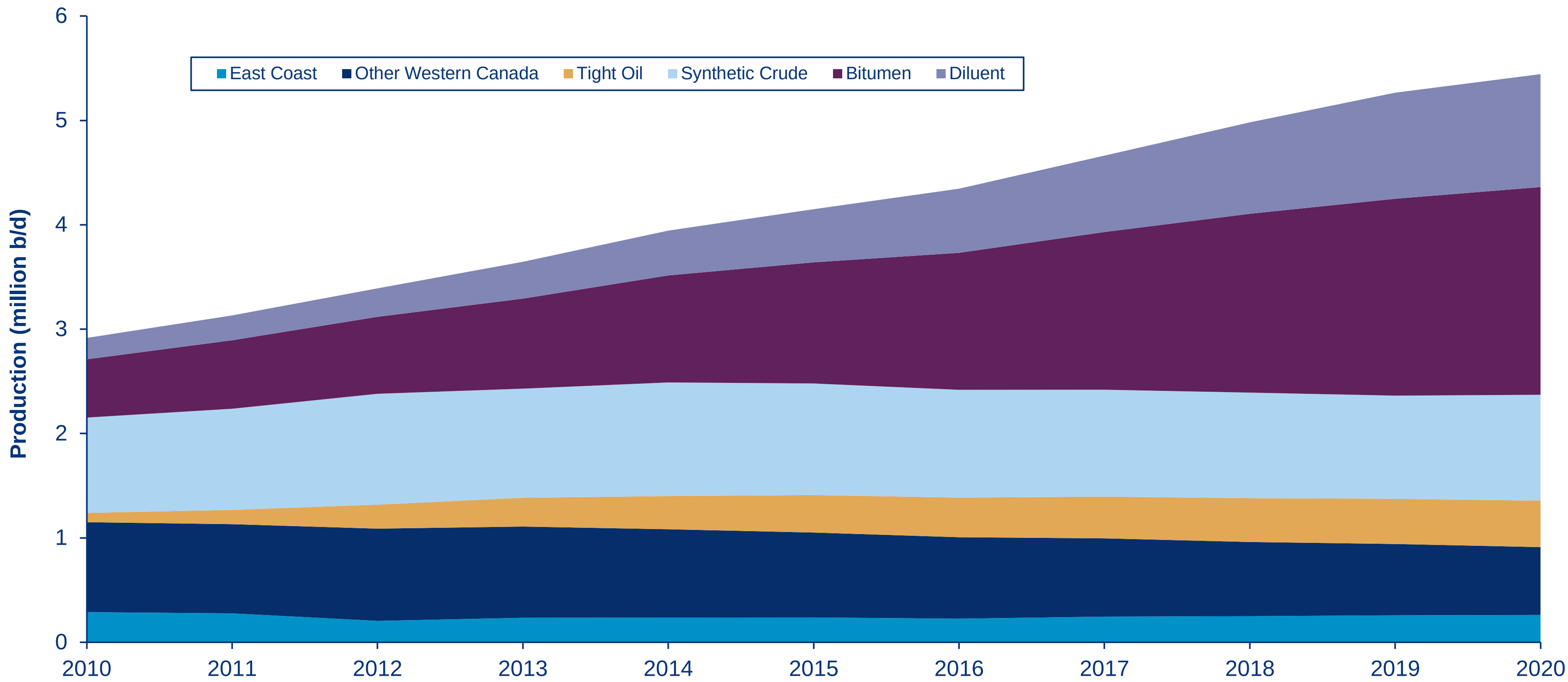
Supply gains in Canada are driven by oil sands and diluent requirements

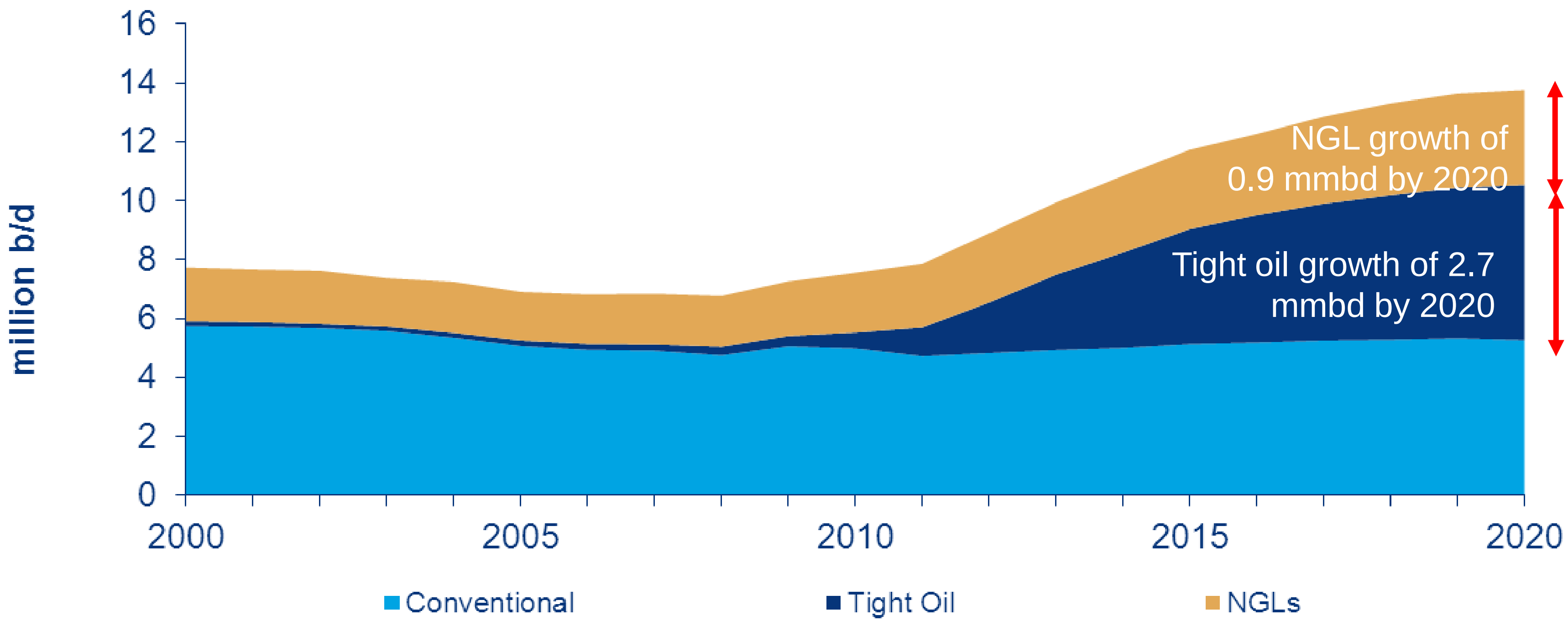
Forecast of total Canadian oil supply by type or location



Source: Wood Mackenzie

US liquids growth driven by tight oil and NGLs

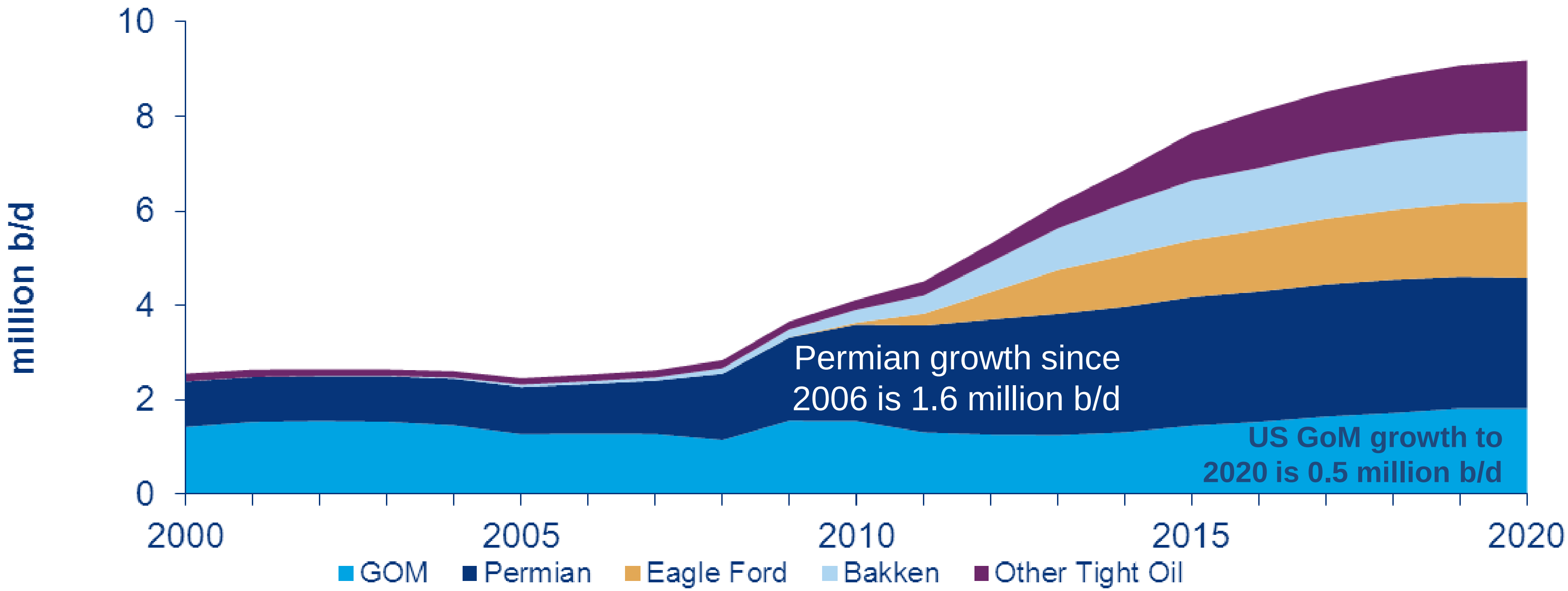
Forecast of Total US Liquids Oil Supply to 2020



