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Trends in Natural Gas

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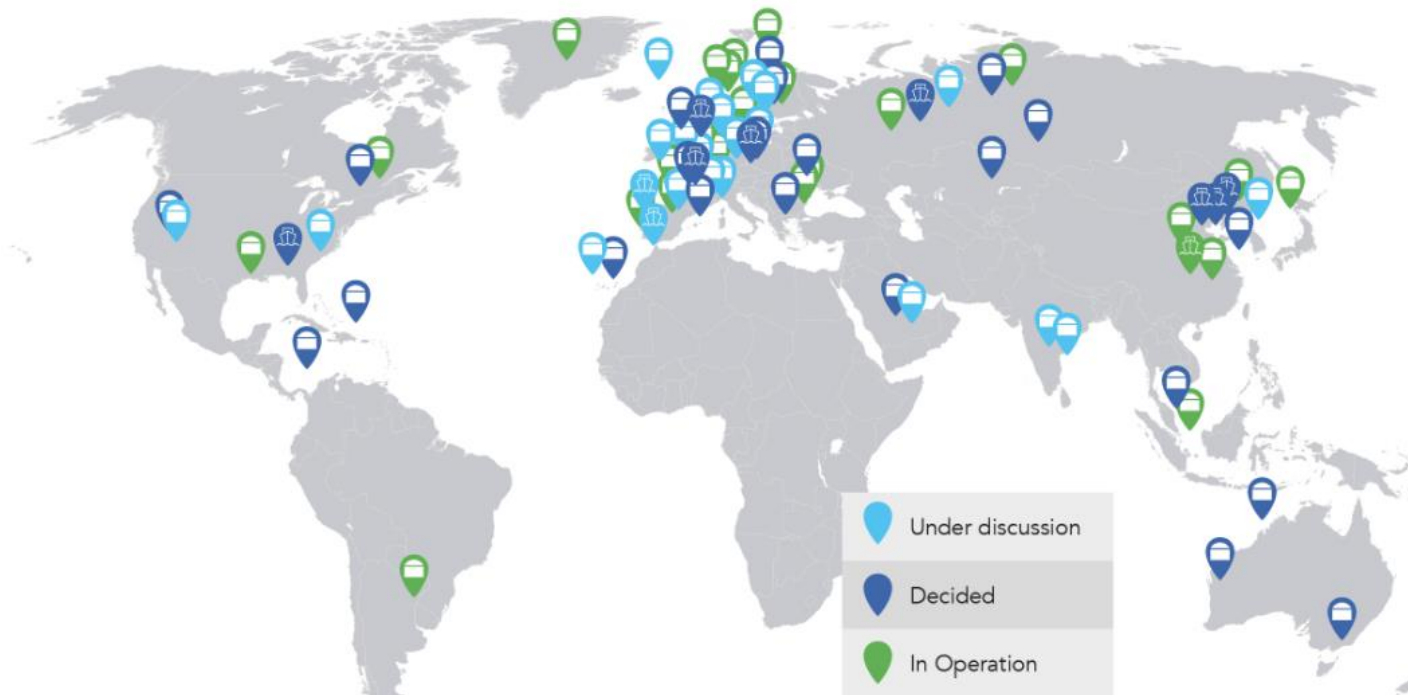
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Bunkering Market in the Arab Gulf

Recent Bunkering Developments



- Singapore has banned open-loop scrubbers, providing increased opportunity in the market for LNG and alternative fuels
- ADNOC and Japan's Inpex have signed an agreement to explore LNG bunkering in the UAE and elsewhere in the region
- Shell and Qatar Petroleum also cooperating on a worldwide network of LNG bunkering facilities; QP expects up to 50 million tonnes of demand annually by 2030

LNG Uptake in the Middle East and Globally

The fuel has merits in the Gulf region...

