EIA Energy Conference
Panel session - Crude exports

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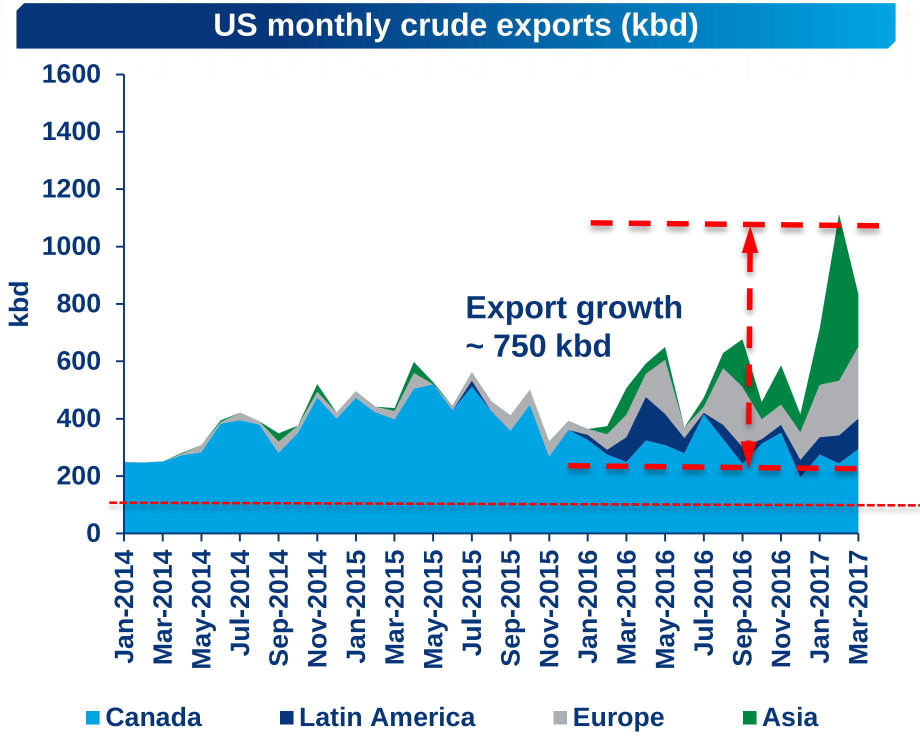
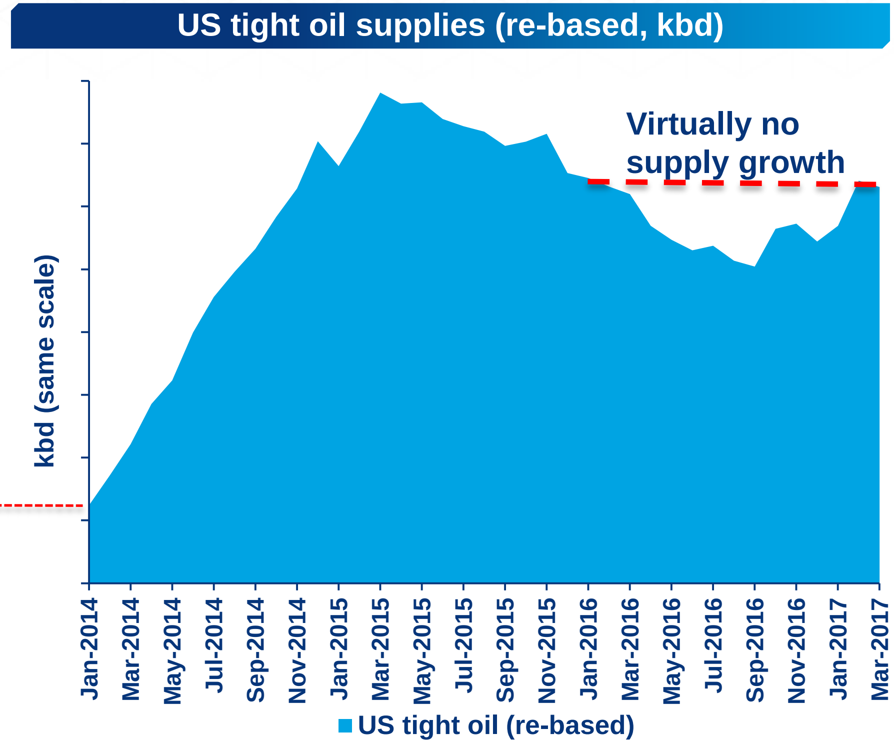
Repealing the export ban has resulted in exports to Europe and Asia growing faster than US tight oil supply growth from Jan 2016