Source Wood Mackenzie

US volume recovery started in the Permian and spreads to the Gulf of Mexico

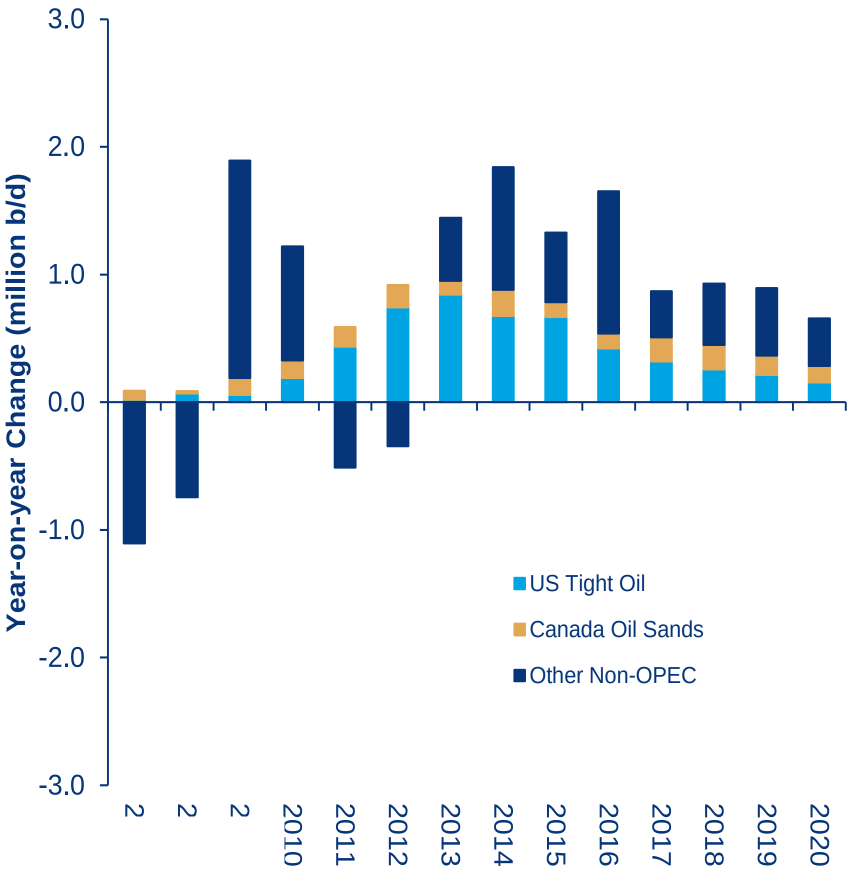
Forecast of Lower-48 Crude Oil Supply to 2020



Source Wood Mackenzie

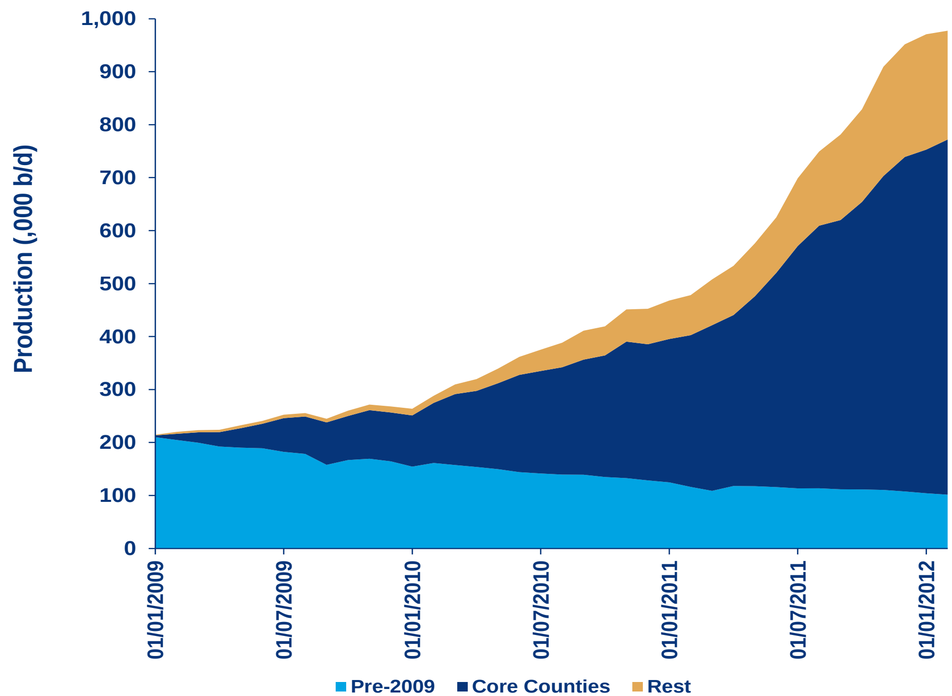
US tight oil still dominates the non-OPEC growth story…and 8 counties dominate the US tight oil story

Non OPEC Supply



- Eight counties in the Bakken and Eagle Ford account for 75% of growth since 2009
- Gains in US tight oil average almost 390,000 b/d per year between now and 2020.
- US tight oil contributes 50% of non-OPEC growth in 2015 and more than 25% in subsequent years.