- LNG is plentiful in several Gulf nations
- The high marine traffic of the region make it an excellent candidate for multiple fuels
- In addition to export terminals, floating import terminals are being strategically installed in Jordan, Kuwait and elsewhere

...But is not without its impediments

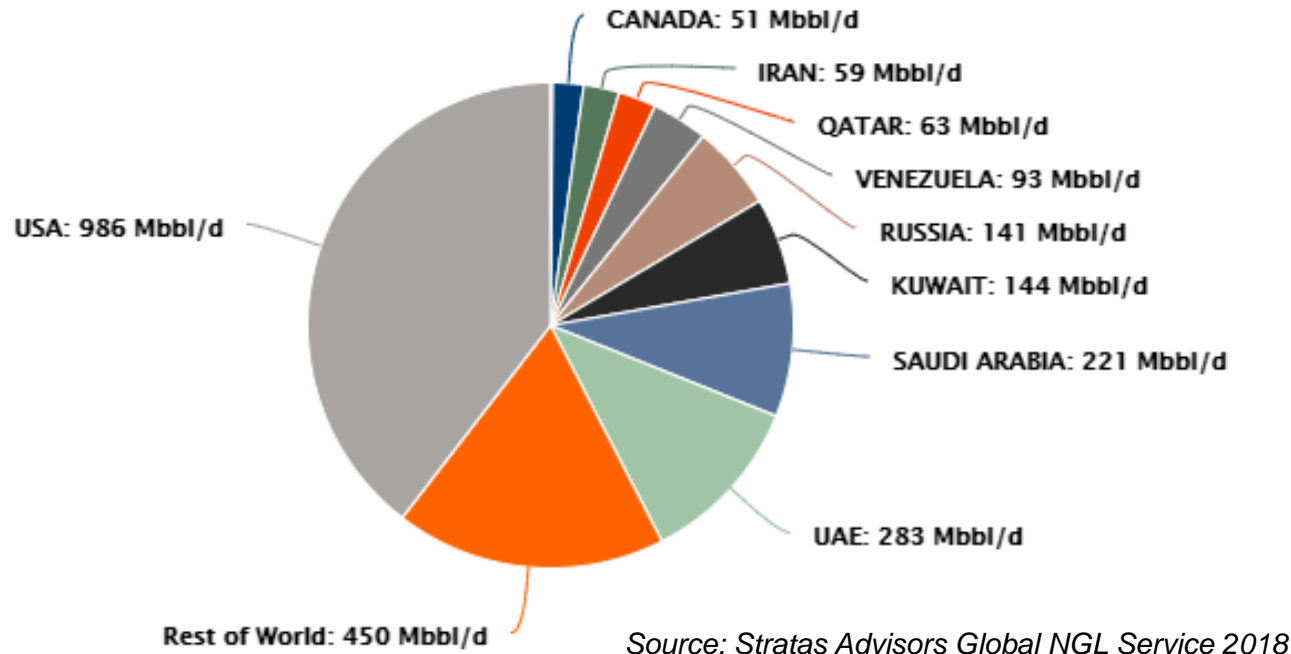
- Without well-developed infrastructure globally, it will be hard make LNG more than a regional fuel
- Dual-fuel engine vessels are priced at a ~20% premium compared to conventional fuel oil vessels, with scrubbers costing only one-quarter of the LNG premium



Global NGL Supply Forecasts

USA Leads Ethane Supply by Key Nations

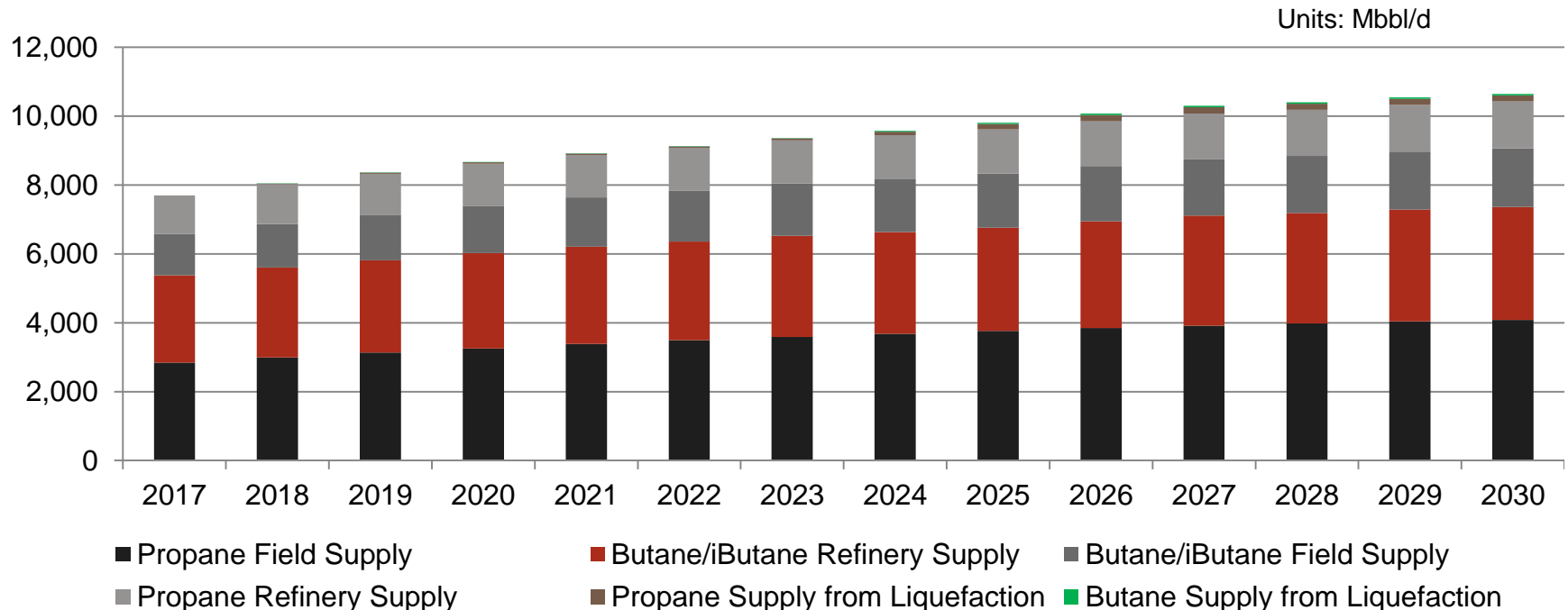
Incremental New Supply between 2030 and 2017



