Alterative Marine Fuels

Research, intelligence, and insights on alternative marine fuels

Multi-Client Study Prospectus

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Outline

- **Study Prospectus**
- About ADI

ADI is offering a multi-client study on alternative marine fuels whose adoption depends on several drivers and challenges

Drivers	
1 **Regulatory pressure**	▪ Tighter fuel sulfur limits for marine vessels ▪ Operators need help to comply with new rules
2 **Growing alternative fuels supply**	▪ Increased supply of cheap gas and NGLs … ▪ … Driving supply of alternative marine fuels
3 **Improving lifecycle costs**	▪ Alternative fuels offer short payback periods ▪ Regulatory incentives for using cleaner fuels

Challenges	
1 **Infrastructure constraints**	▪ Infrastructure availability and regional variation ▪ Cost of building new fueling infrastructure
2 **Oil price uncertainty**	▪ Low and volatile oil price environment … ▪ … Impacts fuel costs and lifecycle economics
3 **Technology adoption risks**	▪ End-user adoption based on many factors … ▪ ... Including company and local issues

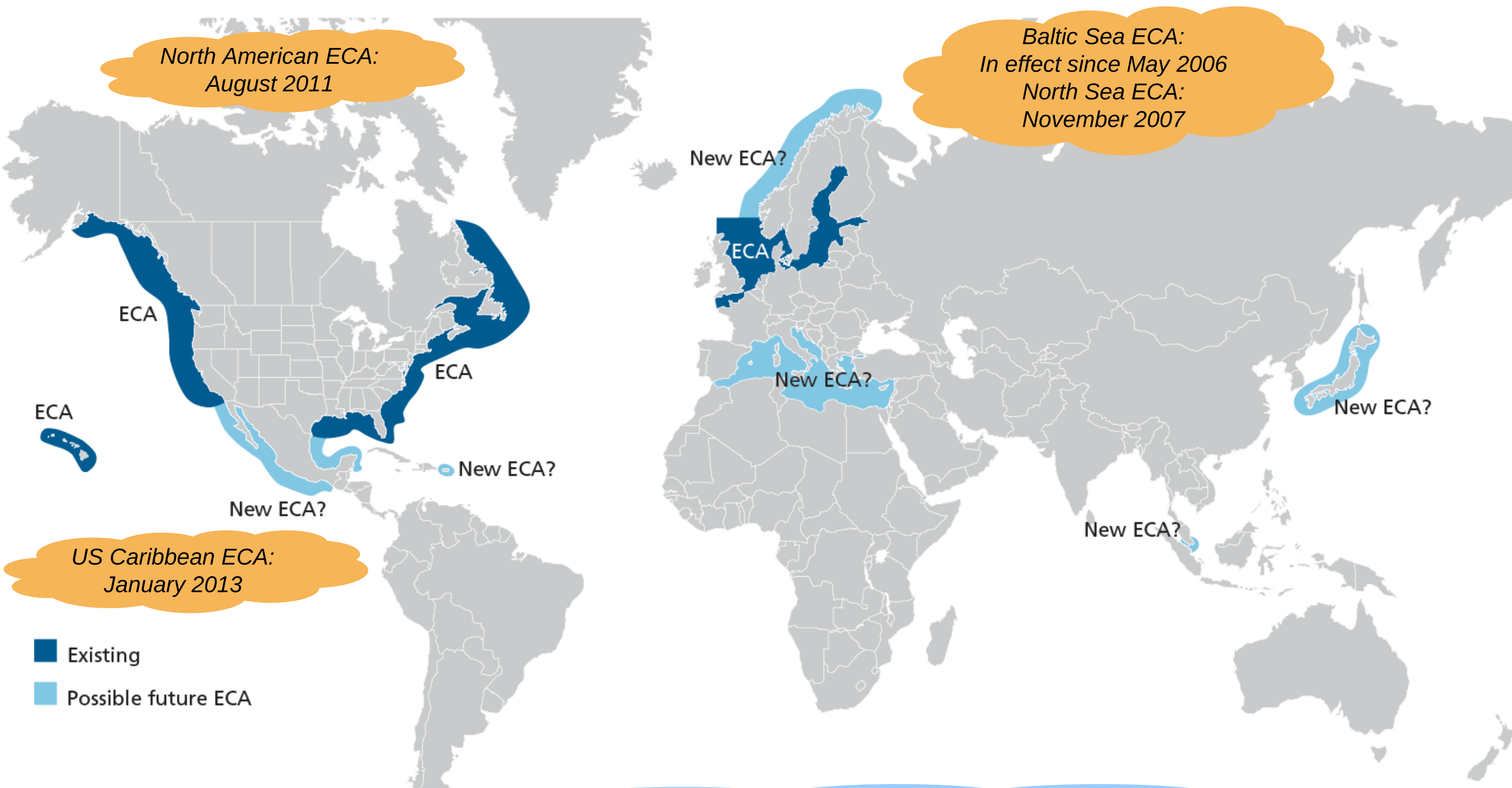
Alternative marine fuels covered in this study