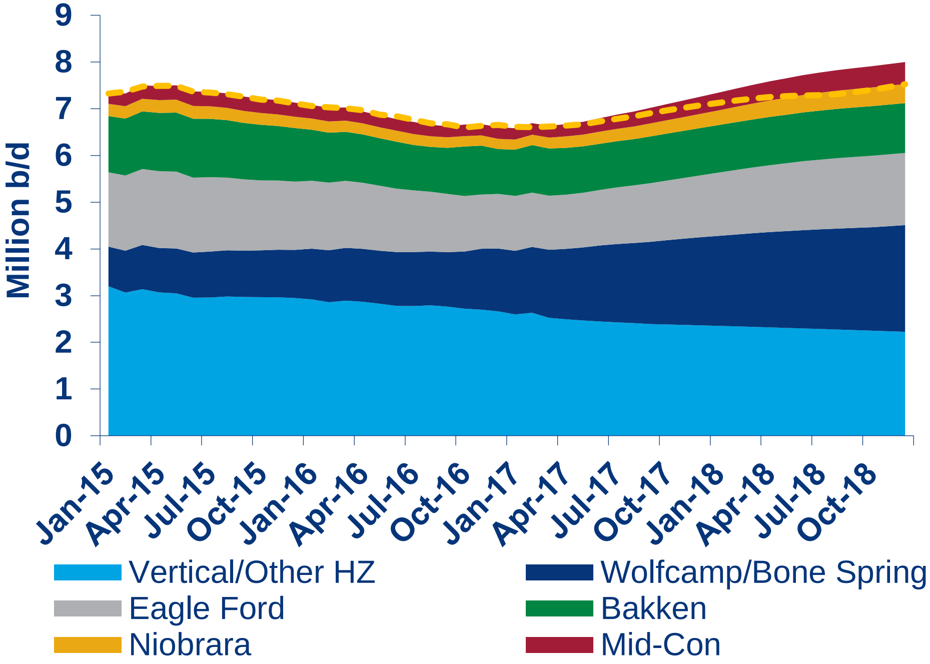




Source: Wood Mackenzie

US Lower 48 crude outlook continues to surprise to the upside in the near term.....

US Lower 48 crude outlook



Source: Wood Mackenzie

- **Lower 48 onshore crude and condensate production has been revised up by approximately 80 kb/d in 2017, and 400 kb/d in 2018 (annual average basis). This revision has been driven by:**
  - Greater baseline production in North Dakota and Texas. The EIA indicated a 220 kb/d increase in onshore crude and lease condensate, January – February 2017, a higher than expected jump. Baseline production was increased by about 80 kb/d.
  - Continued growth in rigs in tight oil plays
  - Increased type well assumptions in active sub-plays: assumptions increased by approximately 15% in the Eagle Ford and 10% in the Permian.
- **If the rate of productivity improvement were to increase to roughly 8% per year vs our base case of 4%, we could see growth in 2018 of nearly one million b/d vs our current expectation of 840 kb/d.**