- Approximately nine countries will have more than $\frac{3}{4}$ of the global ethane supply
- The U.S. will lead the globe in incremental ethane supply
- Plants beyond the borders of the U.S. and Canada are lining up access to low-cost North American ethane supply via specially-built Very Large Ethane Carriers (VLEC) vessels that export U.S. ethane to offshore ethane crackers.

Significant Growth Ahead in LPG Supply

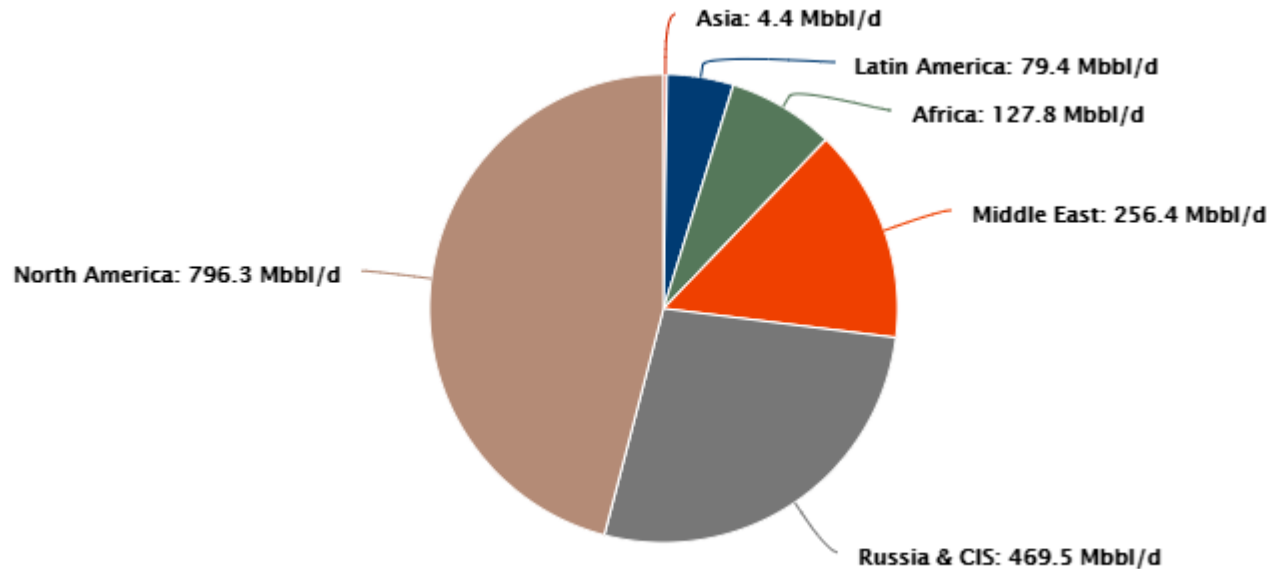
Incremental New Supply between 2017 and 2030



