Energy Outlook

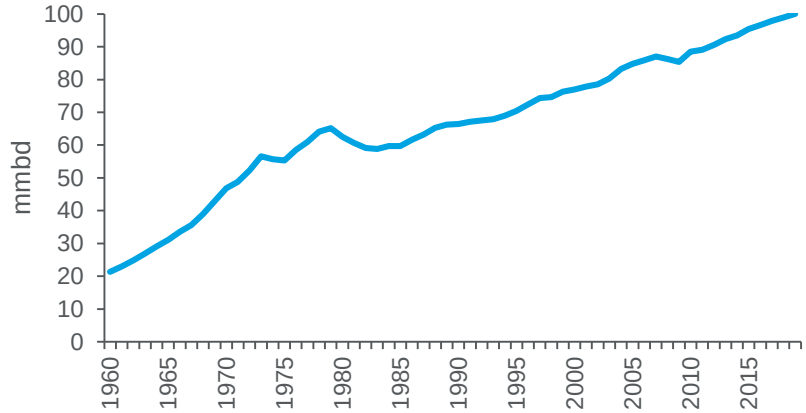
TXCPA Energy Conference

R.T. Dukes - August 2019

Global Oil (Liquids) Demand through to 2019: reaching 100 million b/d

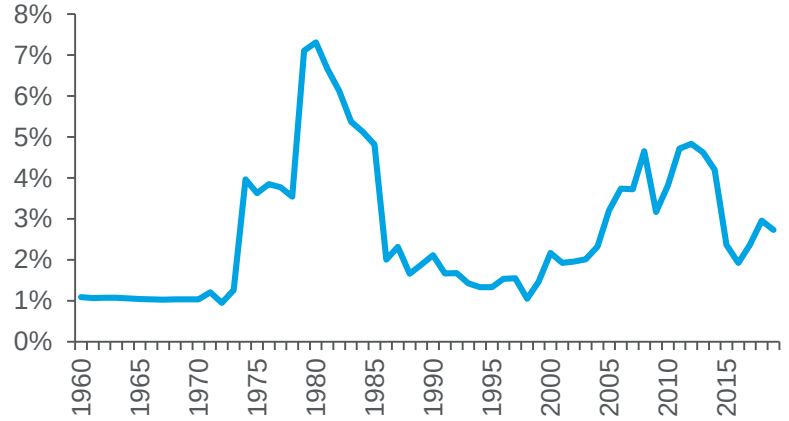
Demand challenge or continued growth?

Global Oil (Liquids) Demand



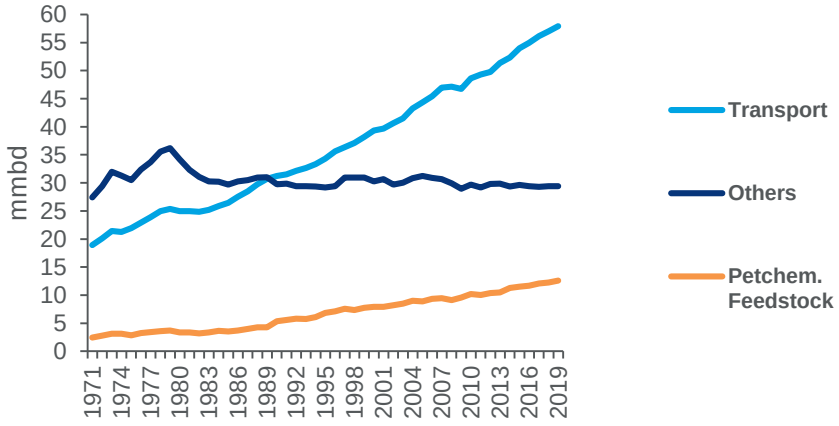
Source: Wood Mackenzie, EIA, IEA

Total Oil Value ($/bbl * total demand)-to-World GDP Ratio



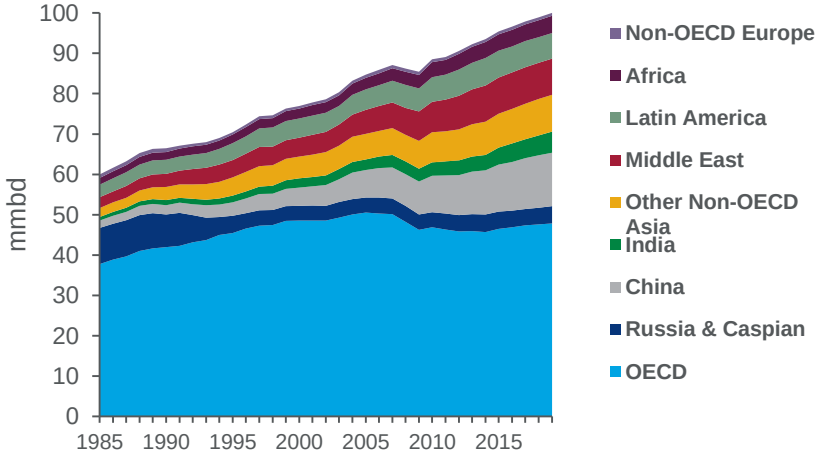
Source: Wood Mackenzie, World Bank, IMF, EIA, BP