Core counties dominate Eagle Ford and Bakken oil production

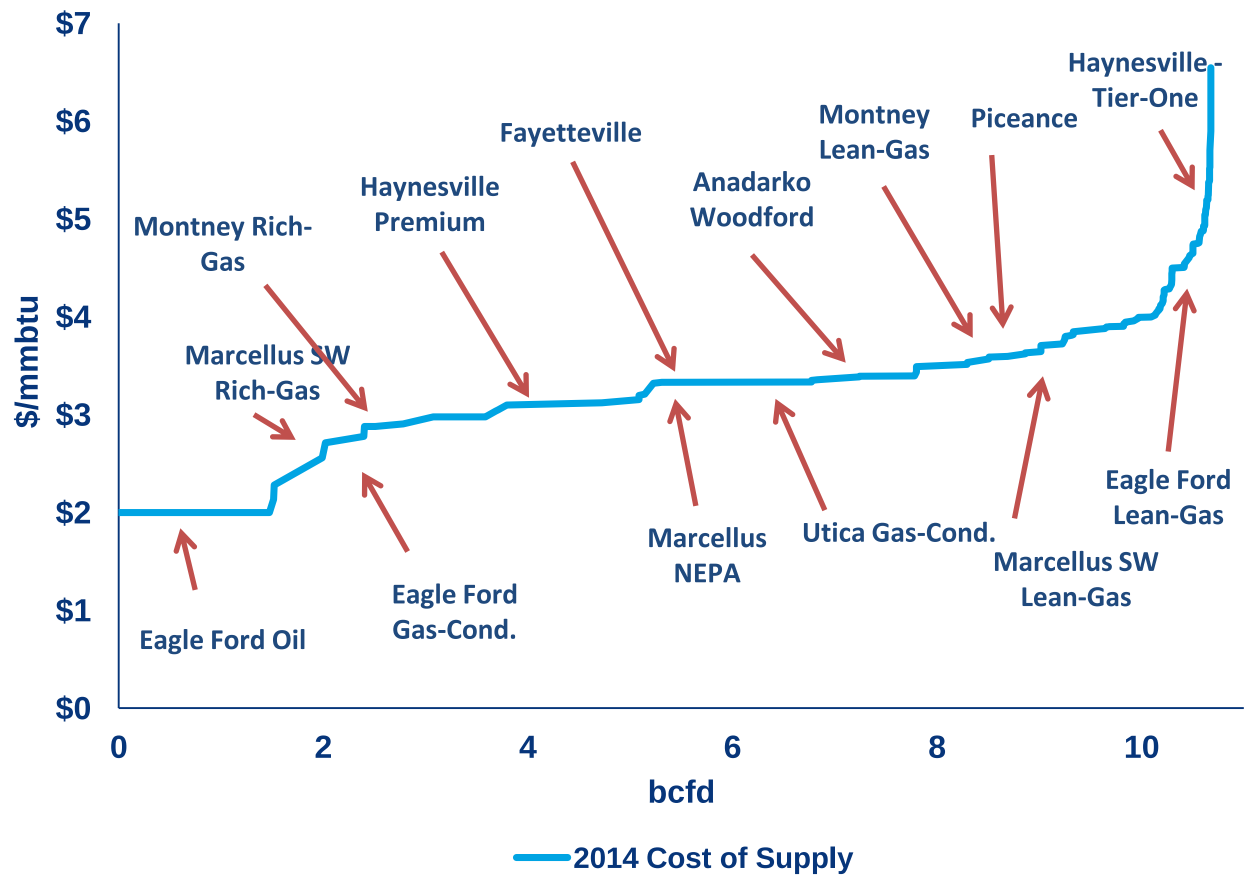


Source: Wood Mackenzie

Majority of gas drilling remains highly economic at prices below $4/mmbtu

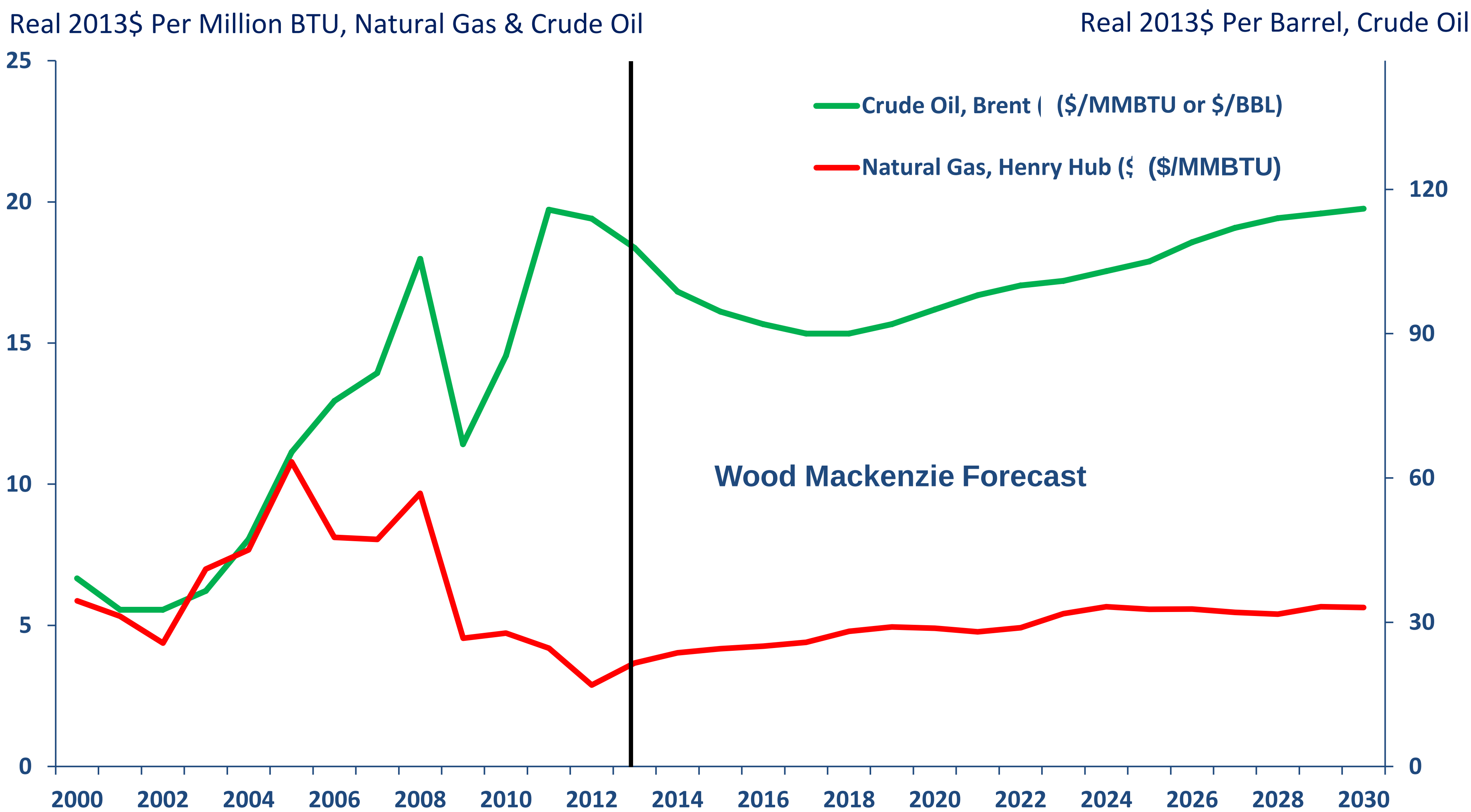
- Over 95% of new production in 2014 will have a breakeven below $4/mmbtu
- Associated gas to add 1.5 bcfd on new-gas volumes in 2014
- Costs have continued to decline in gas-prone areas like the ArkLaTex basin as drilling efficiencies continue to improve and pad-drilling spreads
- Lower realized NGL prices and has increased gas breakevens in some Mid-Continent plays as well as widening basis points in the Northeast

2014 New-drill cost of supply stack



Source: Wood Mackenzie

The price spread of oil to gas encourages demand growth through substitution



Source: NYMEX, Argus Media, Wood Mackenzie

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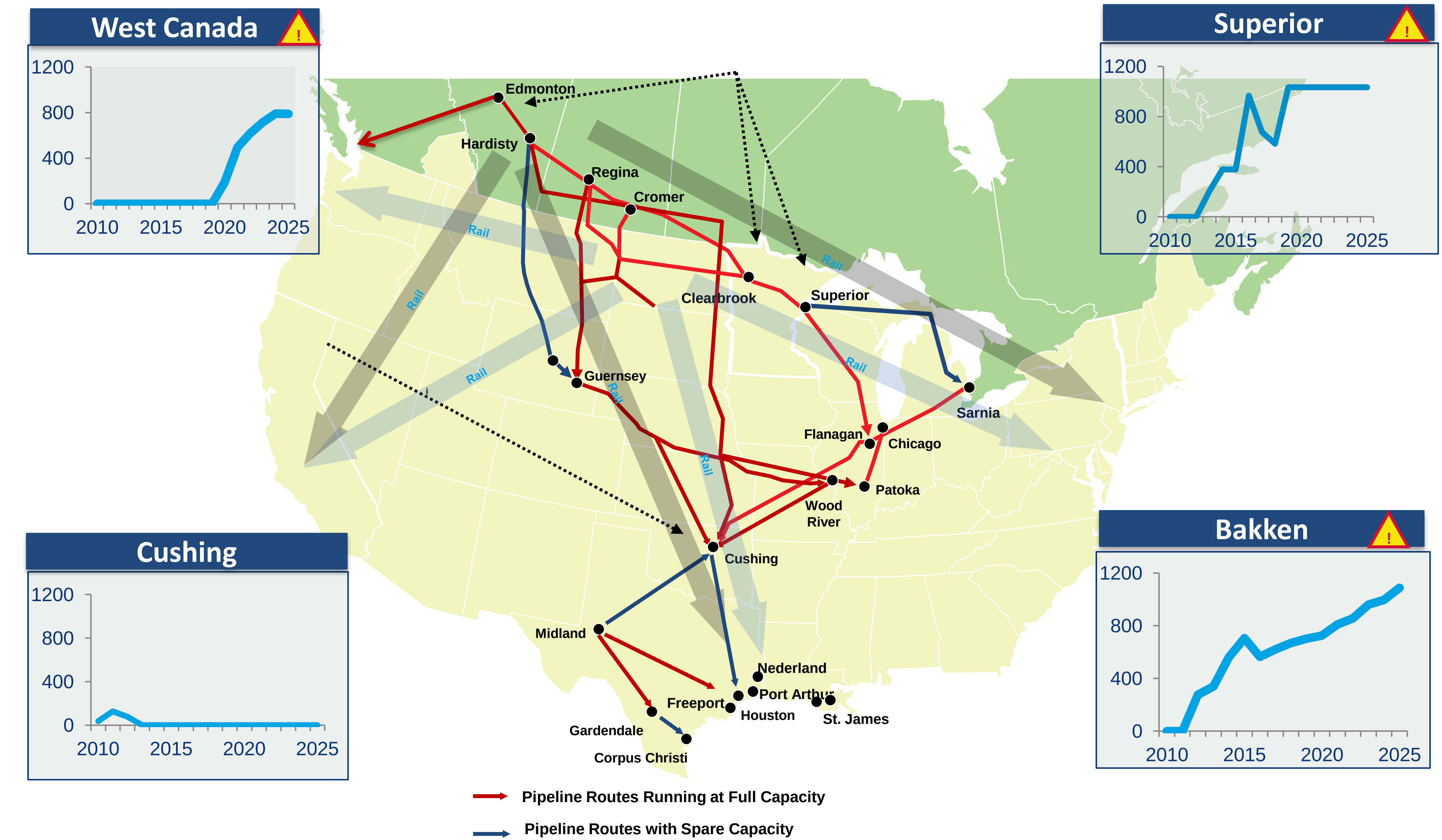
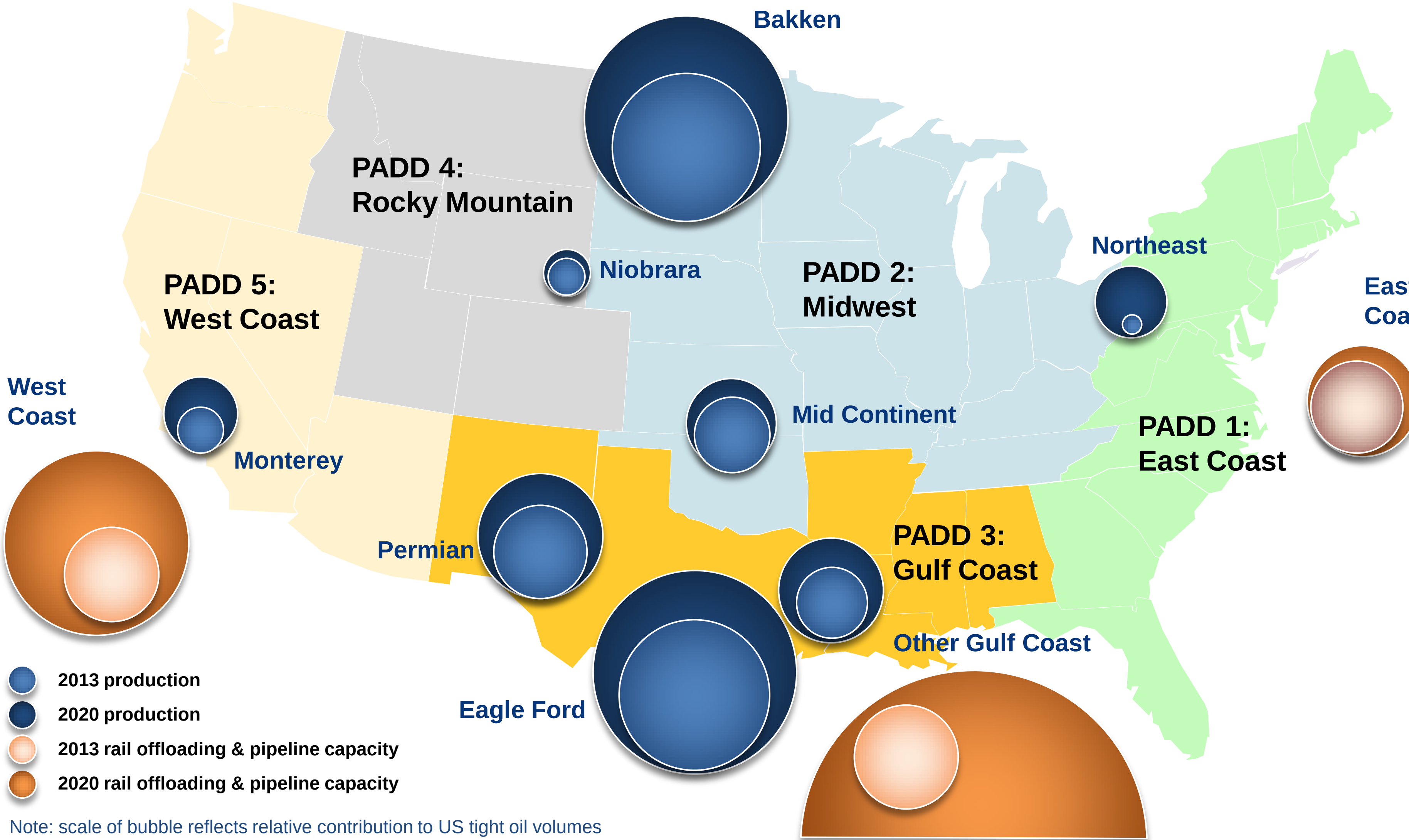
Persistent pipeline "choke points" keep inland differentials wide; as routes south from Canada remain "choked"