- We show that LPG supply will come from three major sources (field, refinery and liquefaction)
- Global LPG supply is projected to grow by 38% or 2,946 Mbbbl/d from 2017 levels of 7,701 Mbbbl/d
- Saudi Aramco has plans to finance projects across Asia which will lead the way in providing new LPG supply from refineries
- Aramco plans to double both its refining and petrochemical capacities by 2030

North America Leads in LPG Field Supply

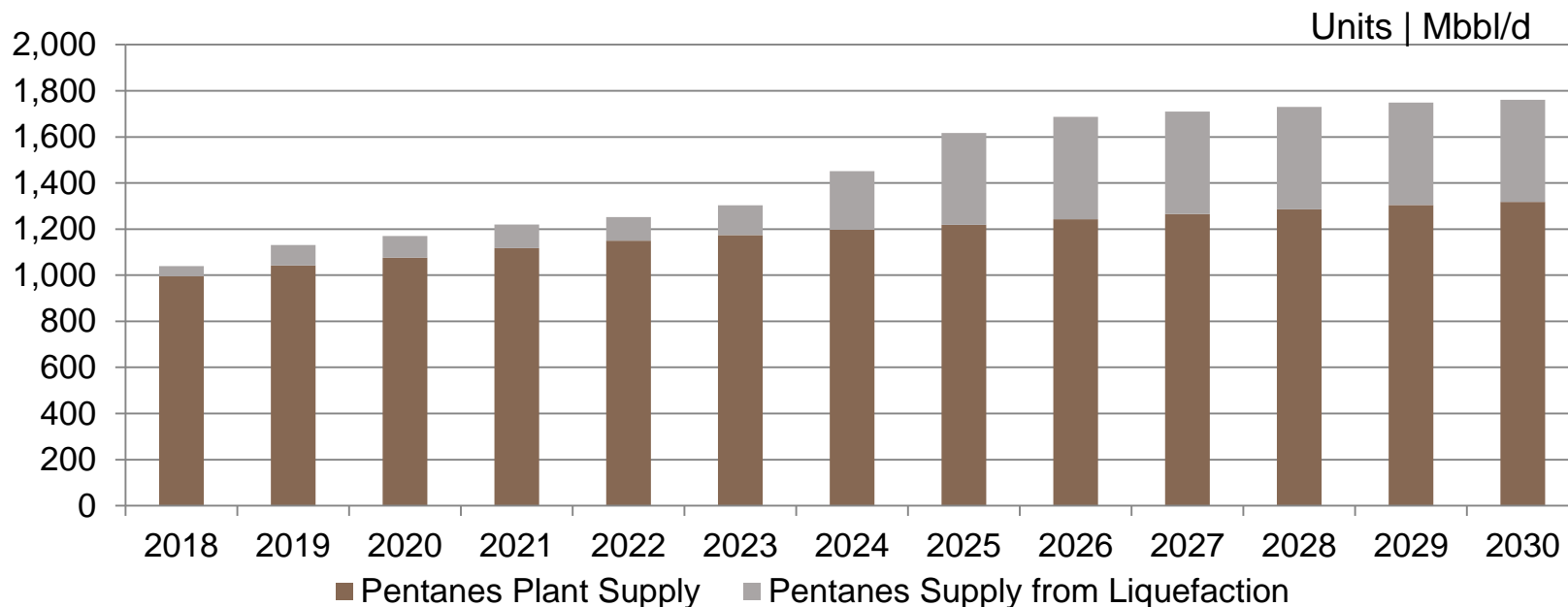
Incremental LPG Field Supply between 2018 and 2030



- North America will see the largest incremental LPG gains by 2030, while Asia is expected to see minimal gains
- Europe not likely to see incremental LPG volume gains due to falling production in the North Sea; the region will require imports to meet demand