Oil (Liquids) Demand by Sector



Source: IEA Energy Statistics, Wood Mackenzie

Oil (Liquids) Demand by Region

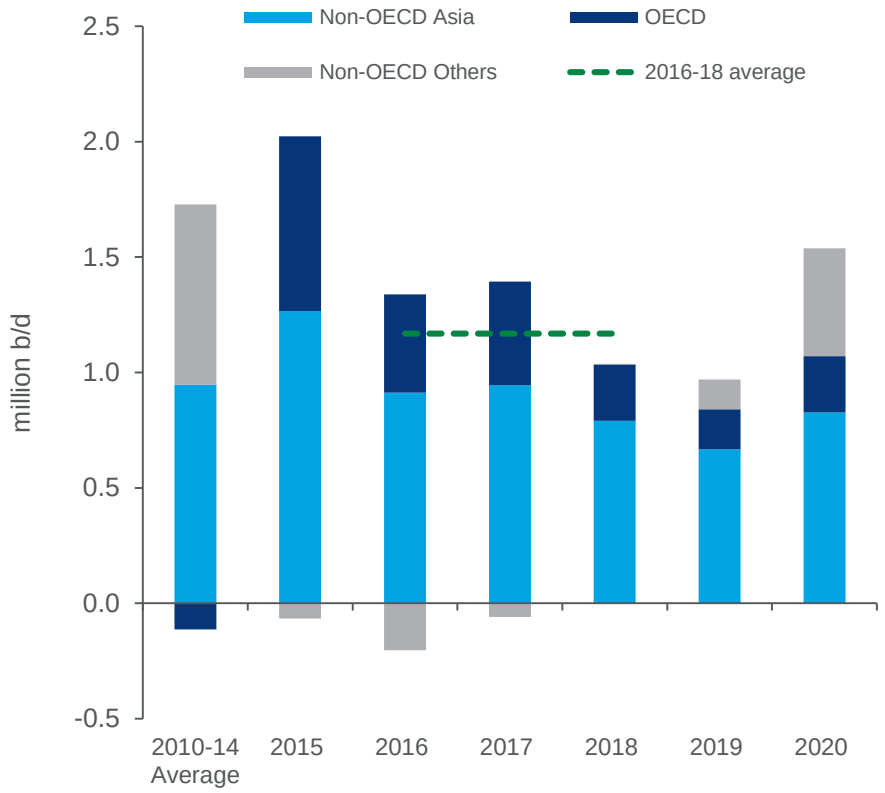


Source: Wood Mackenzie, IEA MODS

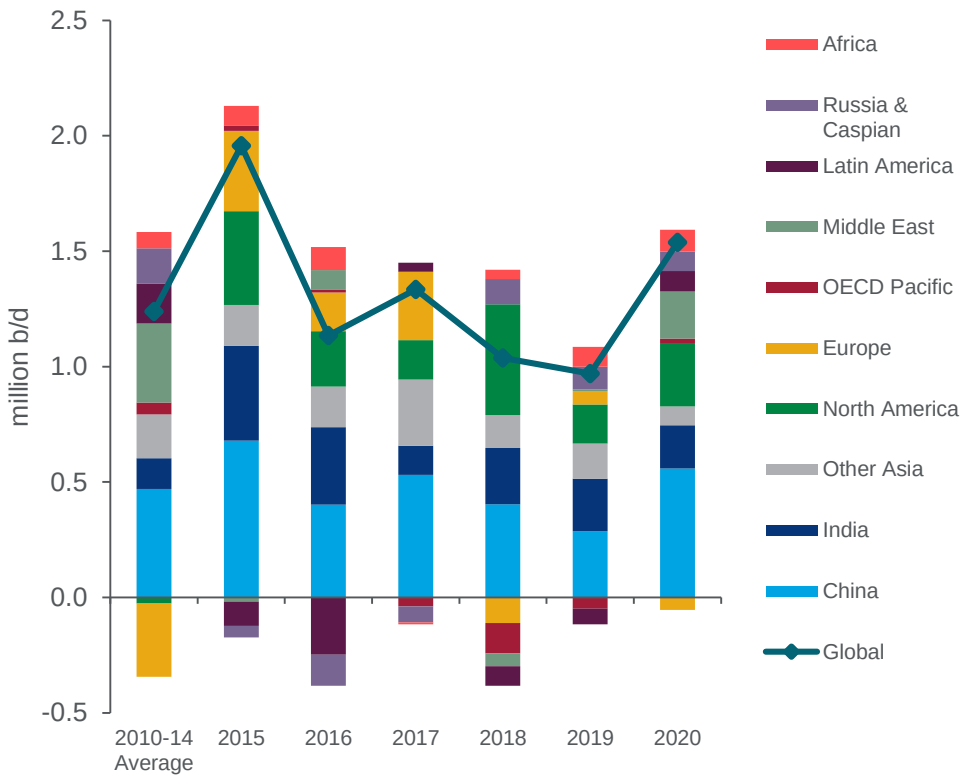
Global liquids demand growth moderates in 2018-2019

Slowing demand growth here to stay?

Annual liquids* demand growth



Annual liquids demand growth

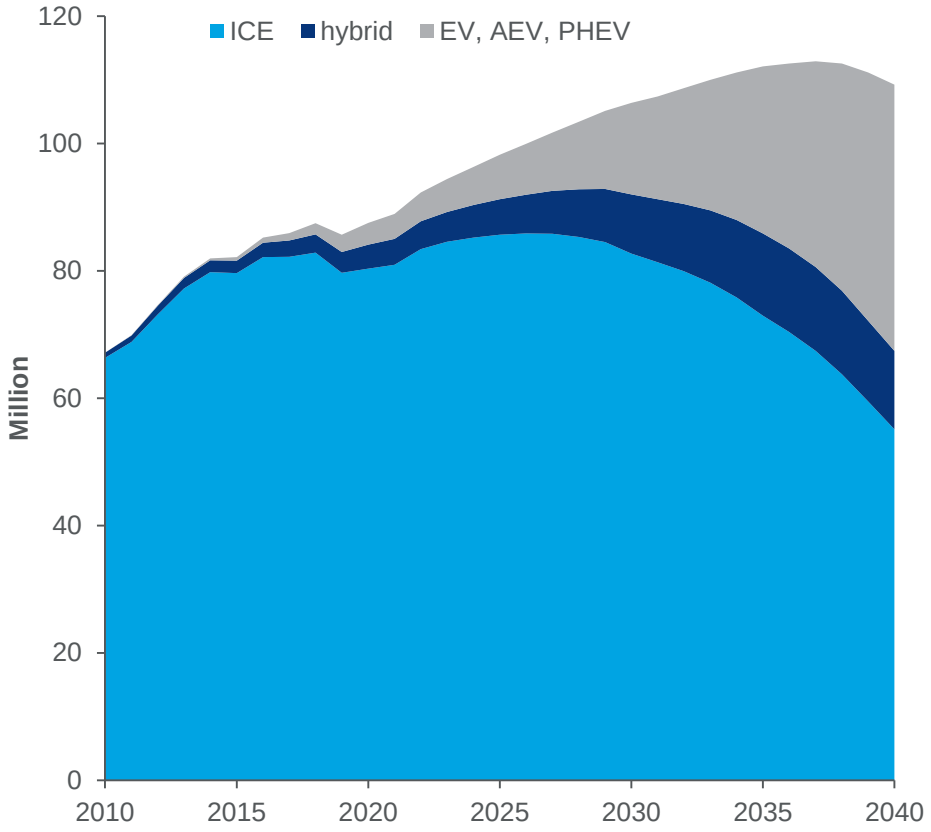


*Liquids include oil products, NGLs and biofuels.
Source: Wood Mackenzie, IEA MODS, EIA and other national statistics

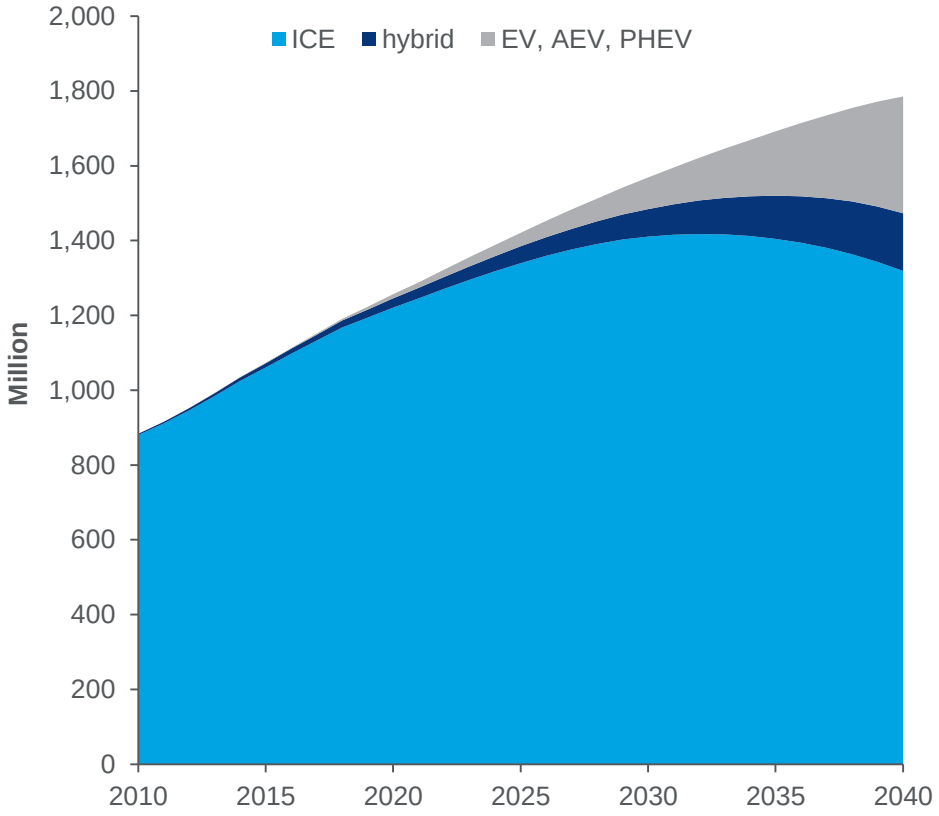
While light vehicle sales and stock continue to increase over current levels, ICE sales peak in 2025 while the ICE stock peaks after 2030

EV market penetration begins to impact oil demand in the 2030s

Global light vehicle sales



Global light vehicle stock

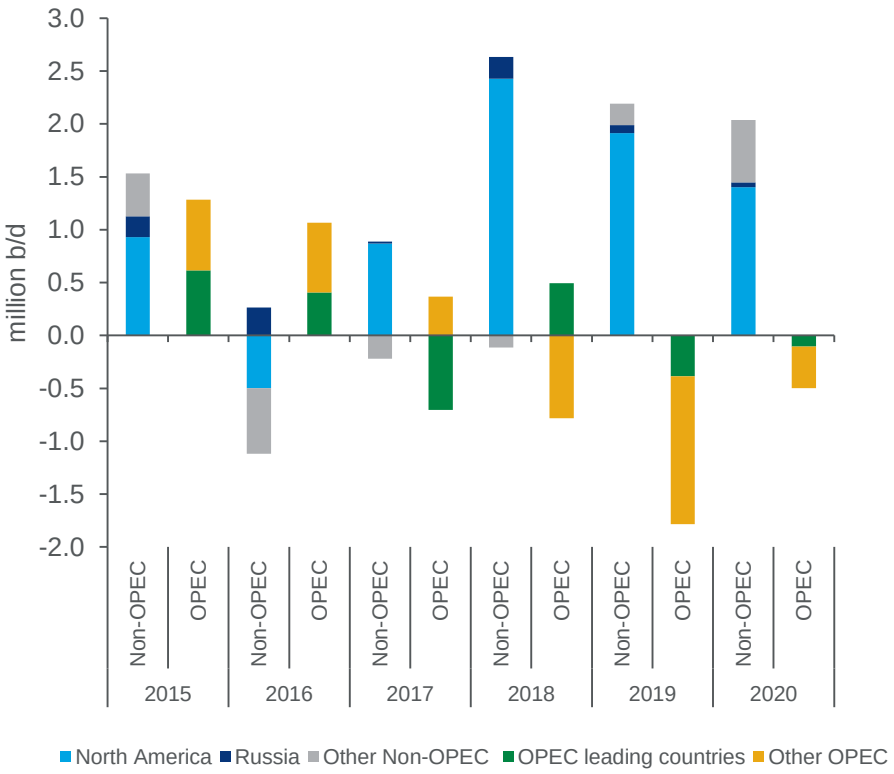


ICE: internal combustion engine vehicles, EV: battery electric vehicles, PHEV: plug-in hybrid electric vehicles, AEV: autonomous electric vehicles