Low-sulfur diesel	**Natural gas (CNG/LNG)**	**Methanol**	**Hydrogen**	**Others (ammonia, electric)**

Pressure to reduce sulfur content in marine fuels has been escalating beginning with a 0.1% limit for ships in ECAs

Existing and Potential ECAs

(ECAs are Designated by International Maritime Organization)

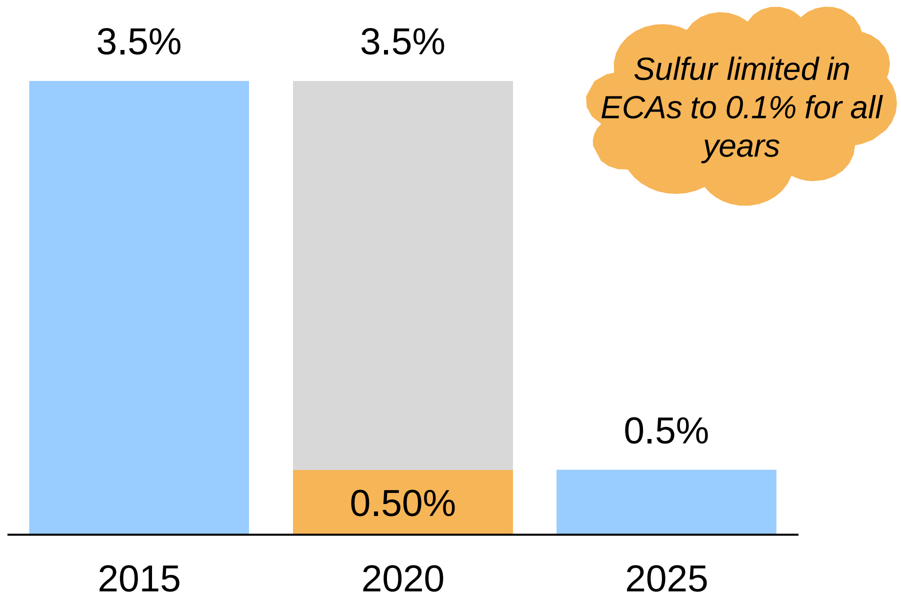


Ships in ECAs (i.e. 200 nautical miles from shore) must meet applicable SOx/NOx emission limits

Source: DNV

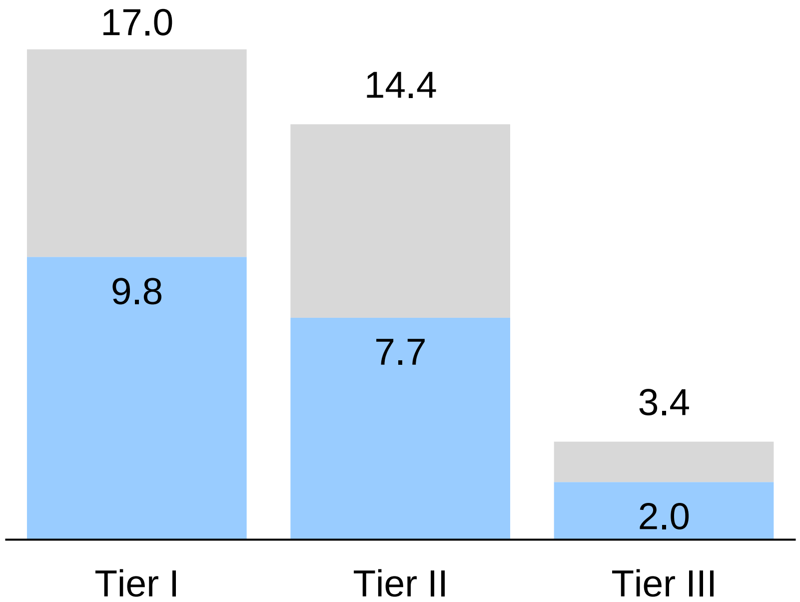
New regulations are likely on sulfur in marine fuels and NOx emissions from vessels driving further interest in alternatives