Global Pentanes+ Supply Growth

Growth to accelerate by mid-2020s



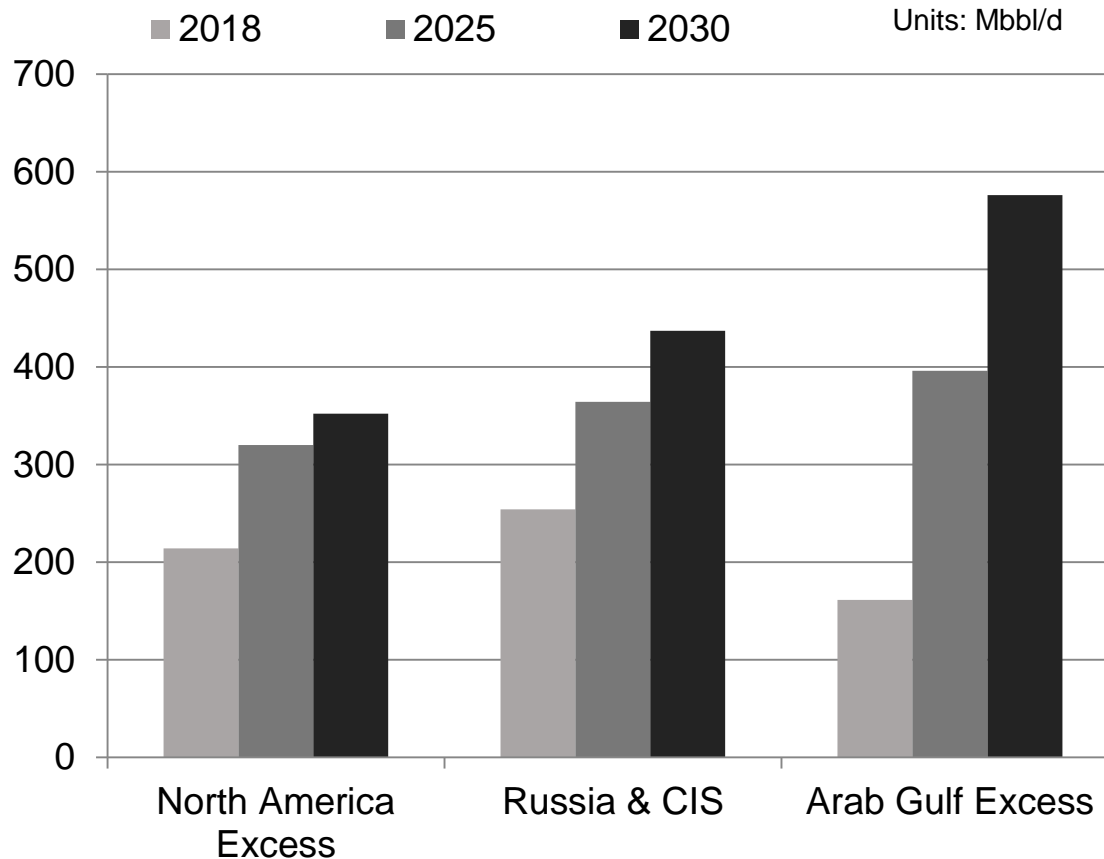
- Pentane+ demand driven by gasoline blending/demand, condensate splitting, and increased heavy crude oil production
- LNG export plants expected to account for nearly 25% of condensate production by 2030, up from 25% currently
- Gas plants in the field will continue to see steady additions to pentanes+ output, but will be outpaced by liquefaction additions