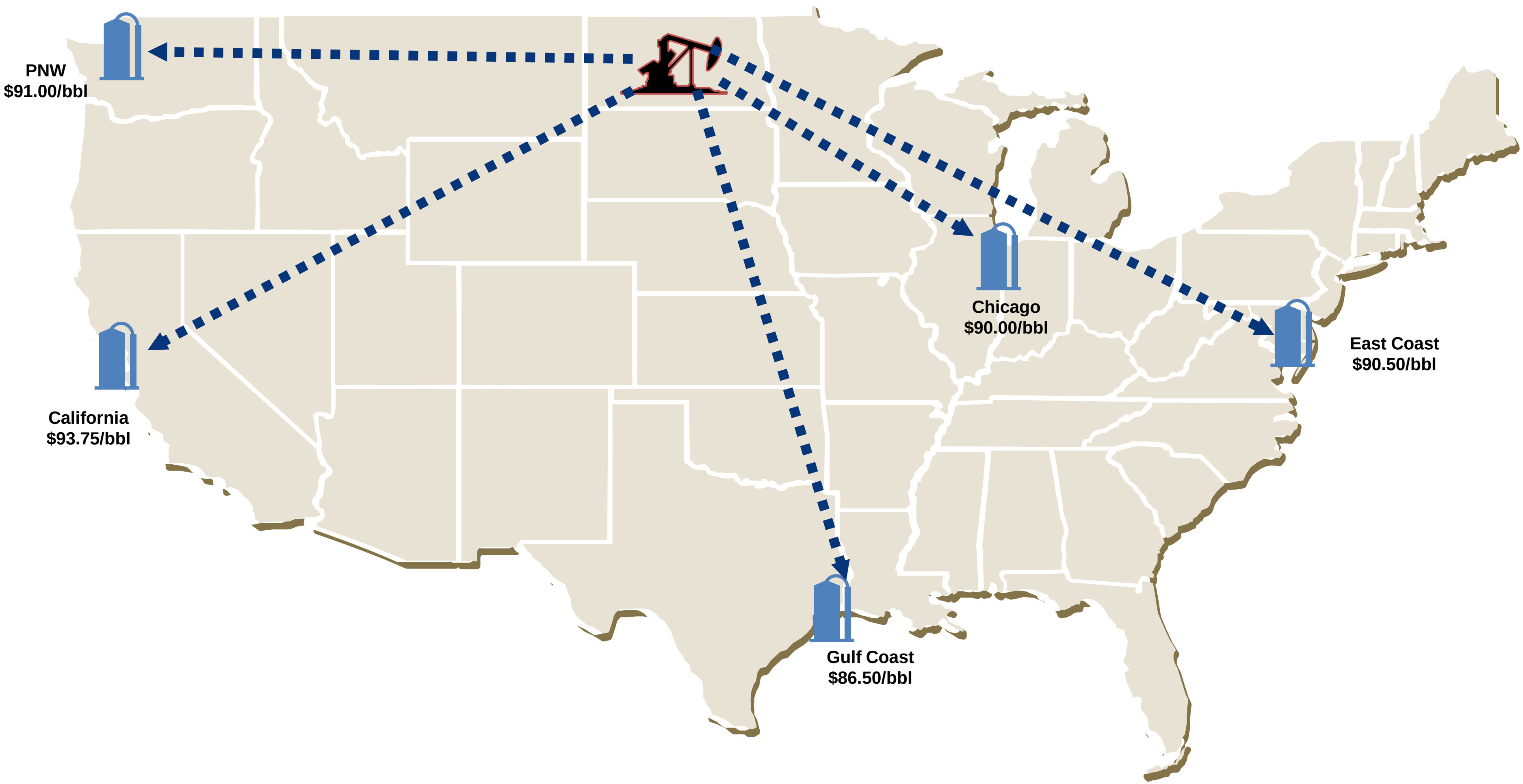


Growing rail infrastructure on the coasts results in greater optionality for inland barrels

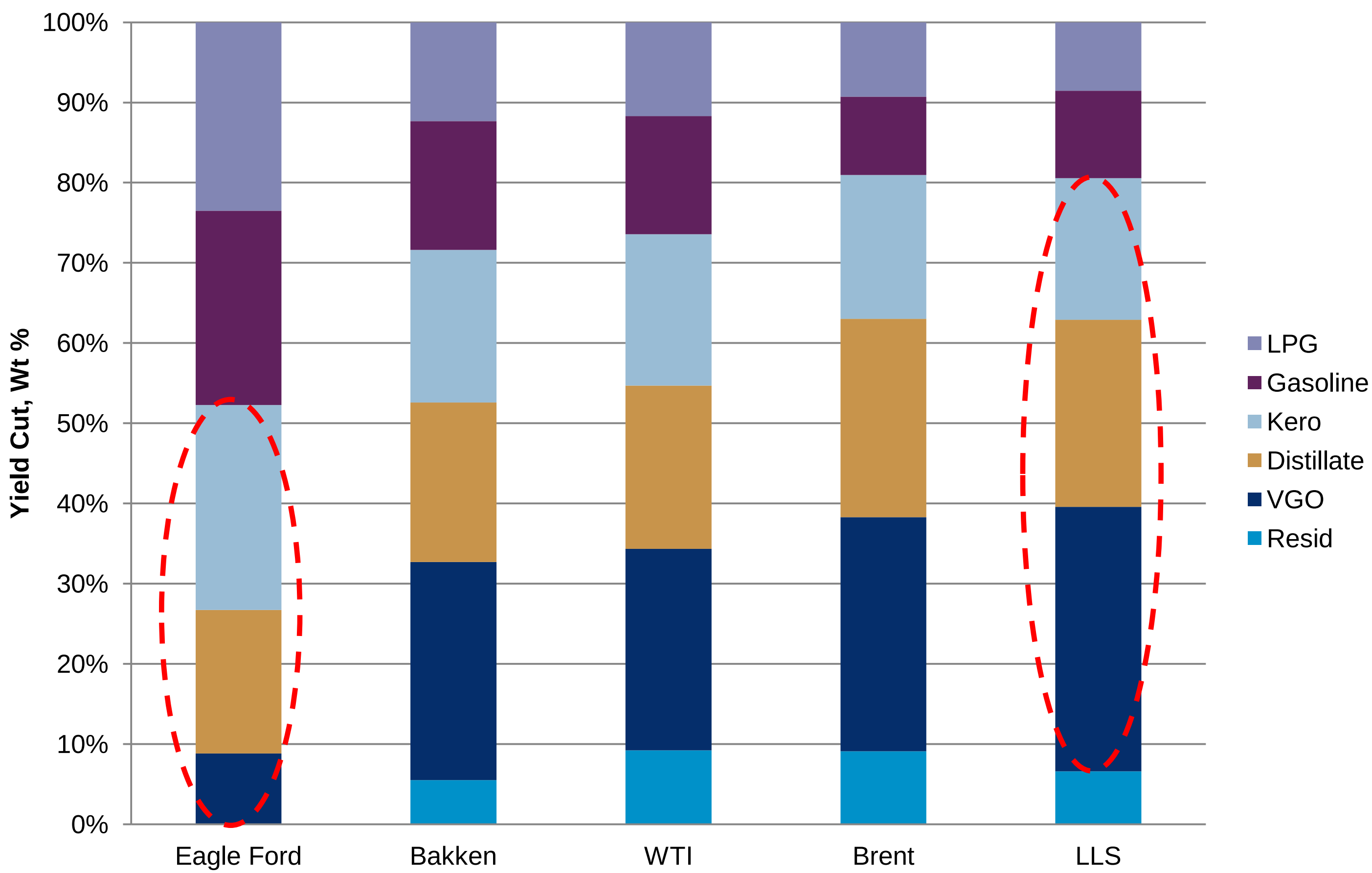


Note: scale of bubble reflects relative contribution to US tight oil volumes

Expanding logistics offer optionality around destination markets



Assay comparison reveals value drivers and further opportunities



API:	58.0	41.7	39.9	38.5	36.4

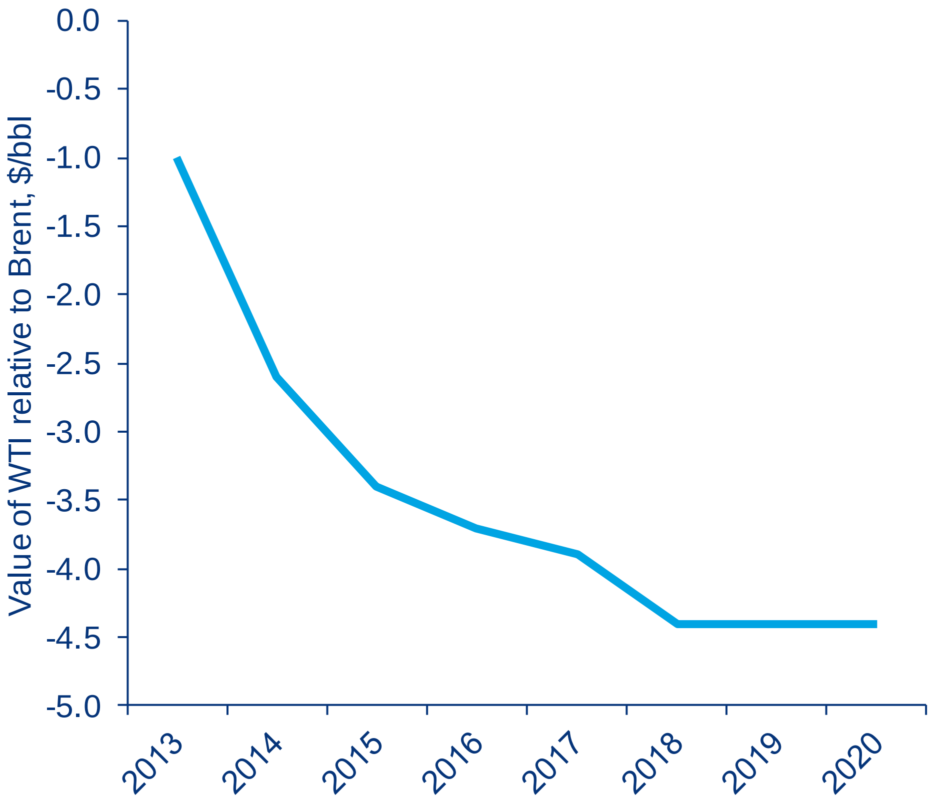
- **Lighter Eagle Ford barrels sell at a discount to LLS:**
  - **Lower potential distillate yield**
  - **Volatility in crude quality remains an transaction advantage for refiners**