Global oil supply growth moderates in 2019, not yet causing a substantial supply/demand tightness

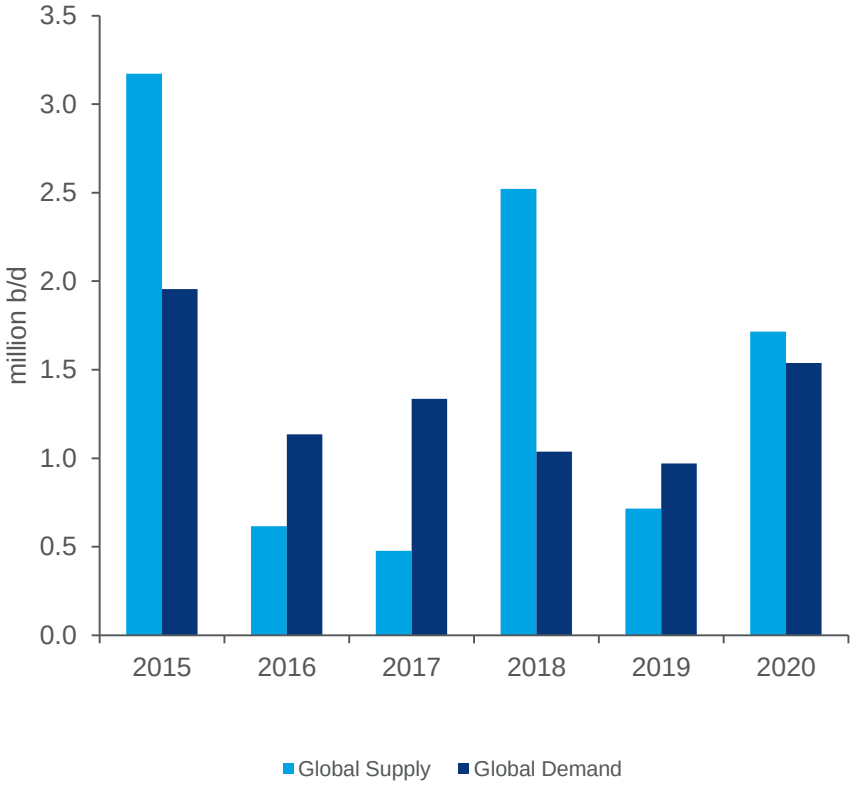
US growth is strong while OPEC production falls

Year-on-Year Crude Production Growth: 2015-2020



Non-OPEC includes NGLs.

Year-on-Year Growth in Global Liquids Supply and Demand

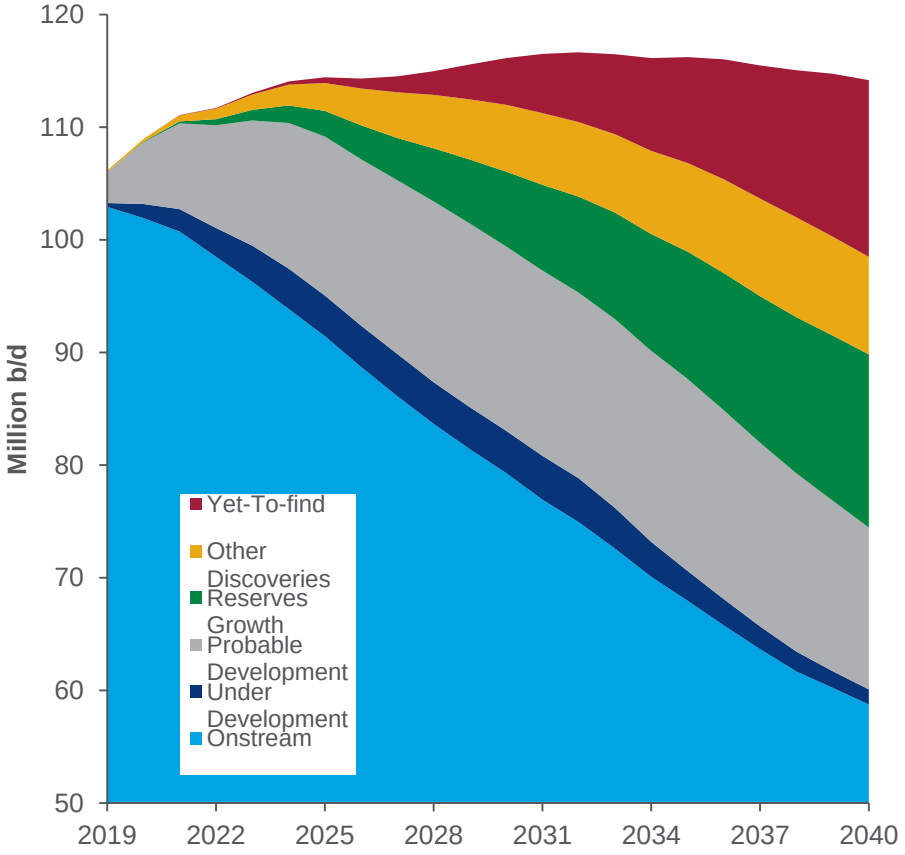


Source: Wood Mackenzie Macro Oils Service and Oil Supply Tool

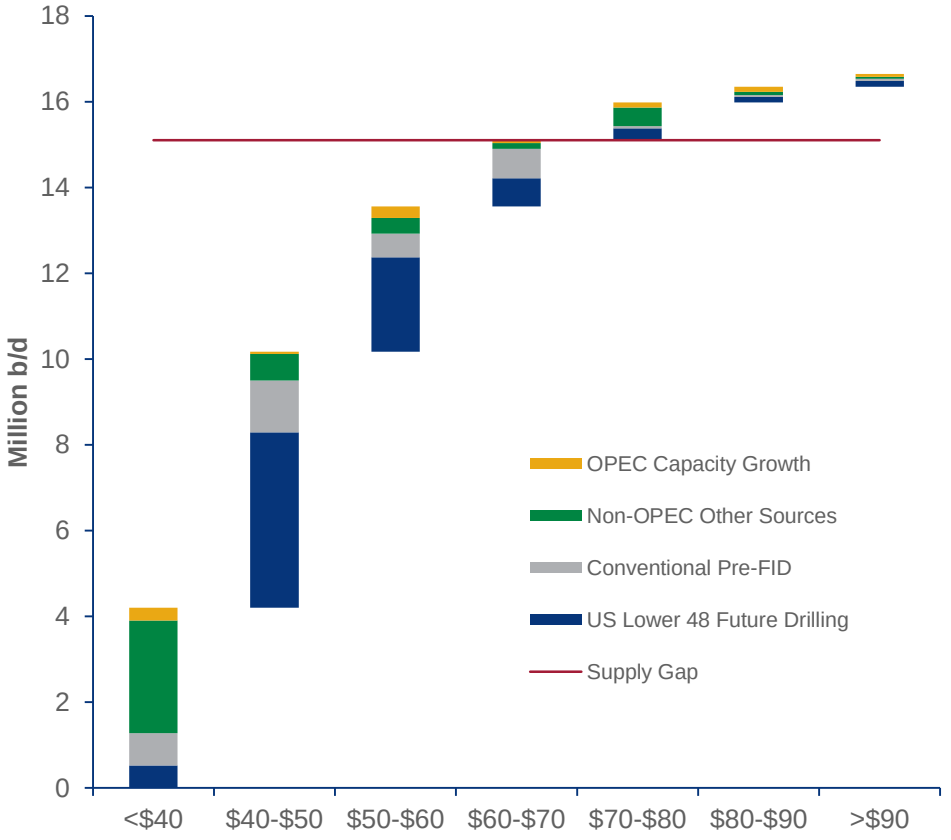
Global production capacity increases from 103 million b/d in 2018 to a plateau of 114 million b/d between 2030 and 2036