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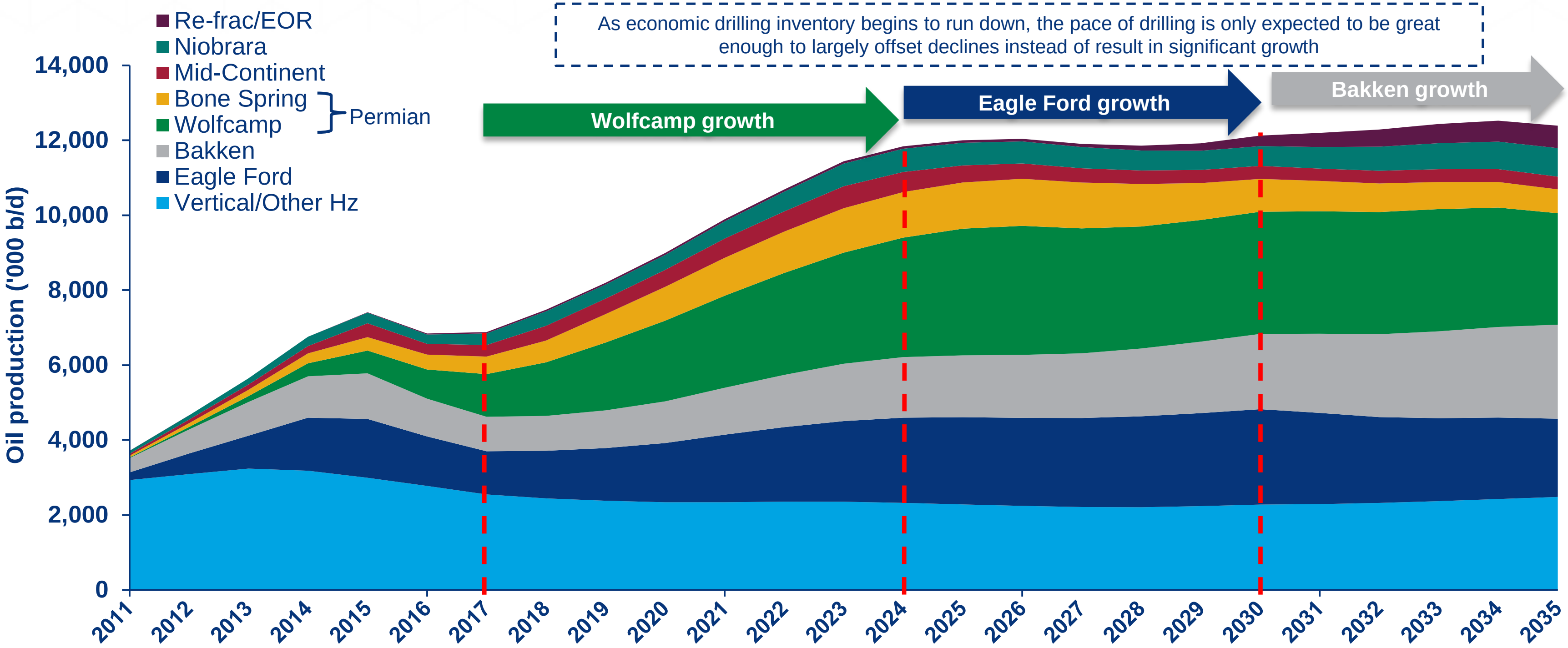
Lower 48 onshore production surges to 12 million b/d by 2025

Wolfcamp drives short-term growth, climbing to 3 million b/d by 2024 (25% of onshore US). Eagle Ford ramps up to 2.5 million b/d by 2030, Bakken growth follows in the 2030s

Lower 48 onshore oil outlook

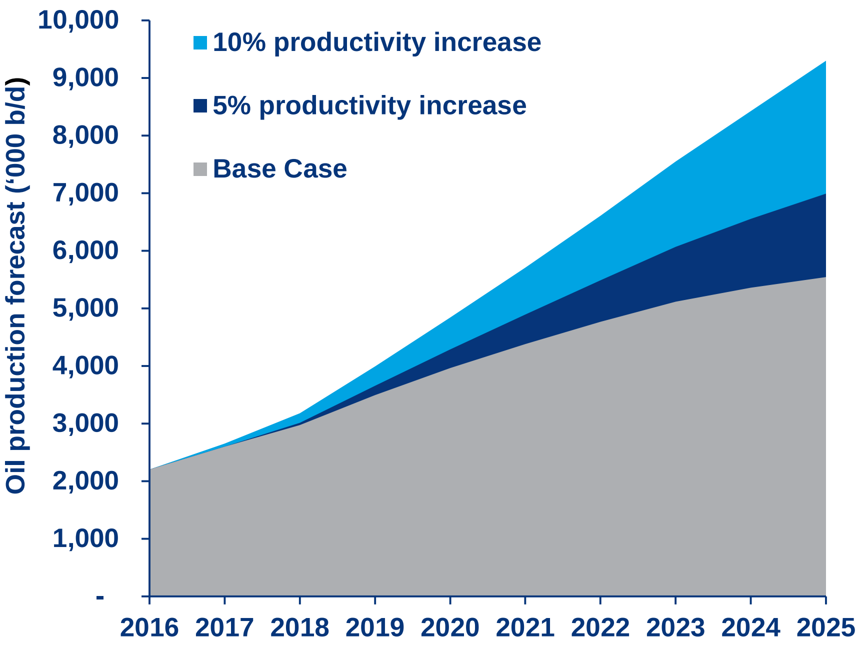


Source: Wood Mackenzie

Tight oil supply is highly sensitive to productivity assumptions

Small improvements in Permian well performance will have big implications for supply

Permian productivity supply scenarios



Source: Wood Mackenzie

- Over the past couple of years, well productivity has increased between 10-20%. This improved productivity led to an increase in our short-term base case of 150,000 b/d.
- Productivity improvements were the result of operators performing larger completions, using up to twice as much sand and more pumping horsepower per well.
- In an unconstrained scenario, the Permian could produce an additional 1.5 – 3.75 million b/d should well productivity rise a further 5-10% from our base case.
- Operators have begun to indicate they are reaching a point of diminishing returns on completion intensity. As a result, we think further 5-10% sequential improvements each year are unlikely on a play-wide basis.
- While much of the risk is to the upside, there is downside potential to the productivity forecast as well. Operators have indicated that there are instances of degradation in productivity due infill or "child" wells and frac hits.