Fuel Sulfur Limits
(Percentage)



- Sulfur today is limited to 0.5% globally
- In 2020, IMO introduced the stricter sulfur limit globally

NOx Limits
(g/kWh)



- Tier I regulations apply to all ships bult on or after January 1, 2020
- Tier II regulations app to ships constructed on or after January 1, 2011
- Tier II regulations only apply to small ships operating ECSs that are bult on or after January 1, 2016

We will study demand, supply, pricing, regulatory, economic, and technology issues around alternative marine fuels…

Overarching questions

- What are the key regulatory, technology, and infrastructure drivers for alternative marine fuels?
- How large is the global market for alternative marine fuels? How will it vary by region and fuel?
- Which factors will drive the adoption of marine fuel applications? What are the key scenario signposts?
- What are the implications of marine fuel alternatives by value chain segment and stakeholder?

1 **Demand / supply**	▪ How is the global landscape for marine fuel demand and supply evolving? ▪ What are the costs and economics of production of alternative marine fuels? ▪ What factors must an end-user consider before switching fuels?
2 **Technology and infrastructure**	▪ What are major alternative marine fuel technology trends? ▪ How is fuel distribution and refueling infrastructure developing? ▪ Who are the major technology, equipment, and infrastructure developers?
3 **Implications**	▪ What signposts exist to help guide key stakeholder strategies? ▪ Which fuel is most likely to be adopted in different scenarios? ▪ How will refiners and other suppliers of fuel be impacted?

… Through a structured and comprehensive report reflected in the proposed table of contents

1	**Executive summary**		
2	**Drivers**		▪ Regulatory pressures, e.g., ECAs and IMO regulations ▪ Cost and economic considerations
3	**Market size / segmentation**		▪ Regional market sizes / growth rates by ship and fuel type ▪ Outlook of marine fuels (diesel, natural gas, methanol etc.)
4	**Fuel profiles**	**Low-sulfur diesel** **Natural gas (CNG/LNG)** **Methanol** **Hydrogen** **Others (ammonia, electric)**	▪ Regional alternative marine fuel demand ▪ Increased alternative fuel availability ▪ Infrastructure needs, costs, barriers, developments ▪ Conversion costs / economics across fuel types ▪ Non-economic issues for conversion ▪ Breakeven costs by ship and fuel type ▪ Most suitable ship types for each alternative fuel ▪ Major players in alternative marine fuels ▪ Key stakeholders (EPCs, technology players)
5	**Strategic implications**		▪ Impact on key stakeholders (refiners, shippers, OEMs) ▪ Identify high growth segments (equipment, technology)
6	**Scenarios**		▪ Demand scenarios at multiple oil / gas price spreads ▪ Fuel demand analysis on several adoption scenarios
7	**Conclusions and recommendations**		▪ Key findings and major conclusions ▪ Stakeholder considerations

Outline

- Study Prospectus
- **About ADI**

ADI is a consulting firm serving oil & gas, energy, chemicals, and industrial clients with expertise, rigor, and passion

Operators | **Investors** | **Industrials** | **Traders** | **Government**

Oil	Gas & LNG	Midstream & NGLs	Refining	Fuels
Feedstocks	Petrochemicals	Basic Chemicals	Polymers & Plastics	Specialty Chemicals
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Markets | **Operations** | **Technology** | **Commercial** | **Policy**