Oil prices over $80 needed to balance the market

Global liquids production capacity by development status



Filling the "supply gap" in 2025

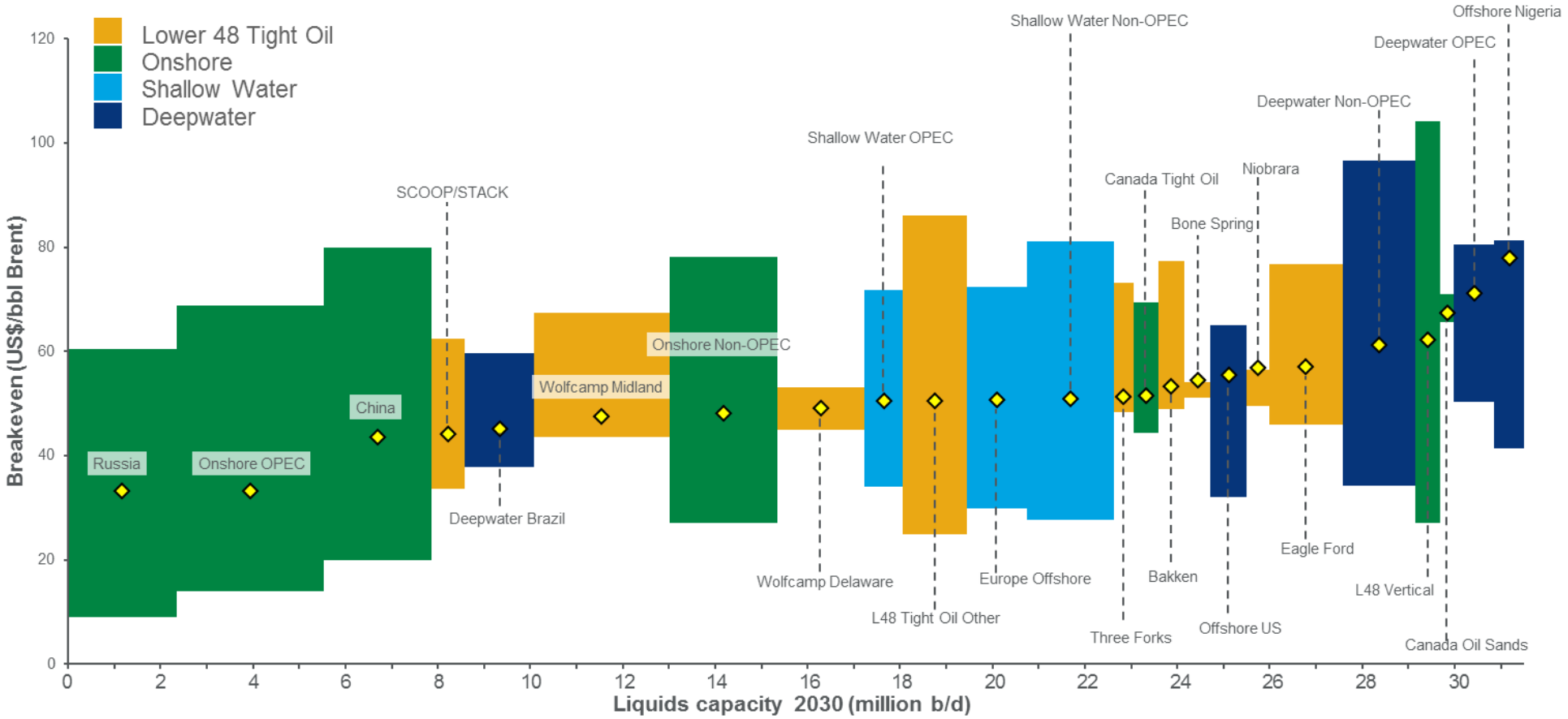


Source: Wood Mackenzie Macro Oils Service and Oil Supply Tool

Global cost curve for all future sources of supply

US tight oil plays a major role in filling the supply-demand gap

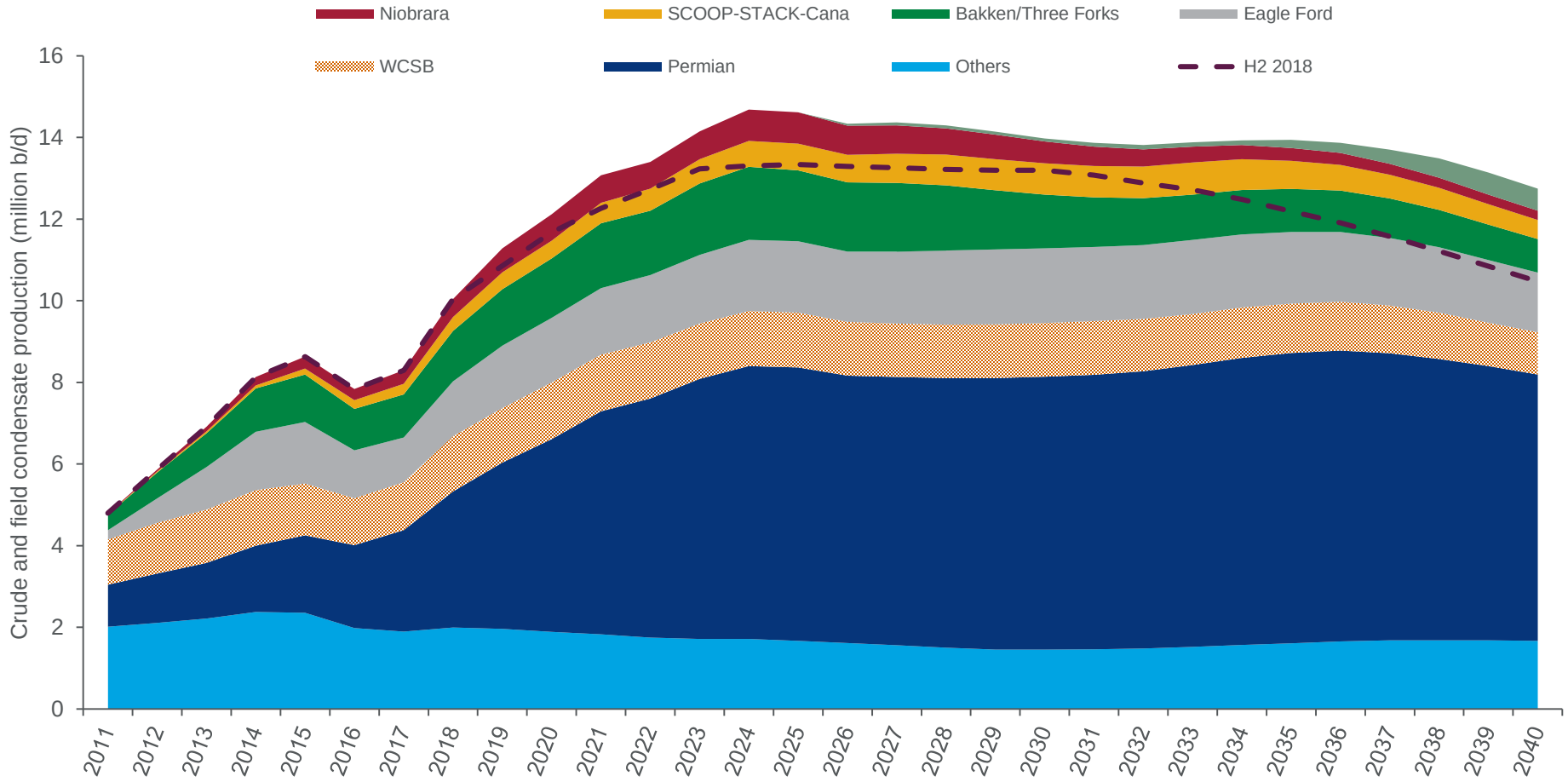
Future sources of supply by breakeven (pre-FID, reserves growth, yet-to-find & contingent resources) in 2030



Source: Wood Mackenzie Oil Supply Tool; excludes Frontier and Unconventionals (CTL,GTL, biofuels and oil shale); colour by predominant water depth, NPV 15; contingent resources also known as other discoveries. Excludes upper and lower 15 percentiles.