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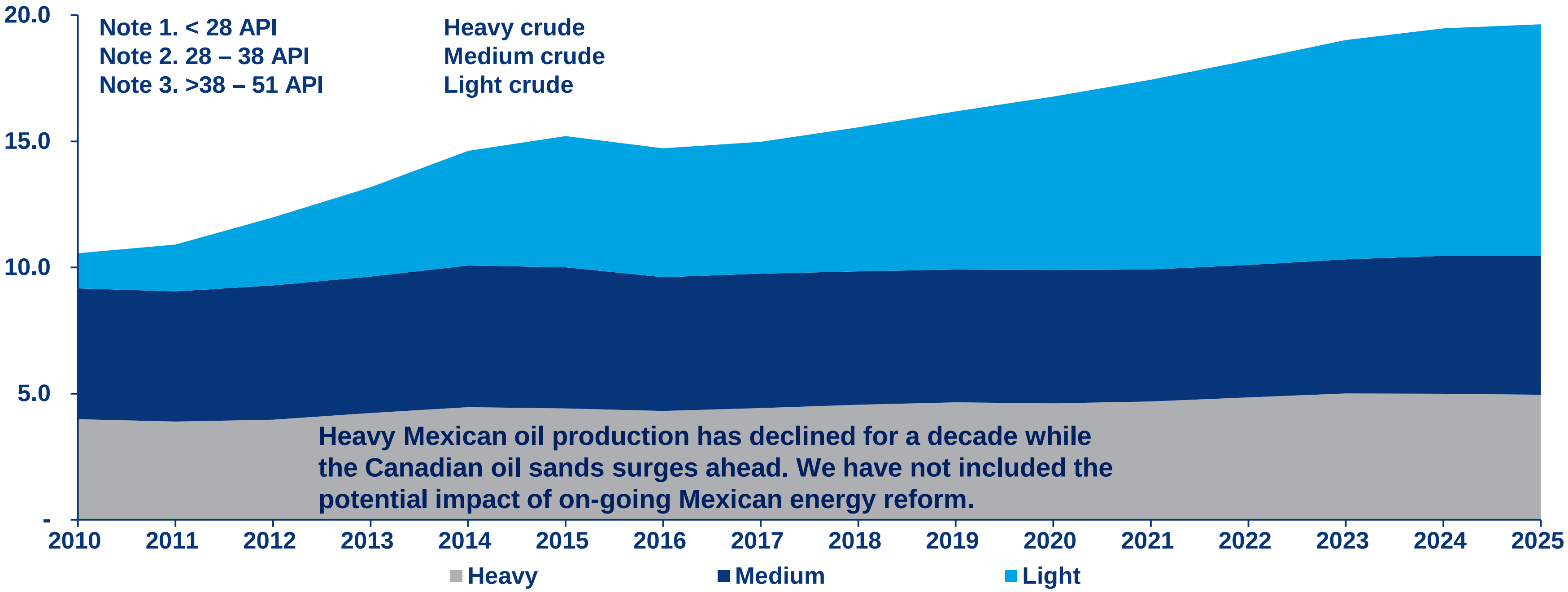
Growth in heavy Canadian oil supply outpaces declines in heavy Mexican oil supply; but crude slate gets lighter

North American crude supply to get lighter due to US tight oil growth (excluding condensates)