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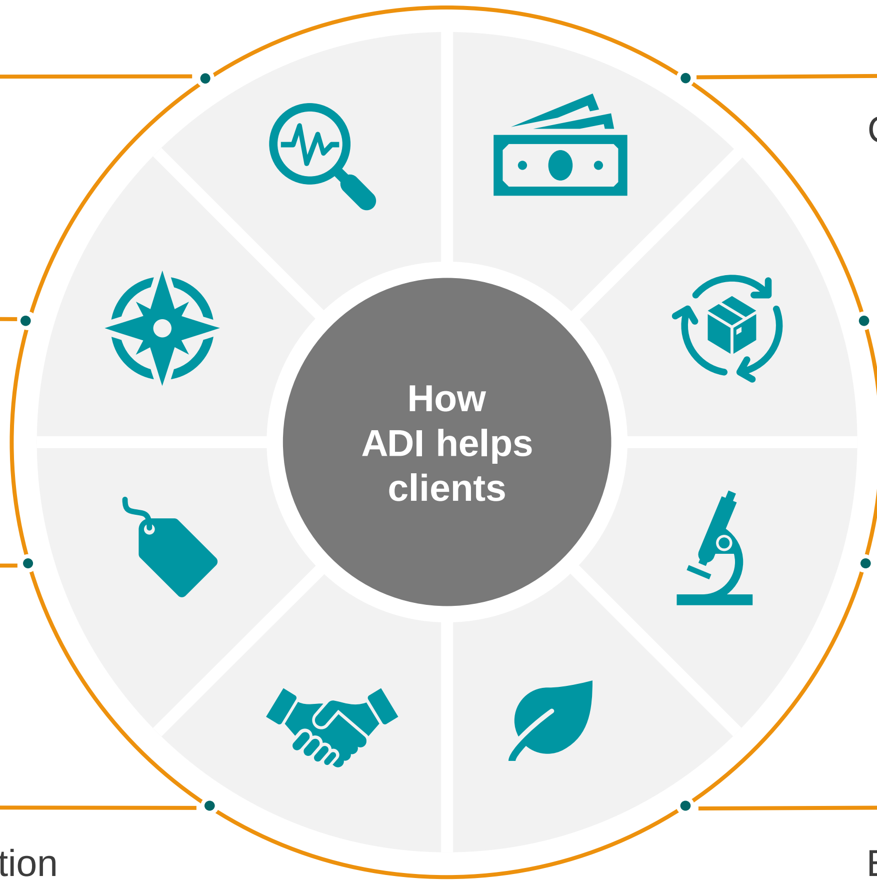

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Upstream

- Oil basins / shale plays
- Exploration trends
- Completion strategies
- Production services
- Oilfield services
- Offshore operations
- Digital & automation
- Oilfield waste mgmt.
- Wastewater treatment
- Oilfield equipment
- Oilfield chemicals
- Enhanced oil recovery
- Upstream technology
- Asset valuations
- Country assessments

Midstream

- On/offshore pipelines
- Gathering & process.
- Gas processing plants
- NGL fractionators
- Oil, LPG, NGL exports
- Ethylene exports
- Ethane rejection
- LNG project feasibility
- Condensate splitters
- Midstream equipment
- Compressor services
- Drag reducing agents
- Corrosion inhibitors
- Sulfur removal units
- Methane emissions

Downstream

- Refining markets
- Refinery operations
- Fuel demand / supply
- Fuel trading and retail
- IMO 2020 regulations
- Fuel product export
- Auto regulations
- Crude-to-chemicals
- Process automation
- Refining catalysts
- Process licensors/EPC
- H2S scrubbers
- Wastewater treatment
- Small-scale GTL/LNG
- Fuel / lube additives