Lower 48 + WCSB crude oil: peak over a million b/d higher

Supported by stronger short-term growth and more favorable economics, Lower 48 production peaks in 2024 at 13.3 million b/d compared to 12 million b/d in 2025 in H2 2018

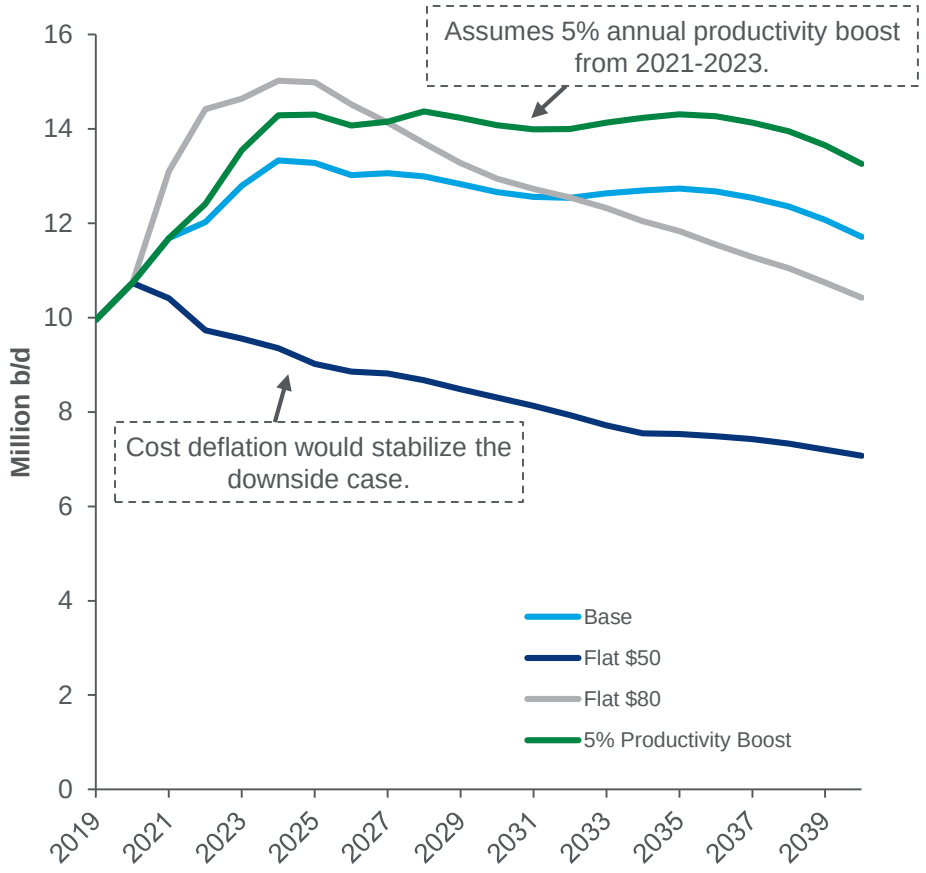


Source: Wood Mackenzie

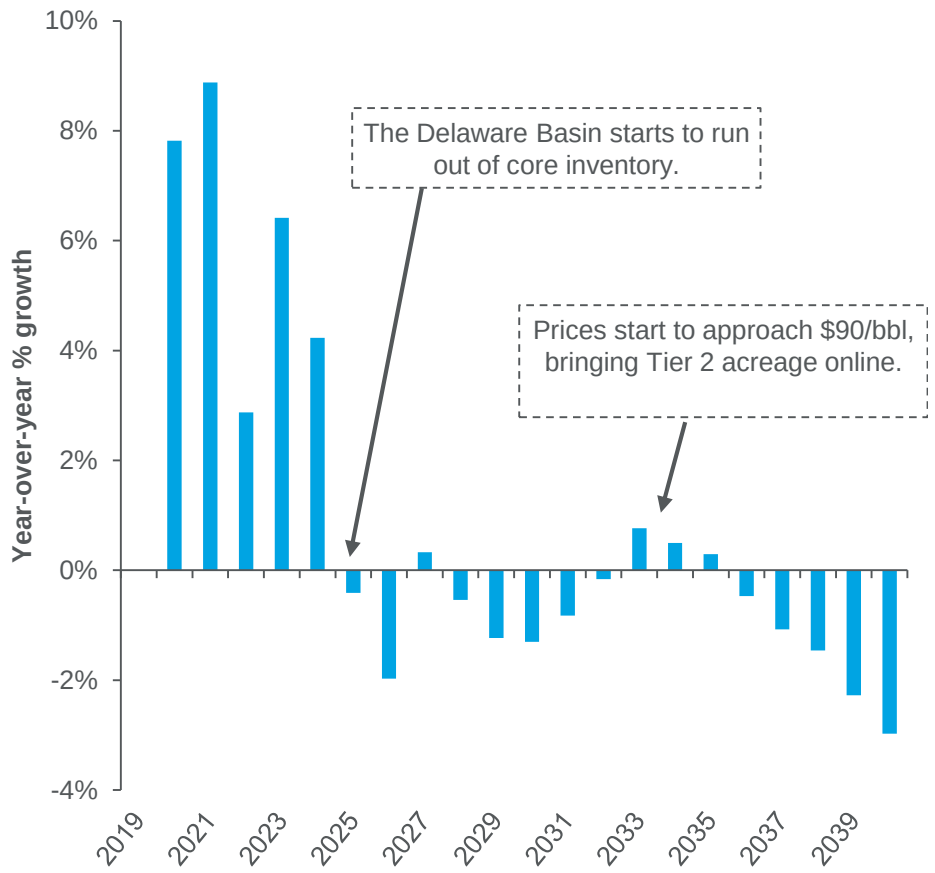
Boosts to productivity could unlock more resource and push Lower 48 to 14 million b/d

However, operators are currently focused on additional cost efficiencies and maintaining productivity gains they have realised in the last couple years

Base case year-over-year production growth



Base case year-over-year production growth

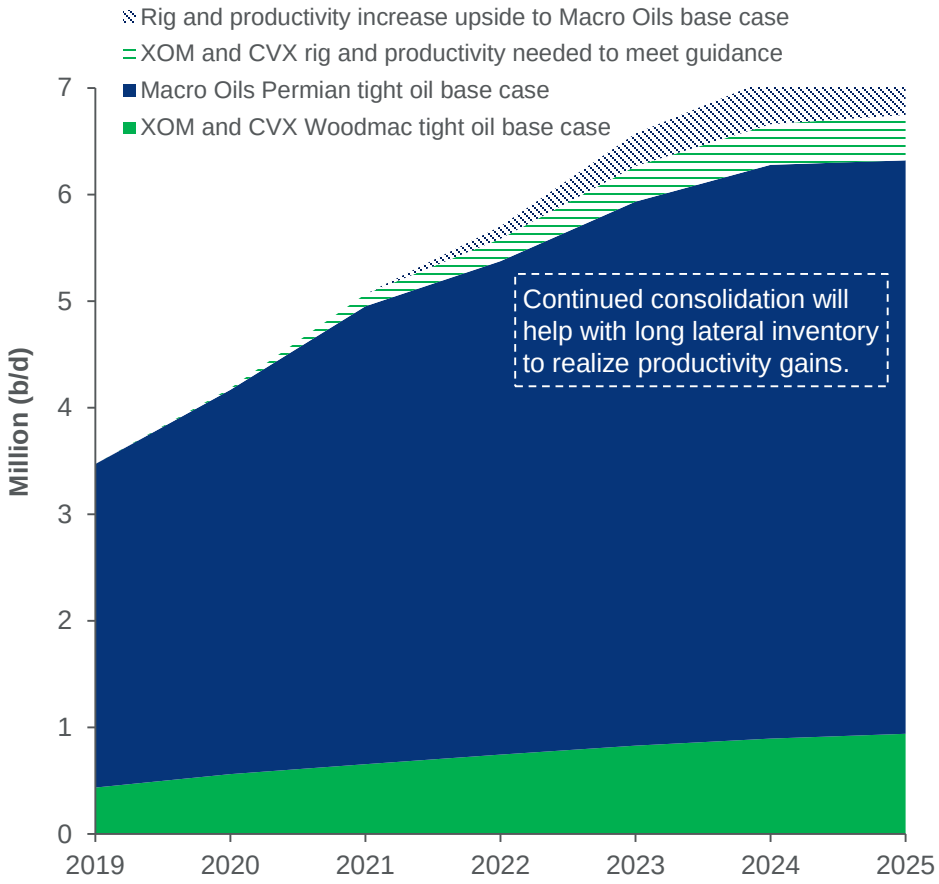


Source: Wood Mackenzie
*Flat price scenarios assume a flat WTI flat price from 2021 forward, 2019-2020 reflects results using the base price assumption; All else treated equal across sensitivities
Analysis excludes systematic risks from parent-child well interference not reflected in our base case key play work