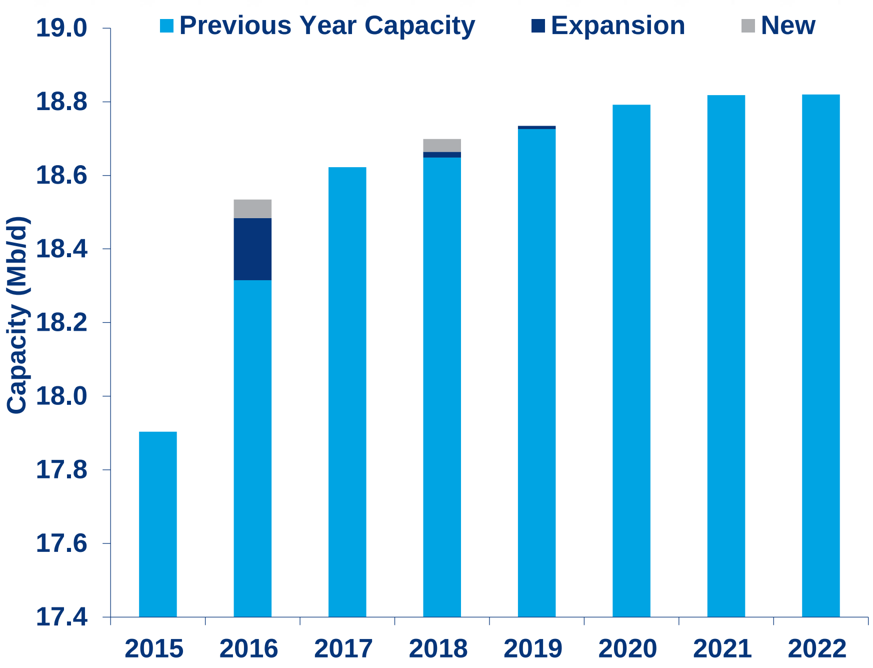
North America crude oil supply outlook by quality (million bpd)



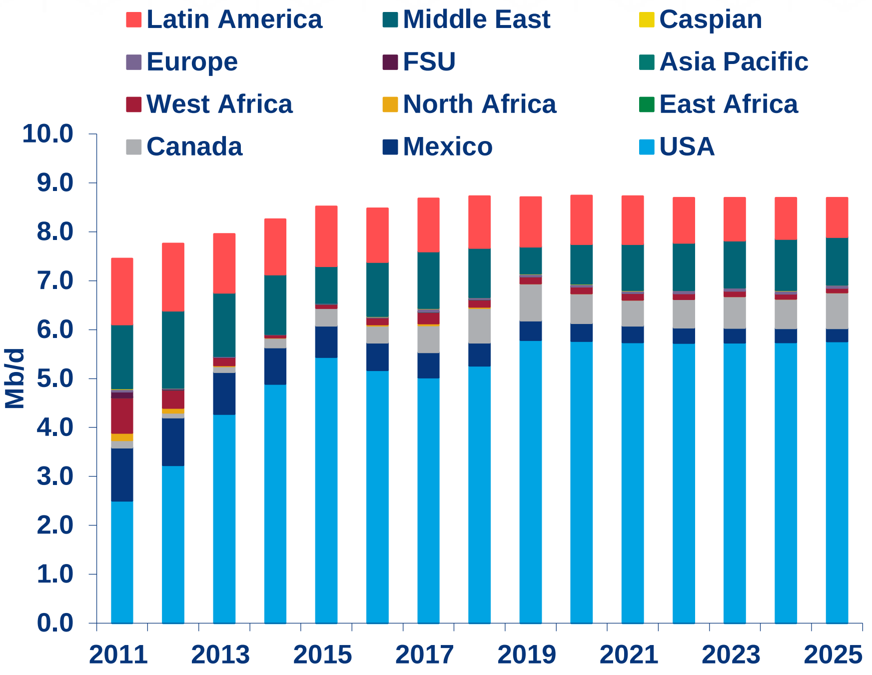
Source: Wood Mackenzie

There are limited crude capacity additions anticipated in the US, so the refining system has limited capability to process more tight oil