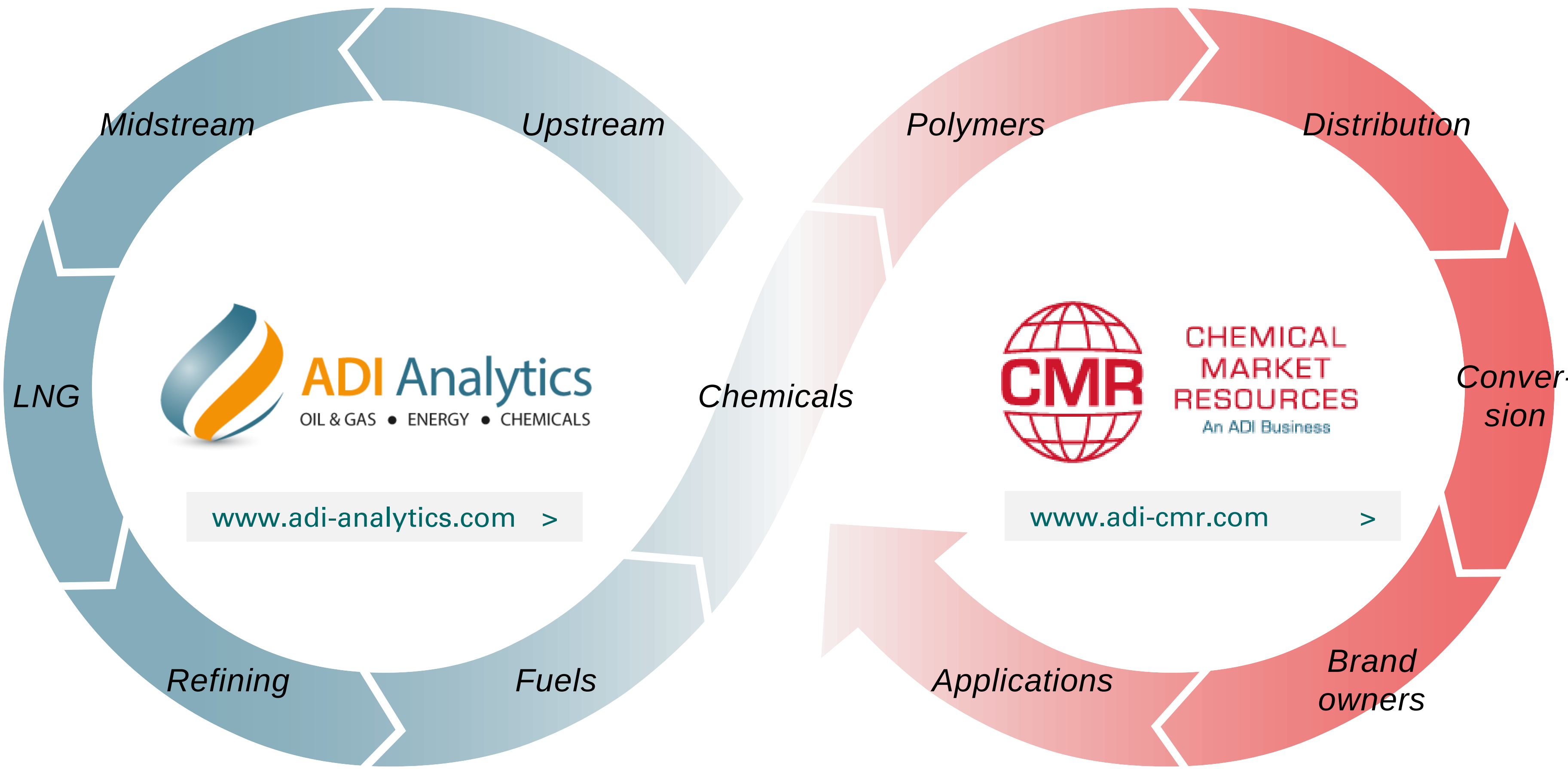
Chemicals

- Olefins and aromatics
- Polyolefins / plastics
- Flexible packaging
- Styrene-block copoly
- Ethylene value chain
- Propylene value chain
- C4 value chain
- Pygas and derivatives
- Bio-based chemicals
- Oxo-chemicals
- On-purpose olefins
- Methanol / ammonia
- Specialty tolling
- Electronic chemicals
- Specialty amines

Energy Transition

- Coal-/gas-fired power
- Solar and wind
- Steam turbines
- Micro gas turbines
- Small modular nuclear
- Geothermal and EGS
- Distributed generation
- Power systems
- Transmission
- Li-ion batteries
- Energy storage
- Boiler feed pump
- Microgrids
- Smart meters
- Demand response