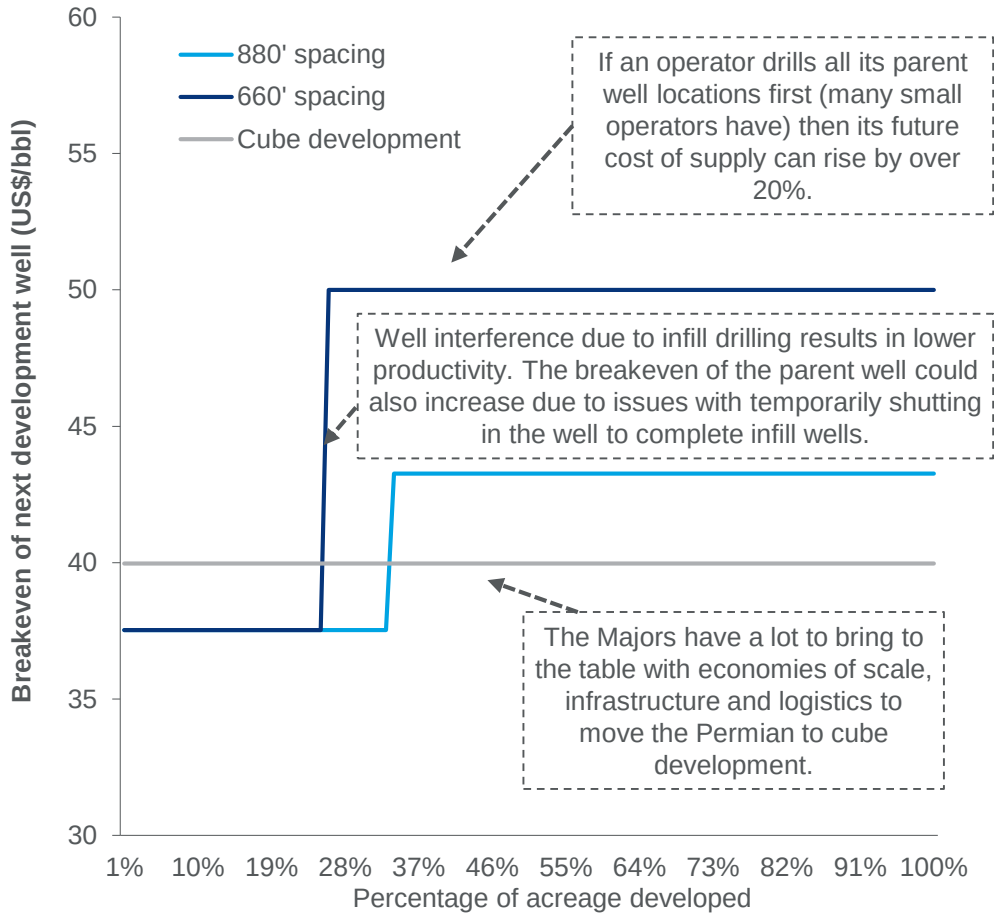
What will it take for ExxonMobil and Chevron to hit their targets? We believe a mix of well productivity and improvements and rig efficiency.

If we assume a 3% rig efficiency gain and 5% productivity gain from 2021-2023 annually on the rest of Permian tight oil, we add over 500 kb/d of production in 2025

Permian production (2019-2025)



Economic impact of various development approaches*

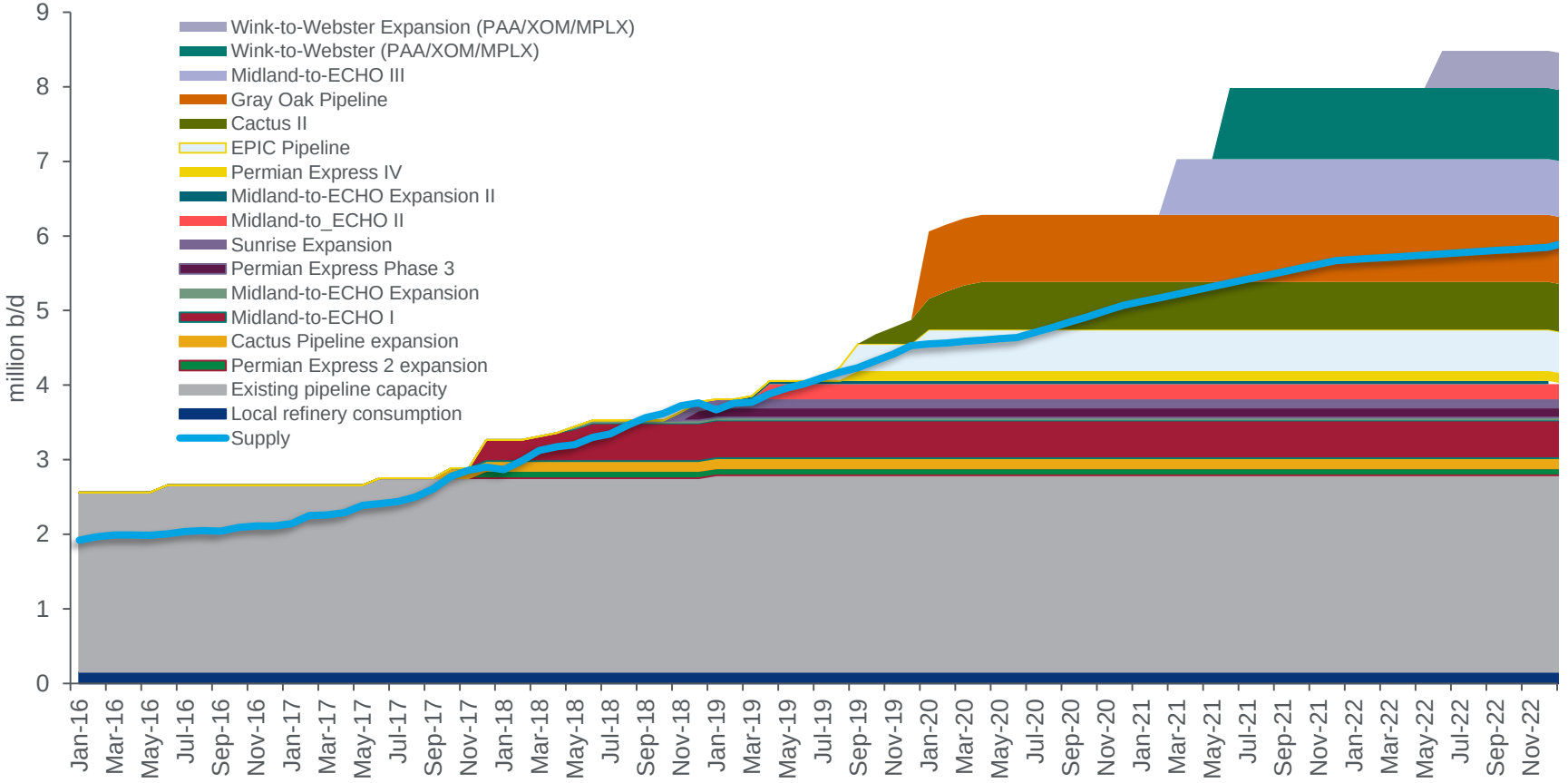


Source: Wood Mackenzie, Contour Valuation Platform
*Analysis done on well in Reeves County targeting the Wolfcamp

Permian basin set to be significantly long pipe capacity starting in 2020

Excess capacity will support US WTI crude benchmark prices in Midland and Cushing

Permian supply vs. long haul capacity (kb/d)