US CDU capacity profile



US PADD III crude slate by source



Source: Wood Mackenzie

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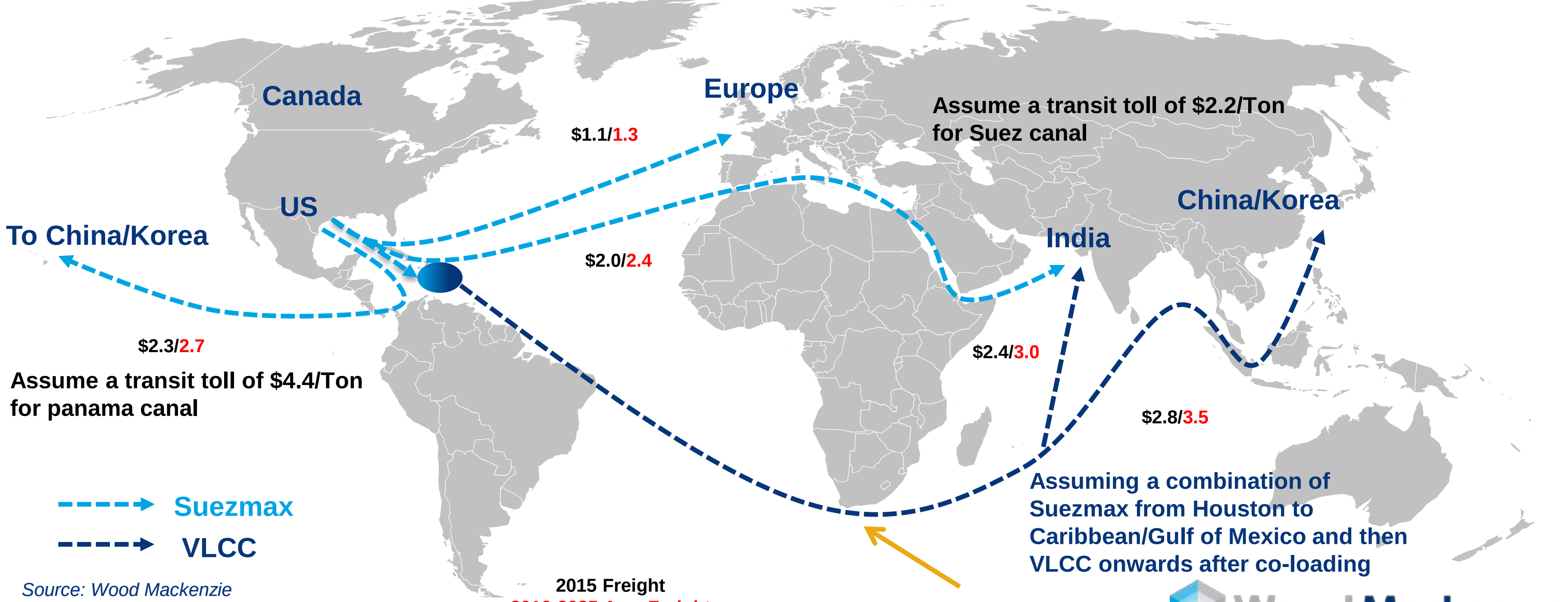
US tight oil exports could hence be the order of 2 – 3 million bpd, targeting European and Asian markets

Freight costs to North Asia is double that of Europe due to longer freight distances. Export logistics infrastructure is key to facilitate the growing trade

US crude export freights 2016 - 2035, $/bbl

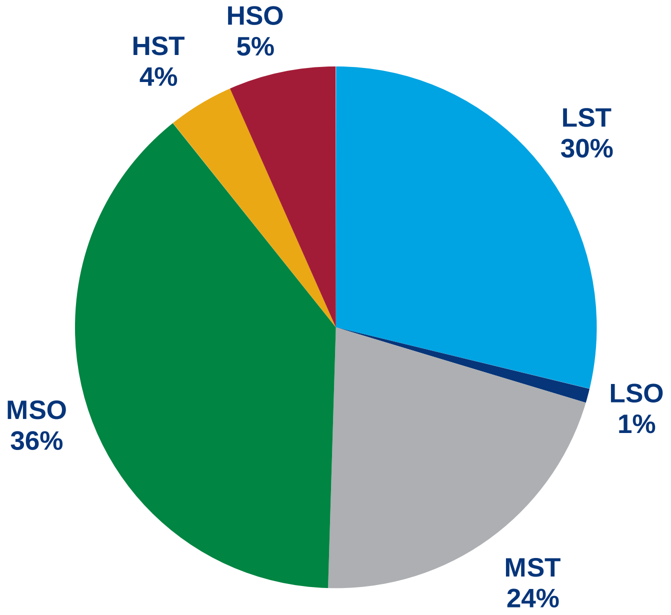


Source: Wood Mackenzie

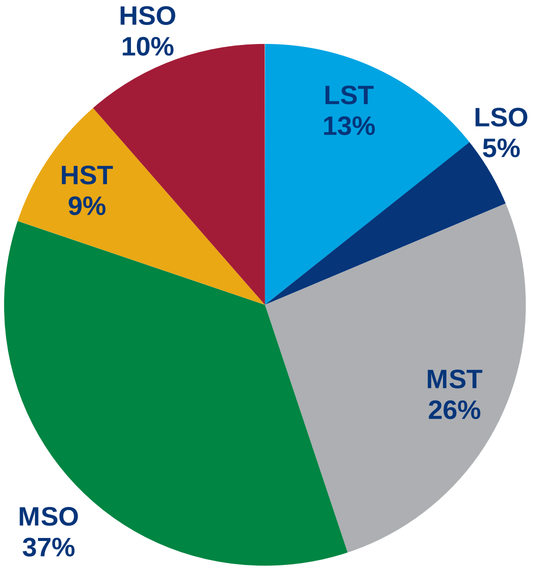
Light crudes are a larger portion of the European refinery crude mix than Asia, which is focussed on medium/heavy grades