Ethane Trade Flows

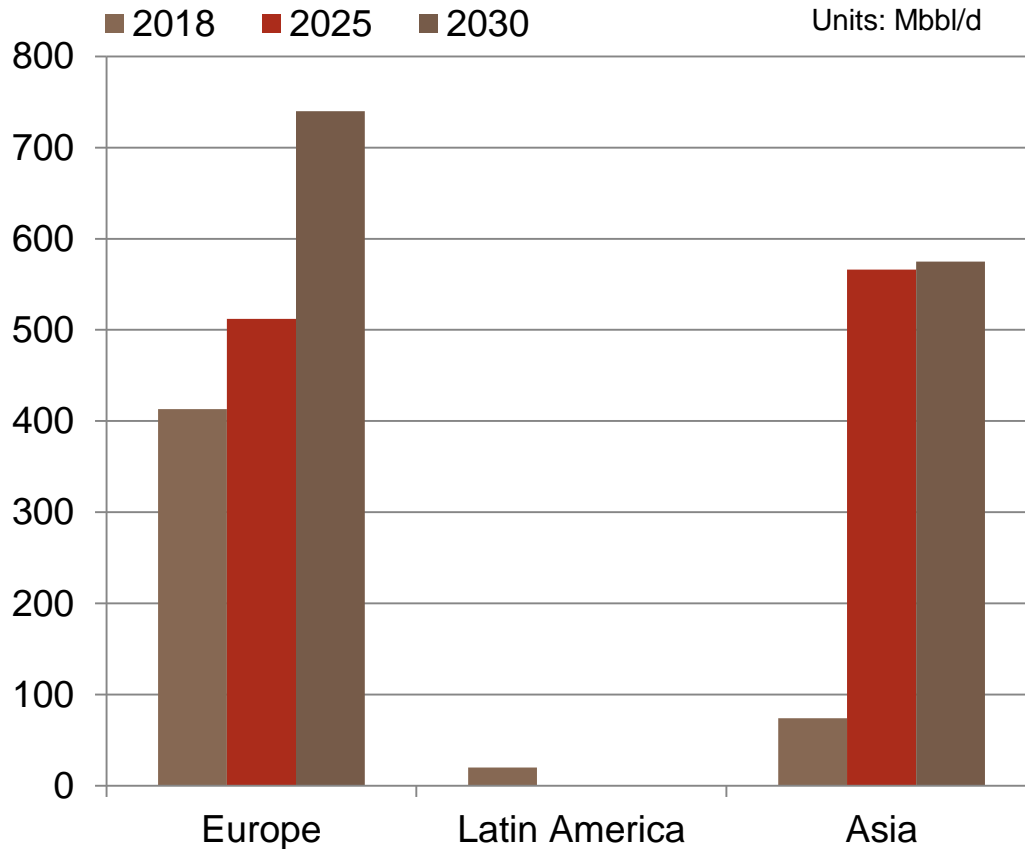
Exportable Ethane Flows

A three-way competition emerging



- New steam crackers and ethane export plants emerging to take advantage of low cost feedstock and greater yield
- Majority of North American ethane is consumed by domestic petchem plants
- Arab Gulf will enjoy the greatest ethane surplus and a favorable location proximate to key consumers in Asia and Europe