- **Brent and LLS should sell close to parity, but US export policy forces LLS quality discount**

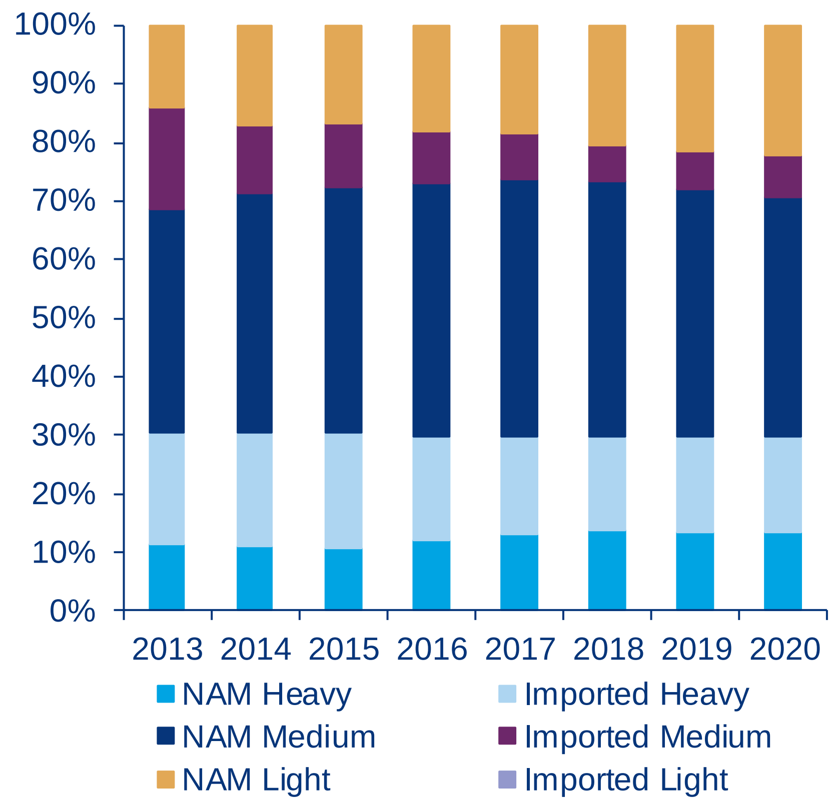
-

Saturation of PADD III with domestic light and medium crudes expected to result in domestic crude refining value discounts

Value of Light Houston Sweet



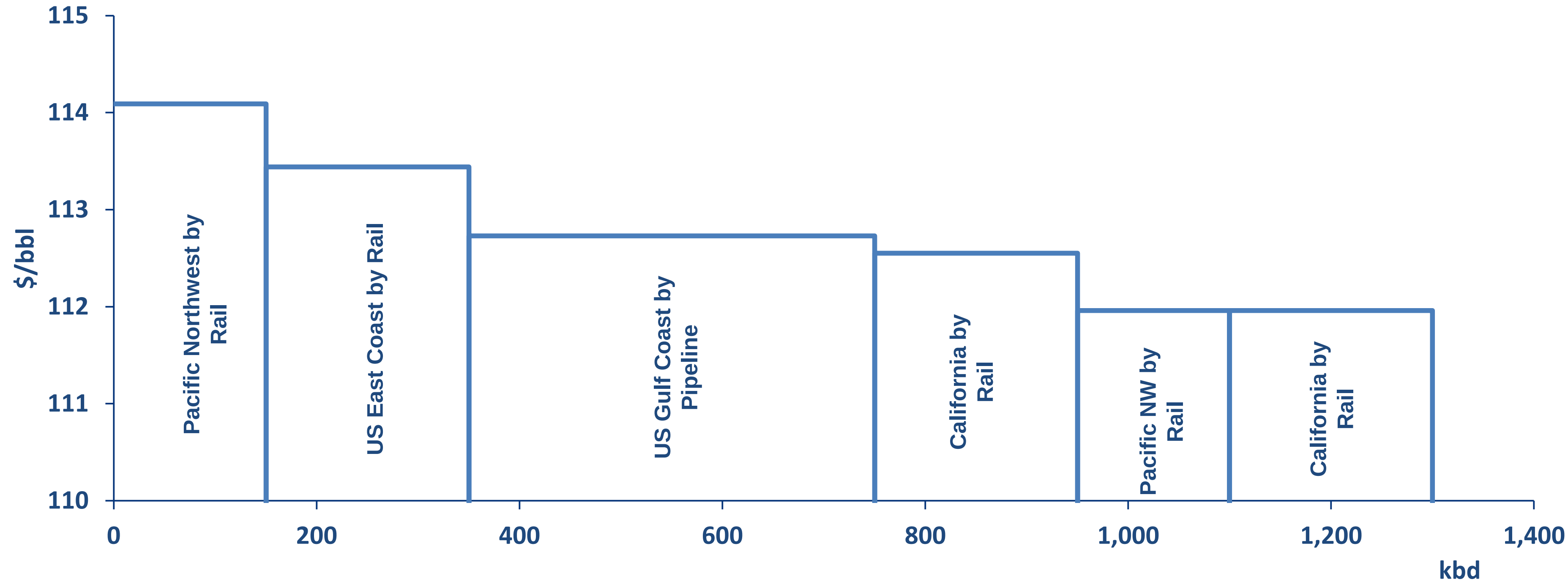
PADD 3 crude slate



Source: Wood Mackenzie

Destination market refining value and transportation to that market are key drivers to allocating North America inland crude oil

Bakken Crude Oil Demand Curve - Illustrative



Source: Wood Mackenzie

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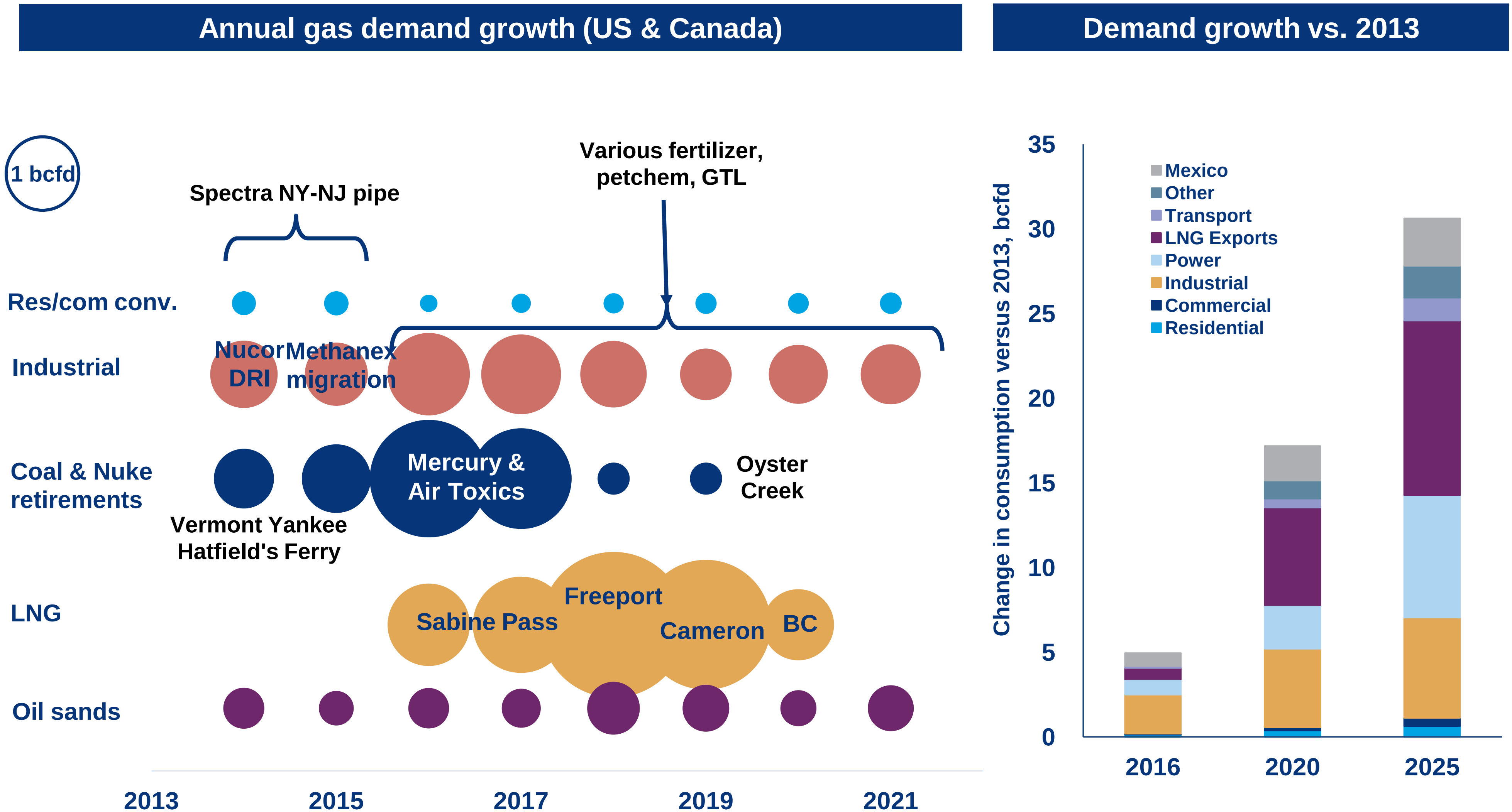
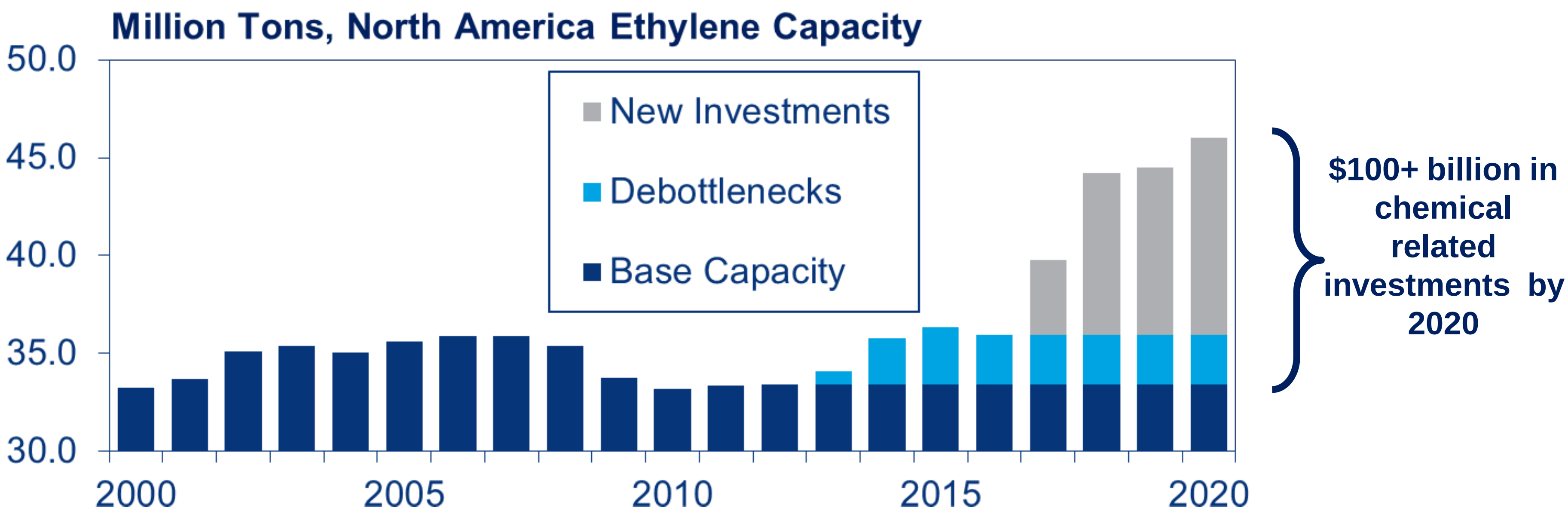
New sources of North America gas demand growth, but prices remain moderate