US crude exports to Asia will compete with West African and Middle East grades

European crude slate, 2020 (vol%)



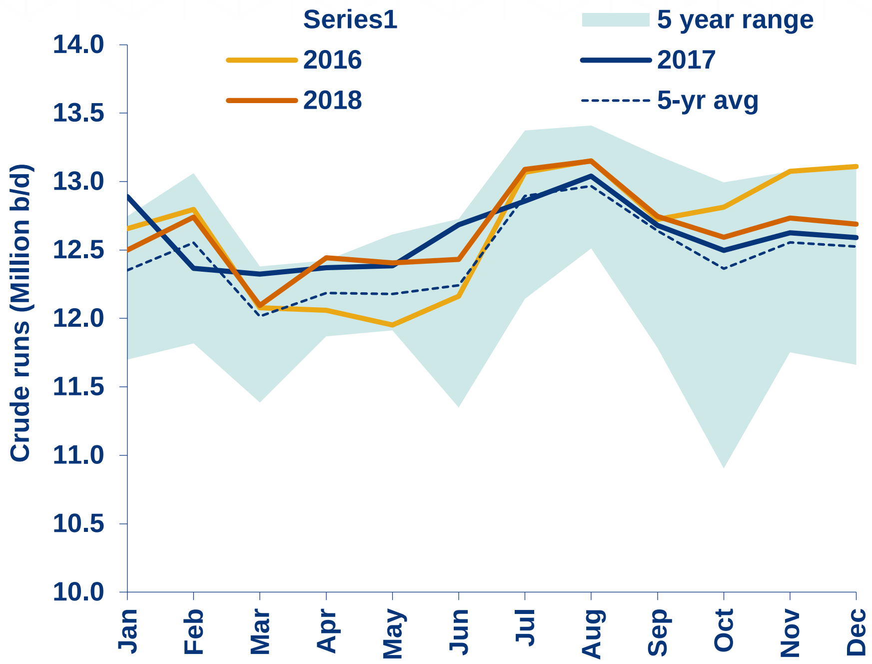
Asian crude slate, 2020 (vol%)



Source: Wood Mackenzie

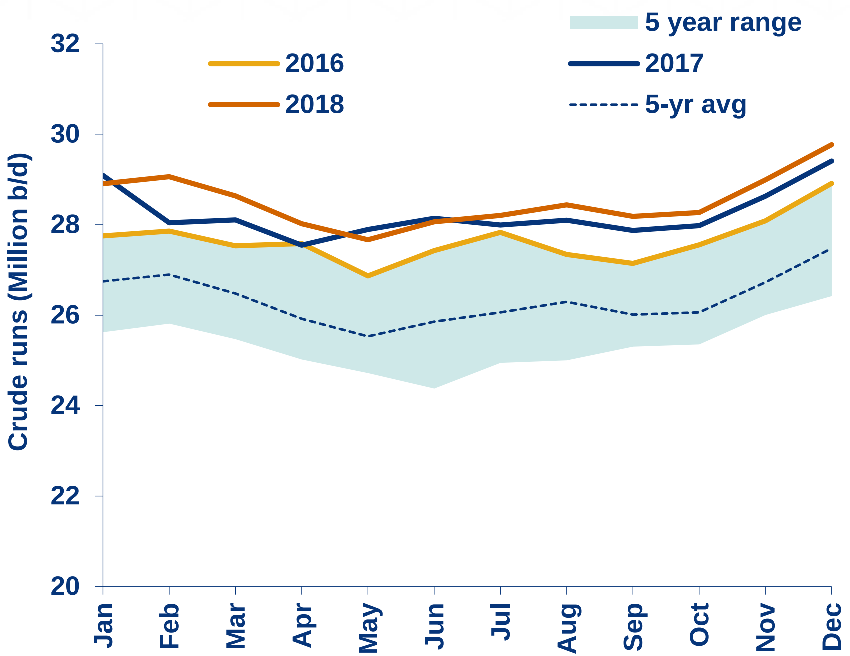
European and Asian crude runs have different seasonality, suggesting crude export destinations will show such patterns