Europe Leads Ethane Imports

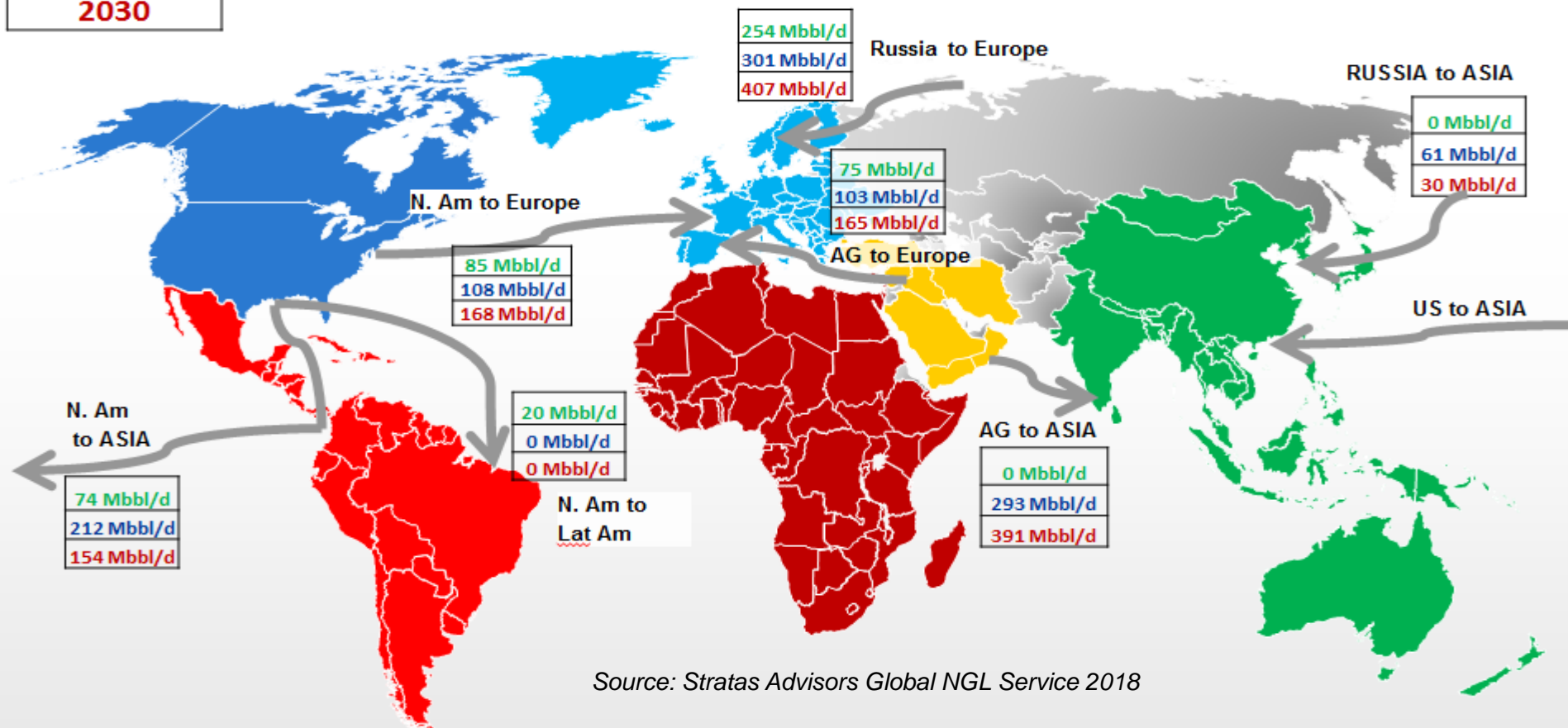


- Europe's net inbound flow is expected to increase as petchem plants lighten their feedstock, to compete in years ahead
- Latin America likely to become self-sufficient in ethane production by 2025
- Asia's petchem industry is lining up significant long-term contracts for importing ethane in shifting away from naphtha for feedstock