Source: Wood Mackenzie

Chemical Expansions: More than just infrastructure constraints



Chemical renaissance is based on:

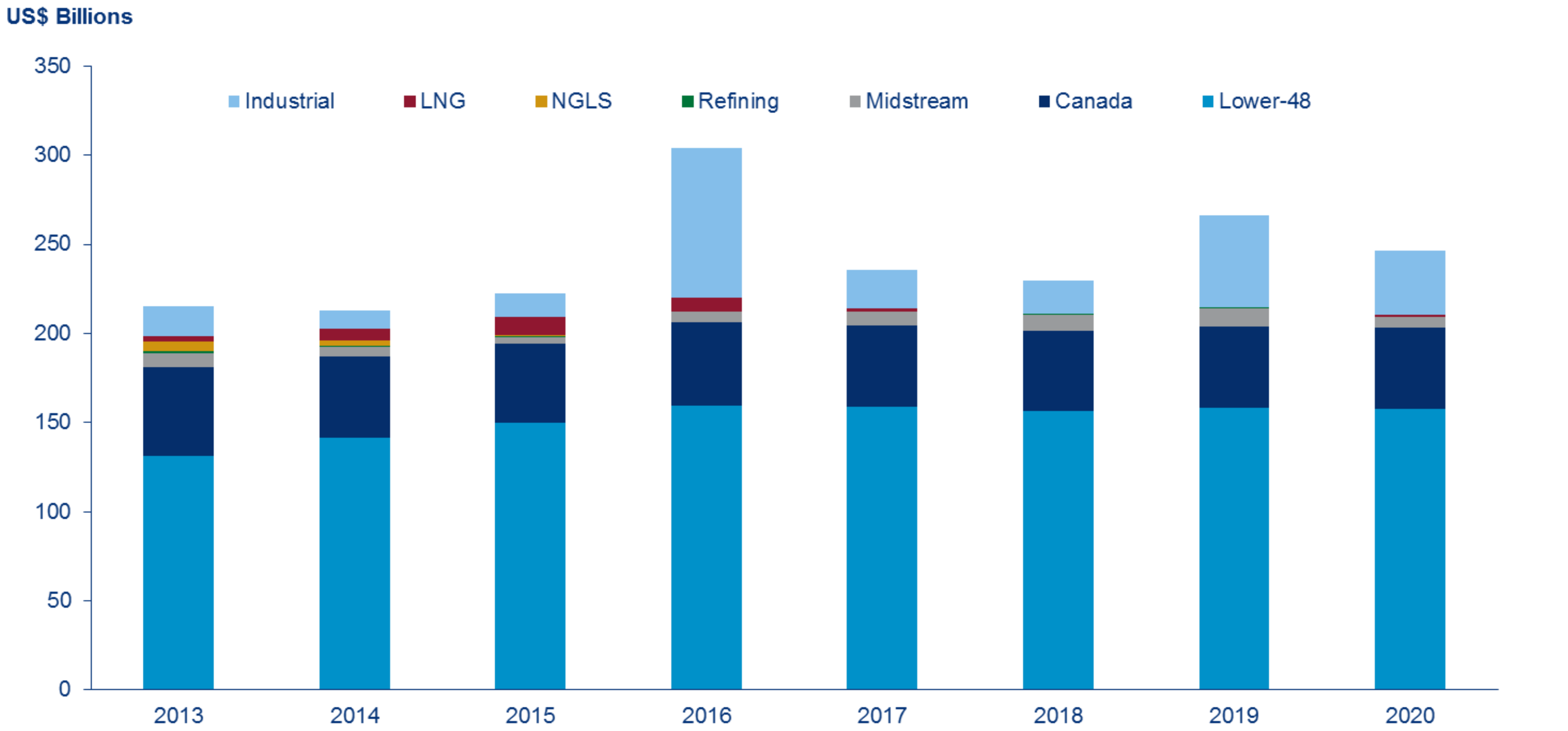
- Geology, technology, & infrastructure that support large volumes of cheap ethane availability
- Stable investment climate / economy
- Existing & expandable infrastructure from the wellhead in the Eagleford to the polyethylene exporter in the US Gulf Coast

Risks to the renaissance are:

- Sustainability of the gas/crude differential
- Ethane deliverability infrastructure
- Environmental permitting, capital costs escalation, construction resources
- Availability of international market demand & trade

Capturing the North America energy value opportunity requires capital....and a lot of it

Capital Spending by Value Chain Segment



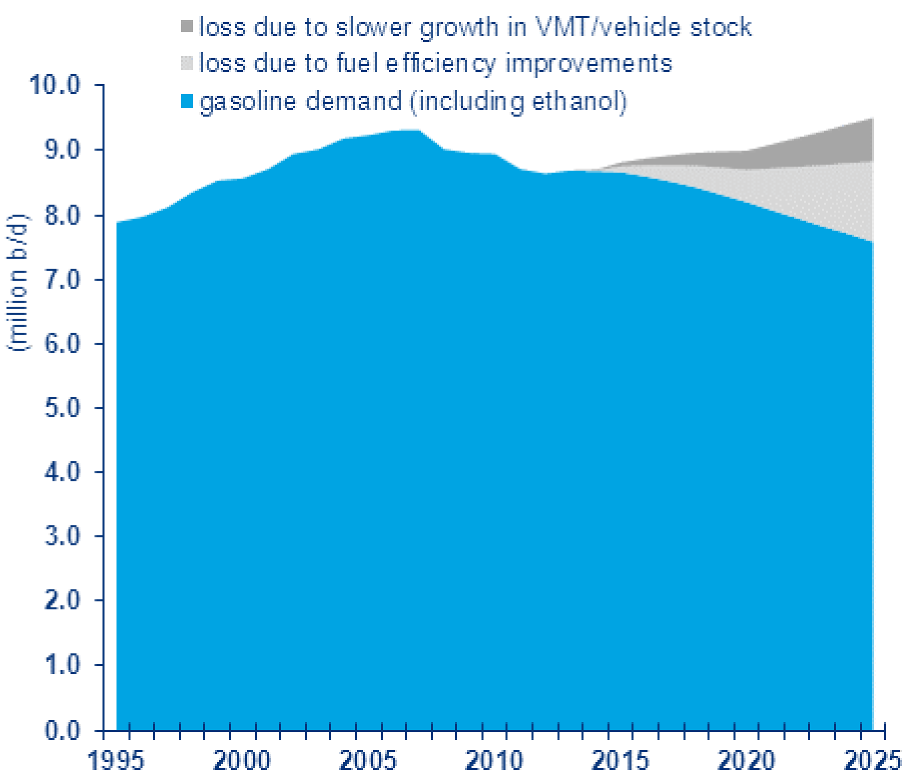
Source: Wood Mackenzie

Black Swans??