European crude runs (million bpd)



Source: History IEA MODS, Forecast Wood Mackenzie

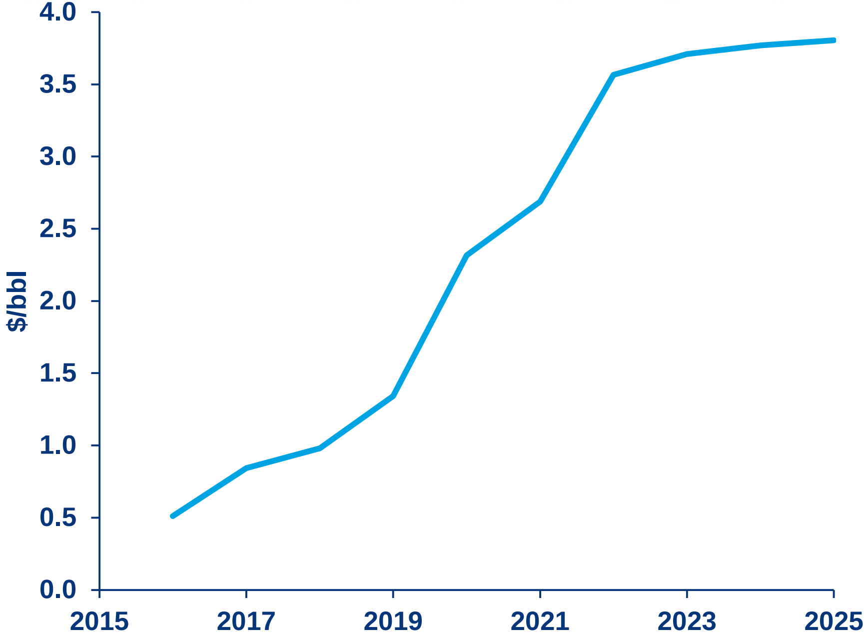
Asian crude runs (million bpd)



Source: History IEA MODS, APEC; Forecast Wood Mackenzie

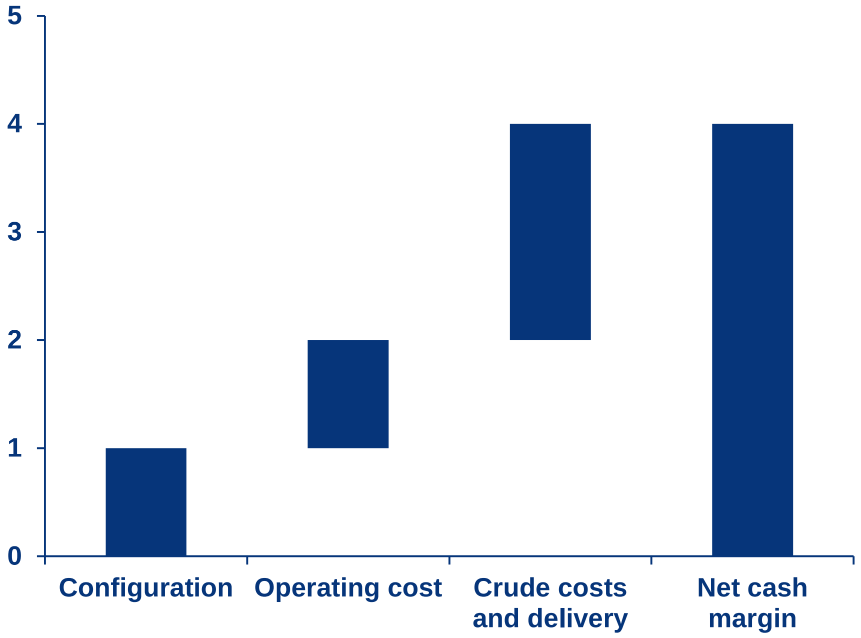
Export growth results in a wider Brent – WTI differential, which sustains an advantaged feedstock position for PADD III refiners

Brent – WTI forecast (US$/bbl)



Source: Wood Mackenzie

US PADD III competitive advantage to Europe (2015, US$/bbl)



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Conclusions

Key takeaways

- US crude exports have grown strongly since the export ban was repealed and US tight oil supplies returned to growth
- Further export growth is projected as:
  - » US tight oil supply volumes double
  - » Limited further investment in US refining anticipated
- US crude exports will flow to both European and Asian refining centres, in significant volumes reflecting:
  - » Refining value of the crude
  - » Seasonality
  - » Freight and logistics costs
- High quality export logistics are key to facilitate the future trade

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