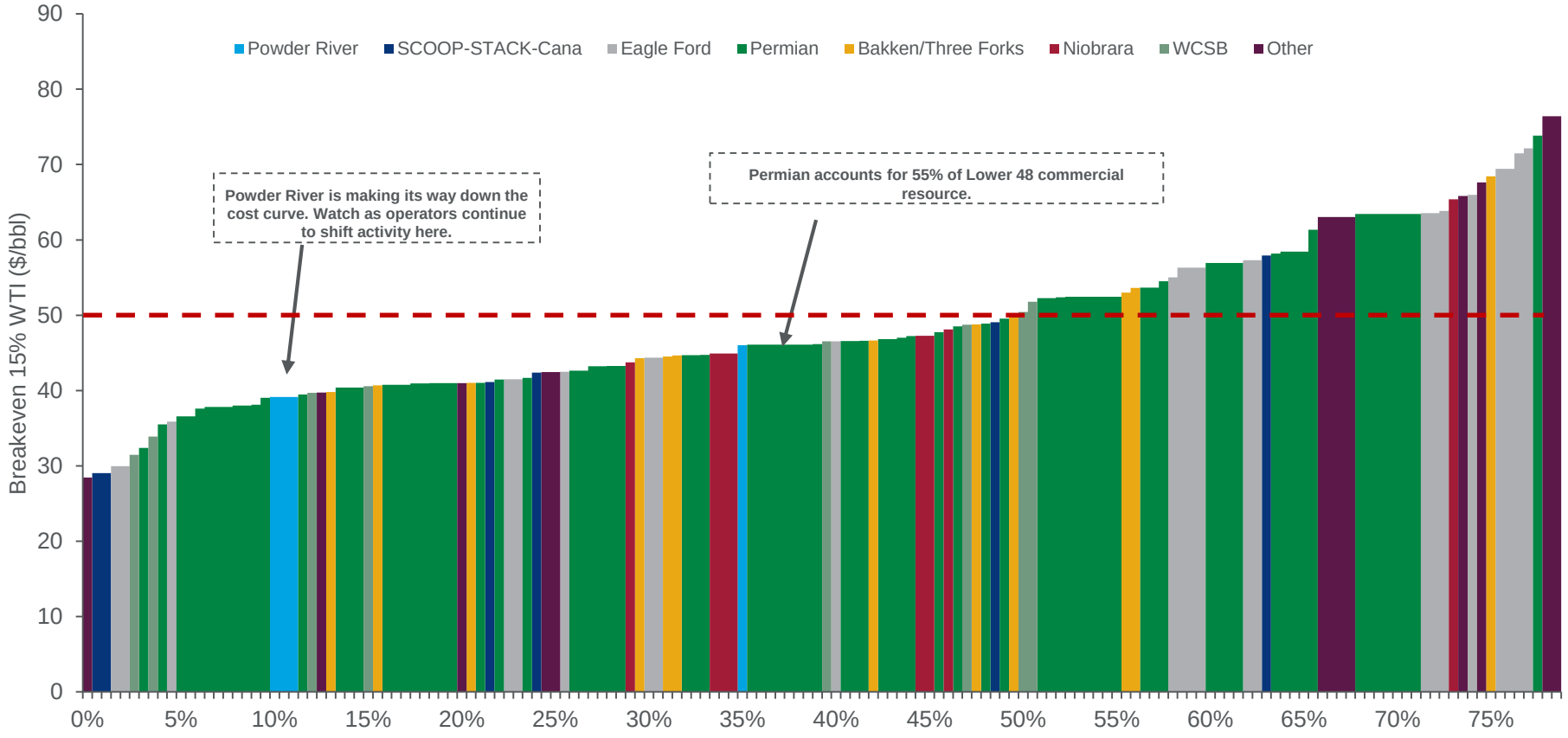


Source: Wood Mackenzie

Cost curve for tight oil plays: 65% of remaining resource is economic at $60/bbl Brent (~$55/bbl WTI)

Expect service costs to start to stabilize: continued focus on capital discipline results in more steady activity levels. Watch the Majors as they are scaling to levels that could improve development economics.

US L48 tight oil play type well breakeven cost curve (<$90/bbl)

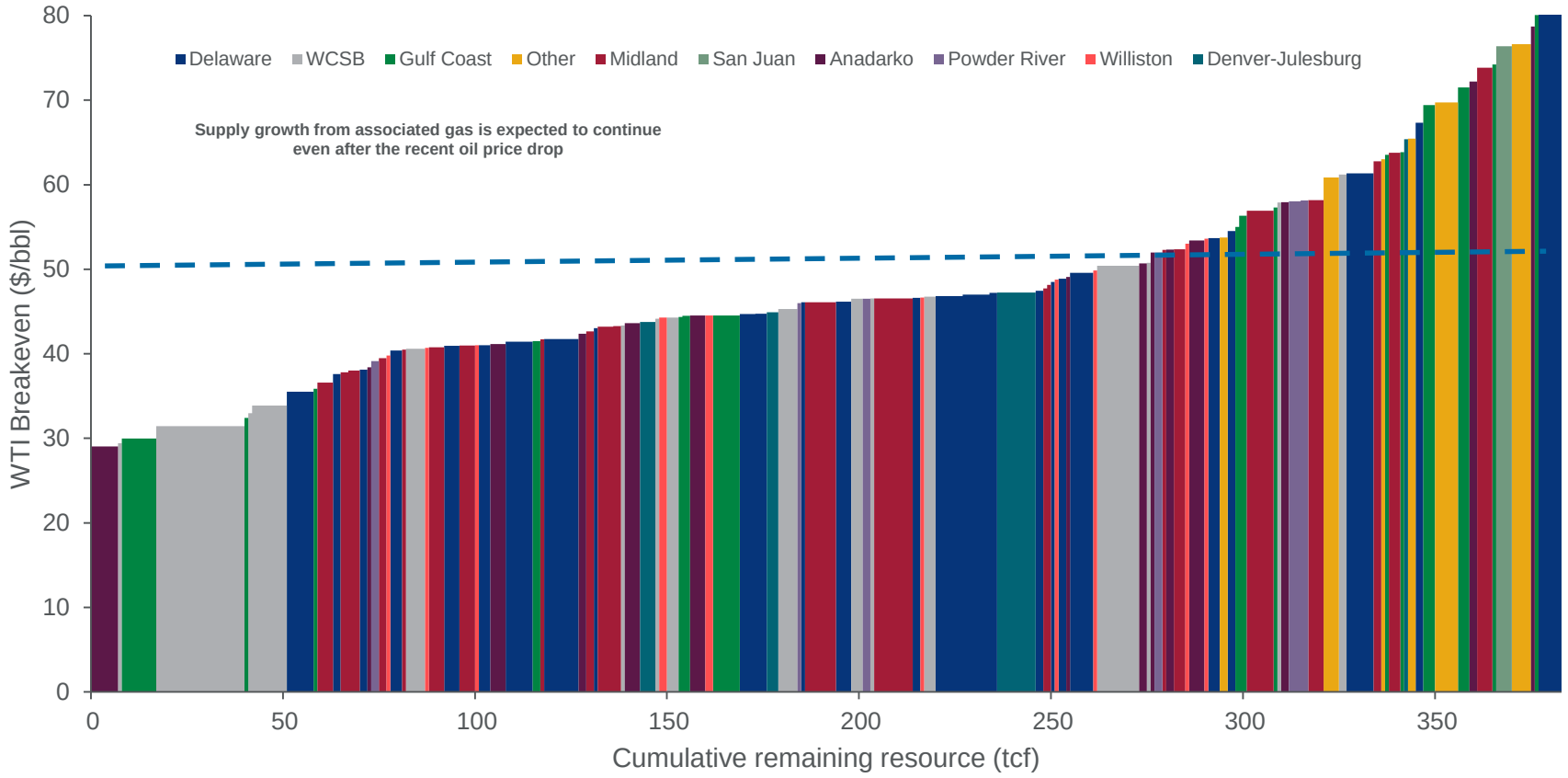


Source: Wood Mackenzie; breakevens calculated for key tight oil plays reflect type well breakevens for future drilling run at 15% discount rate and at a Brent equivalent.

Associated gas: 260 tcf is economic <$50/bbl

Over 90 tcf was added to the <$50/bbl economic threshold since H2 2018. Costs were lowered across the major plays.