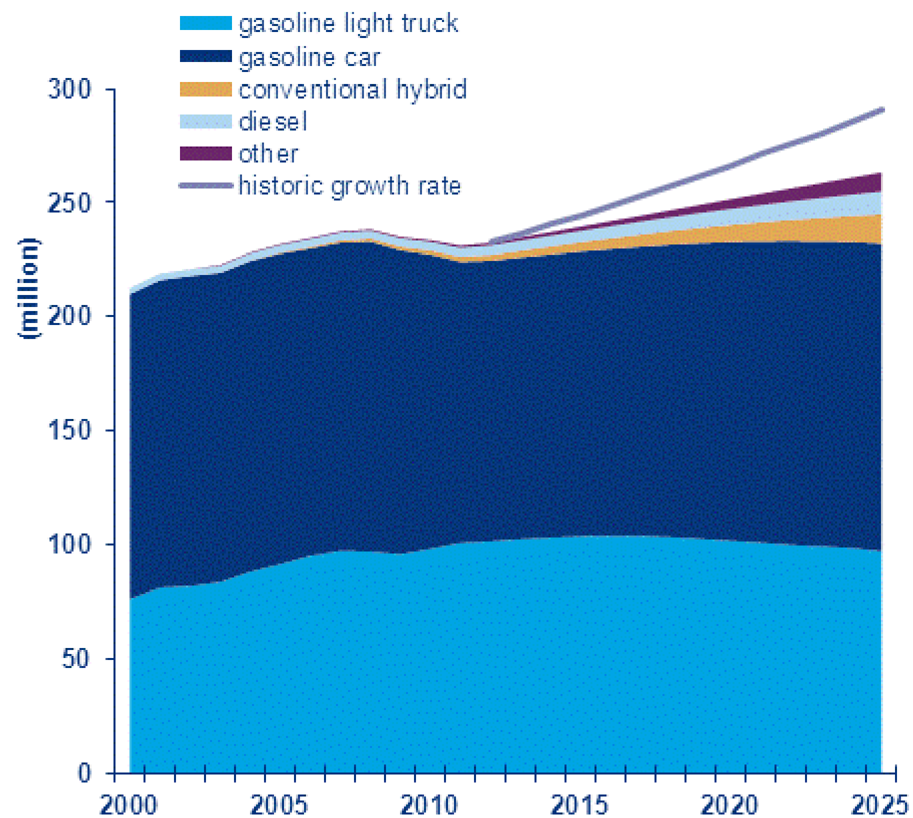
- **Oil demand evaporates**
- US saturates petroleum product export markets
- Oil prices collapse below wellhead break-even

Gasoline accounts for almost half of US oil demand but its dominance is fading. Current stabilization is temporary….

US Gasoline Demand



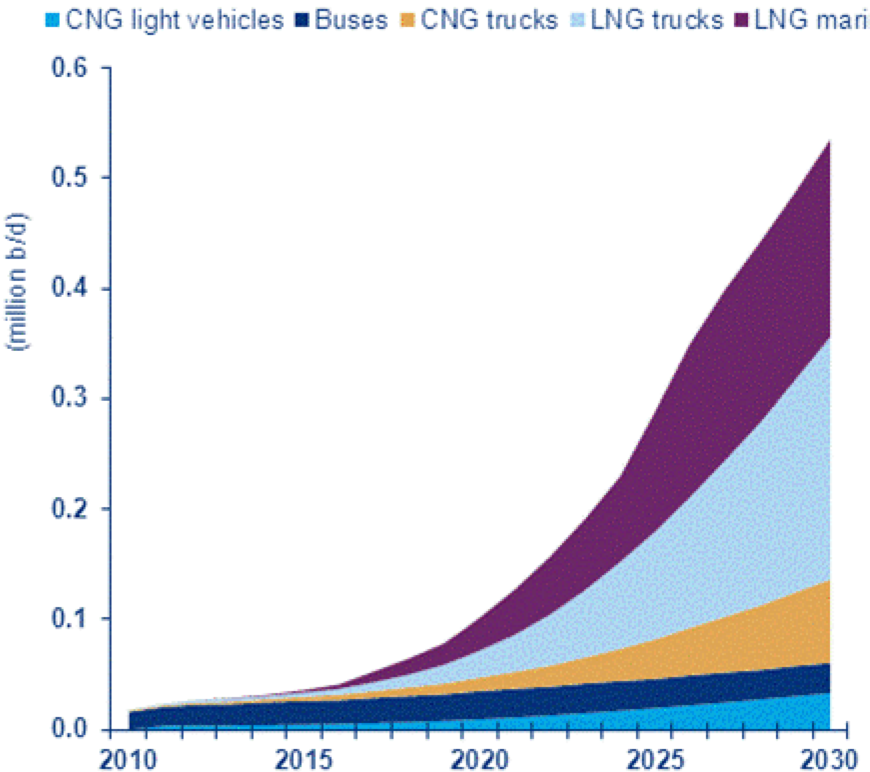
US Light Vehicle Stock



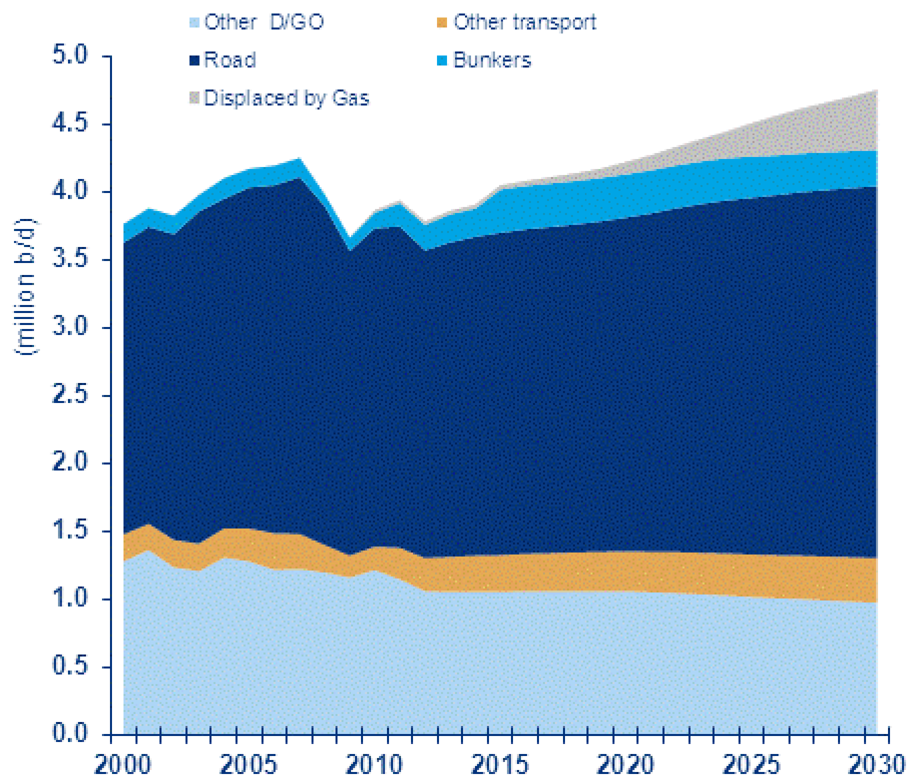
Source: Wood Mackenzie

Shift to natural gas is slow this decade but accelerates post 2020, with LNG displacing primarily diesel/gasoil

Oil Demand Displaced by Natural Gas



US Diesel/Gasoil Demand



Source: Wood Mackenzie

Black Swans??

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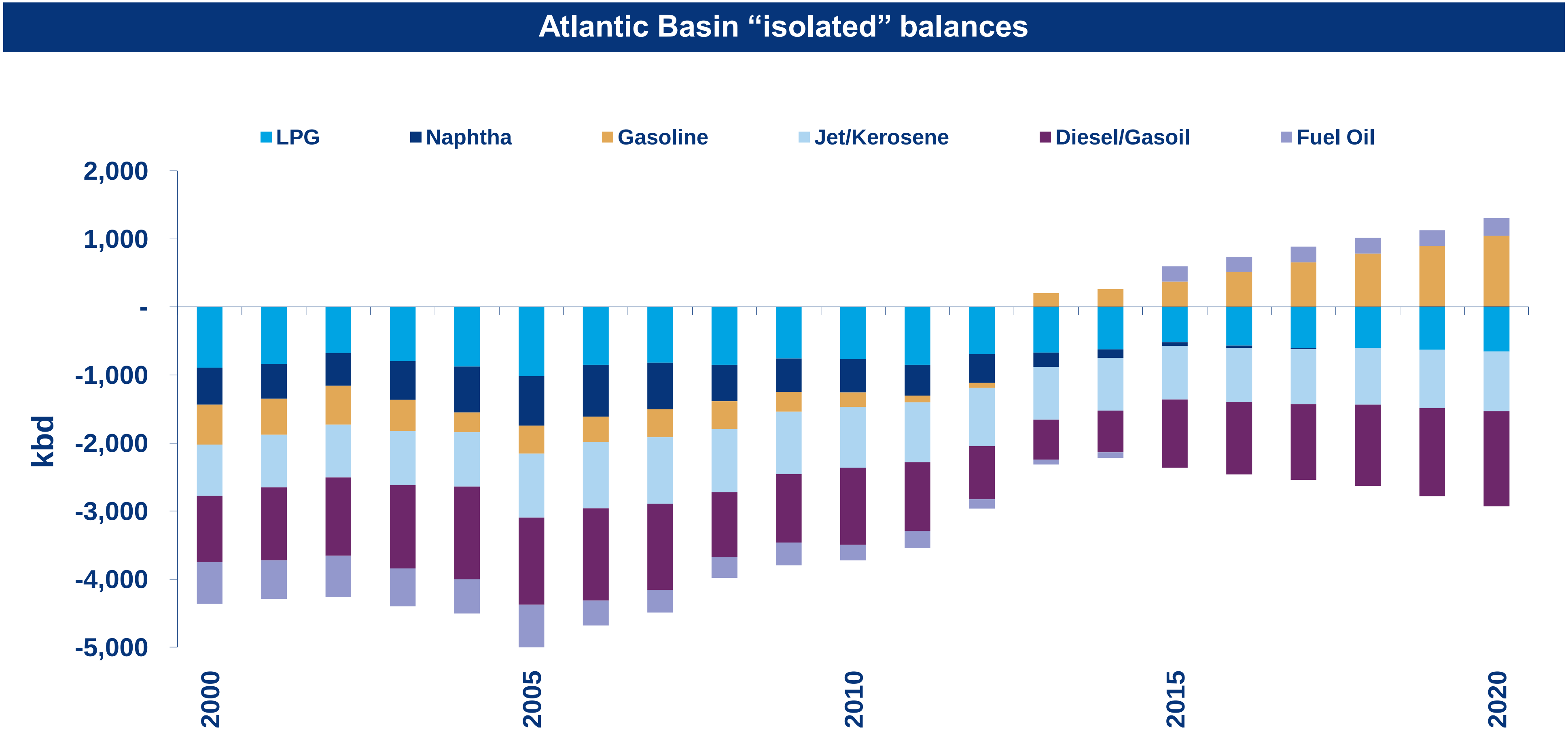
Atlantic Basin is surplus gasoline and fuel oil if all refining centres operate at historical utilisation rates and yields



Source: Wood Mackenzie

Black Swans??