Ethane To Become a New Global Market

Projections of Net Outflows and Inflows between Regions

Year
2018
2025
2030

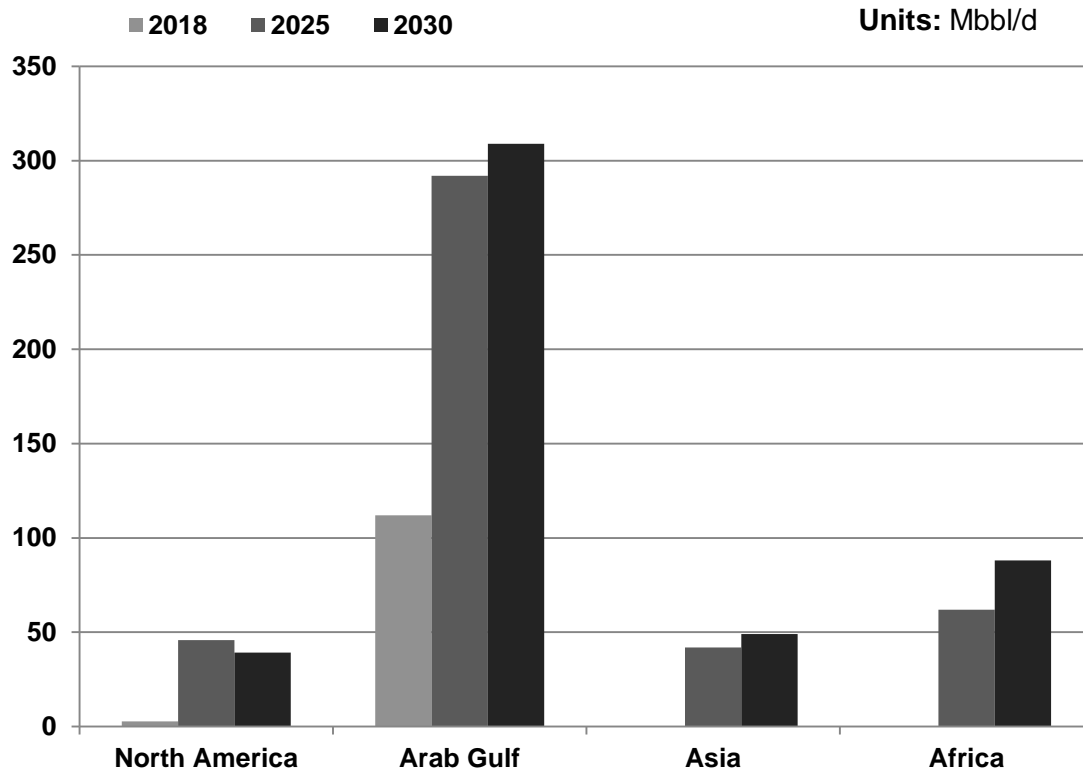


Source: Stratas Advisors Global NGL Service 2018



Condensate (Pentanes+) Trade Flows

Arab Gulf Leads As Condensate Exporter

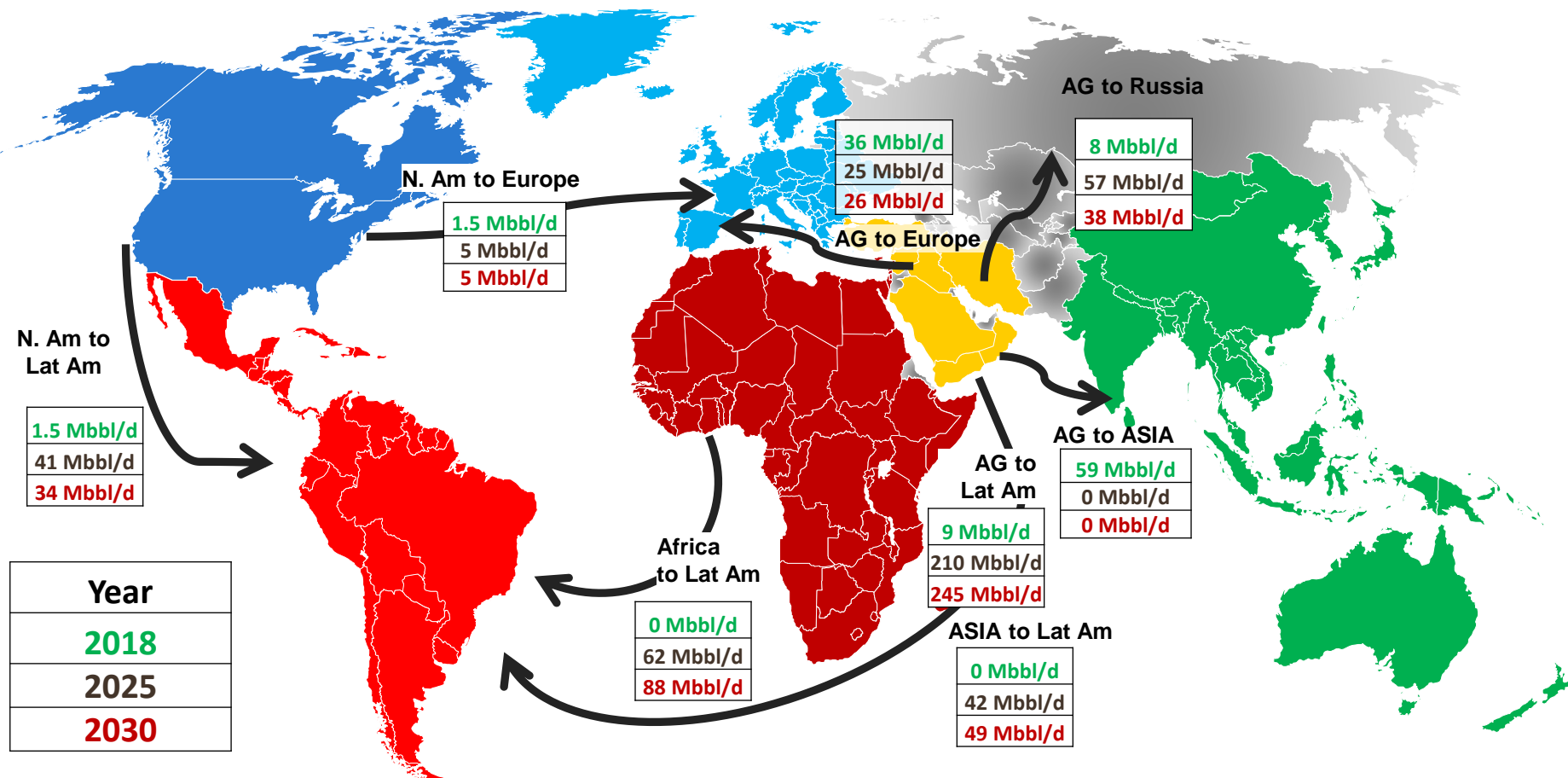


Source: Stratas Advisors Global NGL Service 2018

- Arab Gulf will supply 2/3 of global condensate exports by 2025
- Asia and Africa will emerge as modest exporters by 2025, growing to 2030
- Arab Gulf exports grow because internal diluent demand is low, naphtha petchem feed stocks will seek expanded refinery output
- Condensate will become increasingly available from liquefaction plants out to 2030

Condensate Trade Flows to 2030

Projections of net inflows and outflows of condensate between regions



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