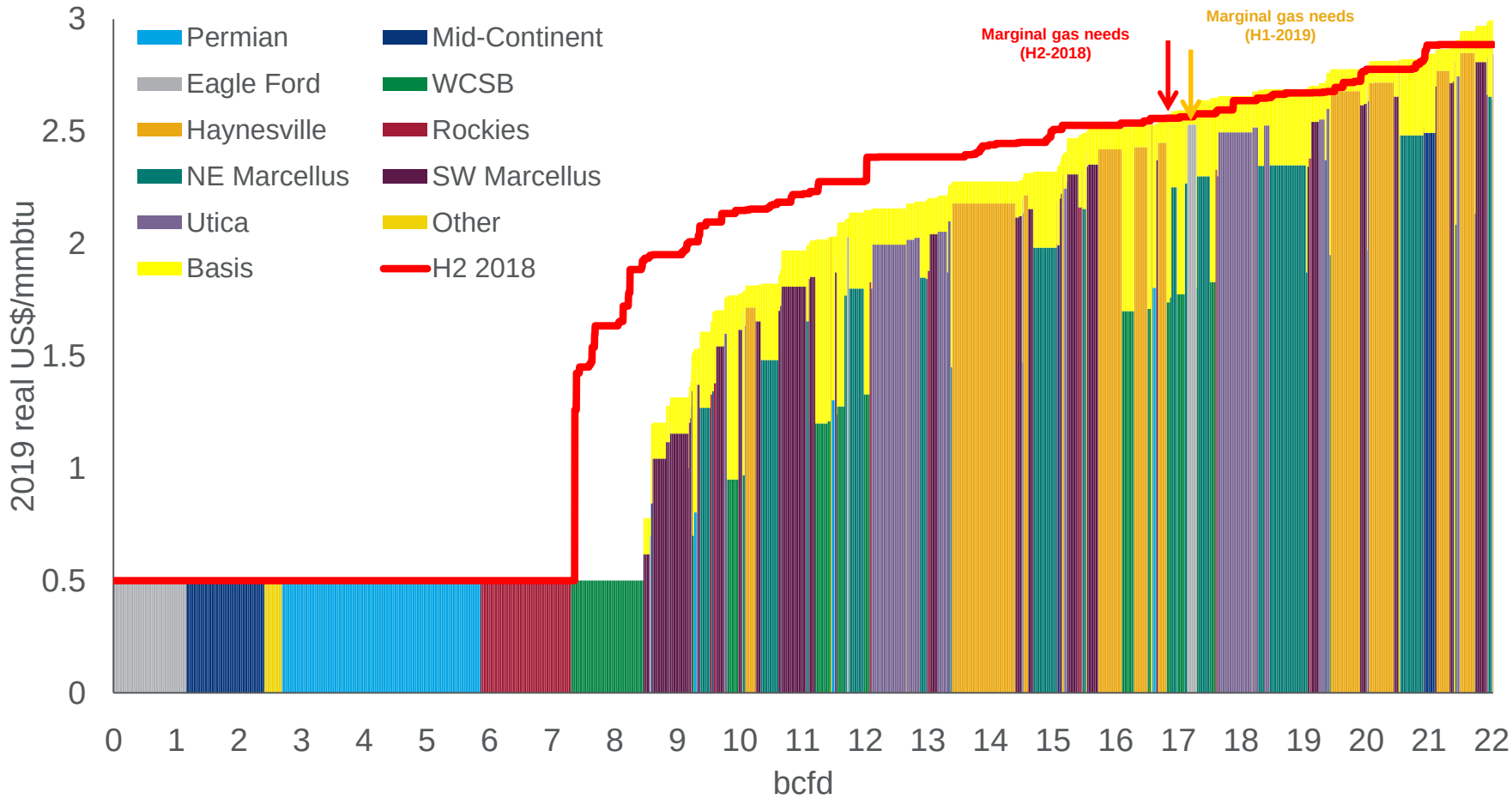
Remaining undrilled associated gas resource by play (<$80/bbl)



Stronger production declines and changing cost of production keep near-term HH more stable and more resilient to associated supply

Associated gas and Haynesville are the fastest growing contributors to our outlook. Permian and Haynesville combined average >7 bcfd higher this outlook.

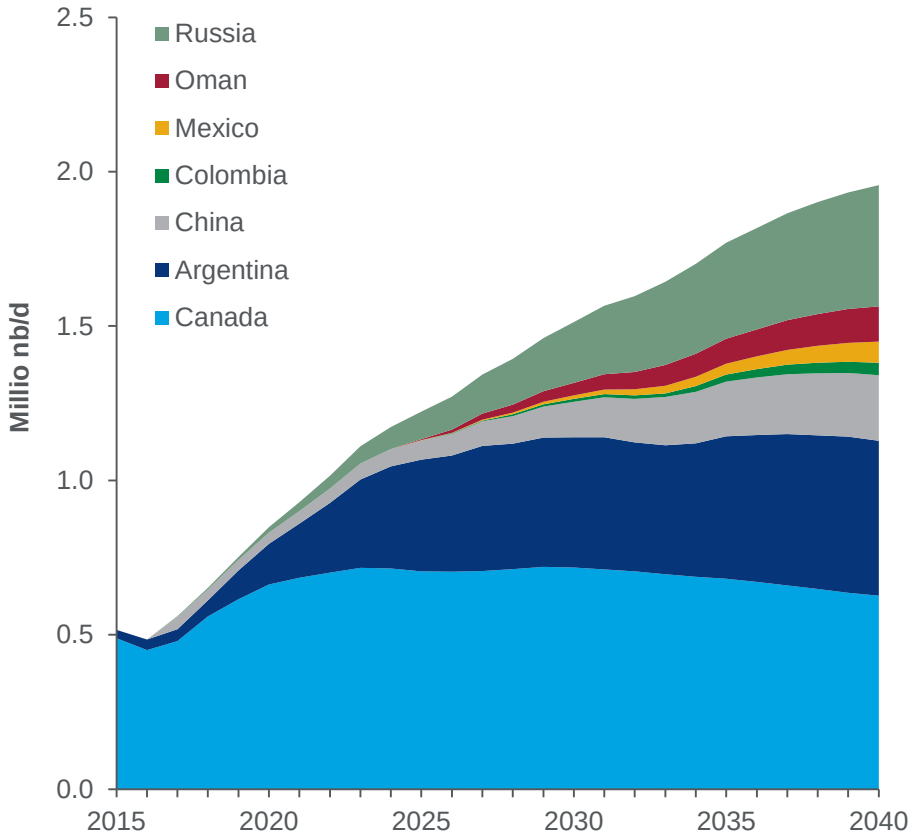
2021-2023 New drill supply curve (bcfd)



Tight oil production outside the Lower 48 reaches 2 million b/d by 2040

Canada, Argentina and Russia are the key contributors – but pace of development and scale will significantly lag onshore US

Tight oil production outside US Lower 48



- After several slow years after the 2014 downturn, the wheels are slowly starting to turn again in global unconventional plays.
- But international plays lack many of the advantages of the US – scale, simplicity of geology, infrastructure, competitive supply chain and a diverse set of operators. As a result, growth will be far more moderate than onshore Lower 48.
- **Argentina**: shale investment will be driven by new Vaca Muerta project sanctions; upside could come from projects that are still in the pilot phase. Oil production reaches ~400 kb/d in the late 2020s.
  - » Large investments are planned at shale developments Loma Campana (YPF), La Amarga Chica (YPF), and Cruz de Lorena-Sierras Blancas (Shell).
  - » YPF have dominated development to date – but a shift in operatorship will see more reliance on smaller companies to deliver too. Companies other than YPF will claim 75% of the plays production by 2024.
  - » Limitations in the gas market could bring more investment to oil projects
- **China**: tight oil production growth is slow, with the bulk of growth post-2030
  - » Complicated geology, high development cost, lack of advanced technology and slow ramp-up of the existing tight oil projects in recent years has led to a downward adjustment on potential
- **Russia**: production reaches 400 kb/d by 2040
  - » The majority of growth comes from the Bazhenov.
  - » Whilst there is massive resource upside and infield infrastructure in place in the Bazhenov, many headwinds exist. Sanctions prevent IOCs from bringing technology and working on the plays; lifting and completion costs are high; and reservoir heterogeneity is yet to be understood.

Source: Wood Mackenzie Oil Supply Tool

Q&A

Wood Mackenzie

A Verisk Business

R.T. Dukes – *Insight into US Unconventionals*

Research Director – US Lower 48 Upstream Research

Introduction

R.T. is widely recognized as a global leader in US unconventional oil and gas. Mr. Dukes advises companies at the executive and board level, as well as being a regular speaker at international industry conferences.

He's a media favorite that you'll find quoted in various print and broadcast media outlets.

Biography

R.T. began his career covering the Barnett Shale as horizontal drilling took off and later managed Wood Mackenzie's Rockies research as Bakken Shale development exploded. His roots in East Texas mean the Haynesville Shale is close to home. By design or maybe happenstance, he has been at the forefront of almost every shale story. He authored research highlighting the potential of tight oil years before US production surged.

He has spent most of his career in the weeds of unconventionals and is leaned on for evaluating the impact to local and global markets. He is a recognized thought leader and is a contributor to many US and macro-market publications at Wood Mackenzie. At the firm, he has worked in various research and consulting roles and contributed to valuation and due-diligence work that accounts for billions in transactions.

Mr. Dukes is a native Texan and calls Houston home. More importantly he is a proud husband and father. He spends most evenings and weekends as a youth sports coach. He graduated Cum Laude from Texas A&M University with a bachelors degree in accounting and a masters degree in finance. He serves on the Former Student Advisory Board for the Professional Program in Accounting.

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