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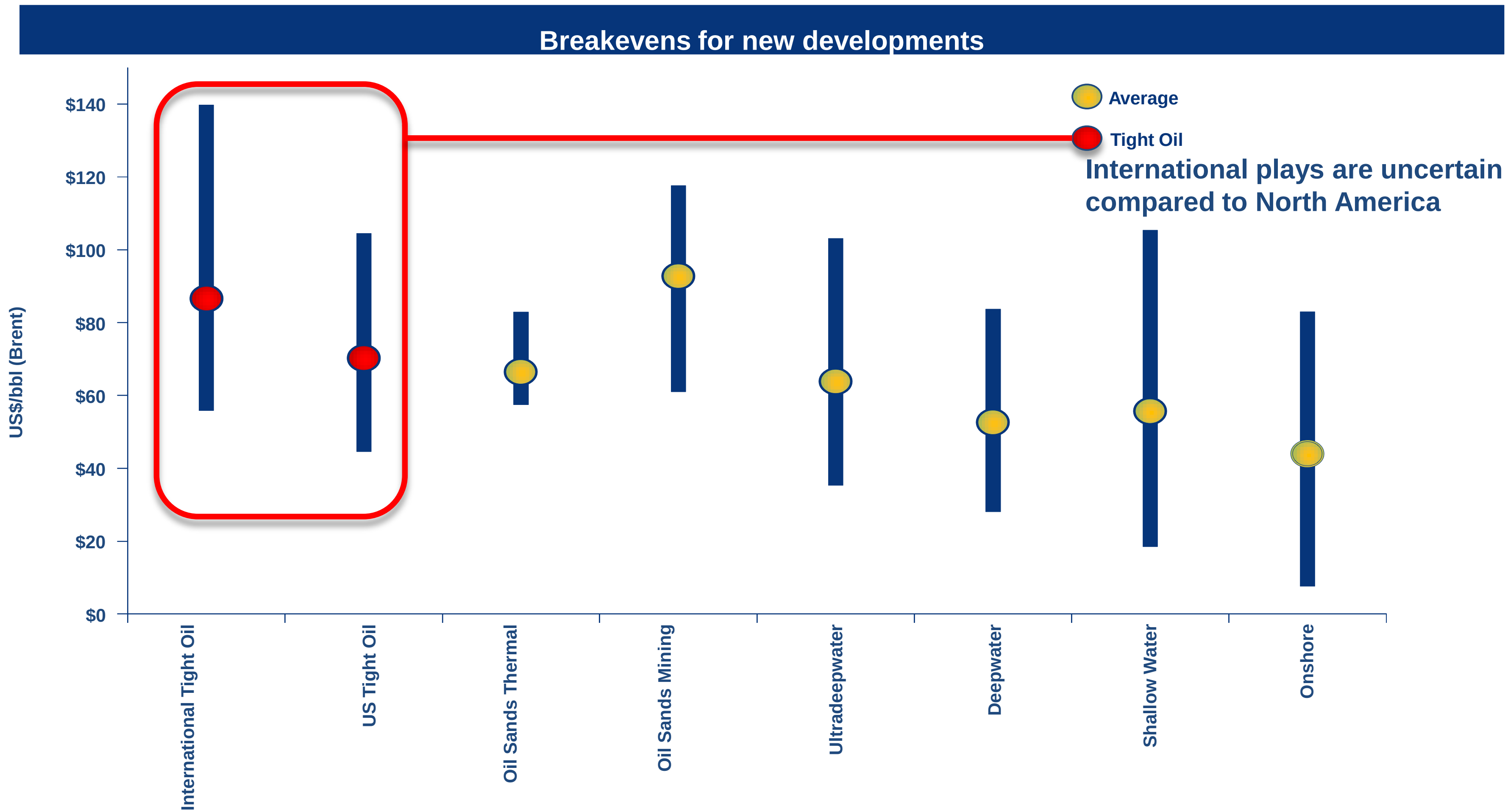
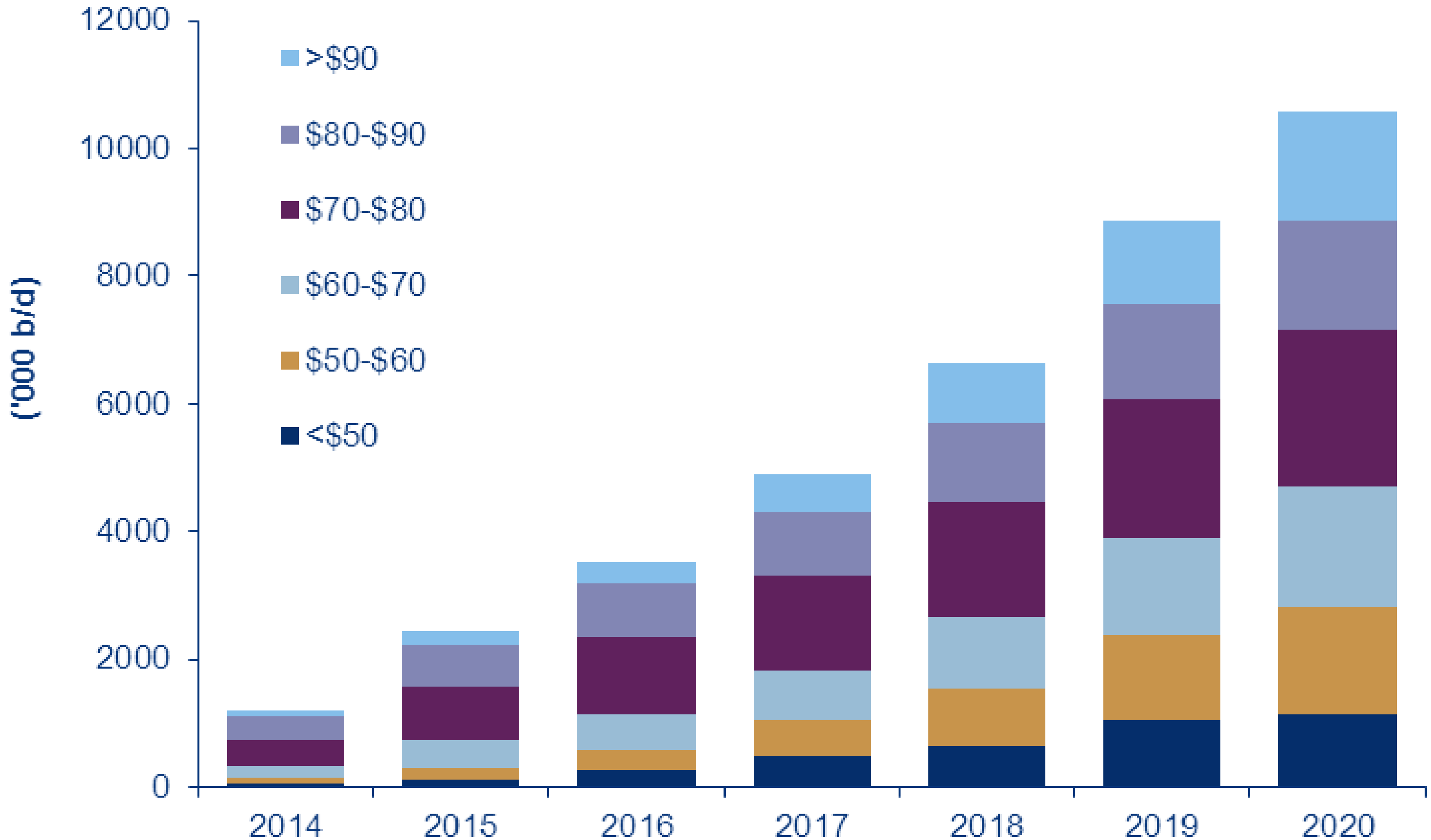
Breakeven for new developments help set a floor for oil prices



Source: Wood Mackenzie

Thus there is a limit to how low prices can fall….a third of new oil developments requires more than $80 per barrel to breakeven

Production from new oil developments by breakeven range in Brent terms real



Source: Wood Mackenzie

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- Skip York is a Principal Analyst in Wood Mackenzie's Oils Research Team responsible for cross-segment integration of petroleum market and infrastructure issues for North America. With over 20 years of worldwide experience across the energy value chain, he has deep expertise in petroleum market economics and price-setting mechanisms including valuing non-fungible crudes across a number markets, NGLs, and leveraging technologies for competitive advantage.
- Specializes in strategy, transaction support, asset valuation, and commercial optimization. Recently he has been focusing on the implications of logistic constraints on market-clearing dynamics and prices for Canadian heavy crude oil and NGL production growth from unconventional plays.
- Prior to joining Wood Mackenzie, Skip worked for ExxonMobil in a variety of strategic planning assignments. He held roles as the global expert on joint venture negotiation best practices, managing new business development downstream opportunities in Asia Pacific, and leading research teams on studies of the economic impact of large-scale oil investments on the economy of Russia. He also has consulted for clients at McKinsey & Company and Charles River Associates.
- Skip holds a PhD Economics from the University of Virginia, as well as, a Masters of Science and Bachelor of Science also in Economics from the University of Wyoming.

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