After acquiring Chemical Market Resources, ADI's expertise has grown and now spans the entire hydrocarbon value chain



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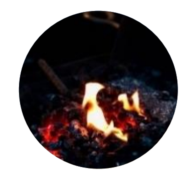
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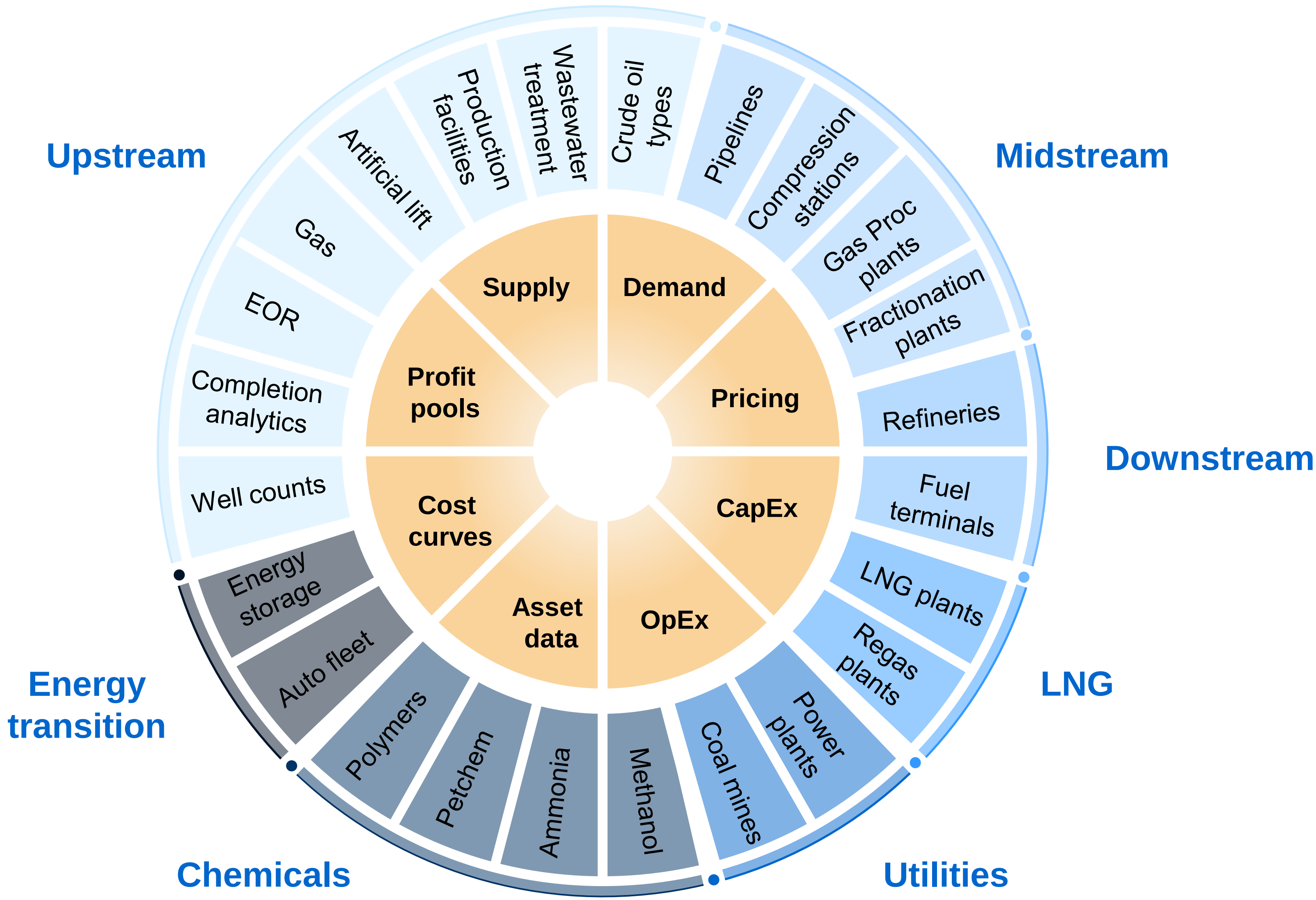

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