

Linear Alpha Olefins Market Study : Chemical Strategic Report

September 2023

Hormuzd Karanjia, Director, Chemical Consulting, Hormuzd.Karanjia@spglobal.com

Nikita Kheterpal, Consultant, Chemical Consulting, Nikita.Kheterpal@spglobal.com

Dr. Mark Morgan, VP, Specialty Chemicals & Renewables, Mark.Morgan@spglobal.com

Mohit Sood, Director, Chemical Consulting, Mohit.Sood@spglobal.com

S&P Global
Commodity Insights



Contents



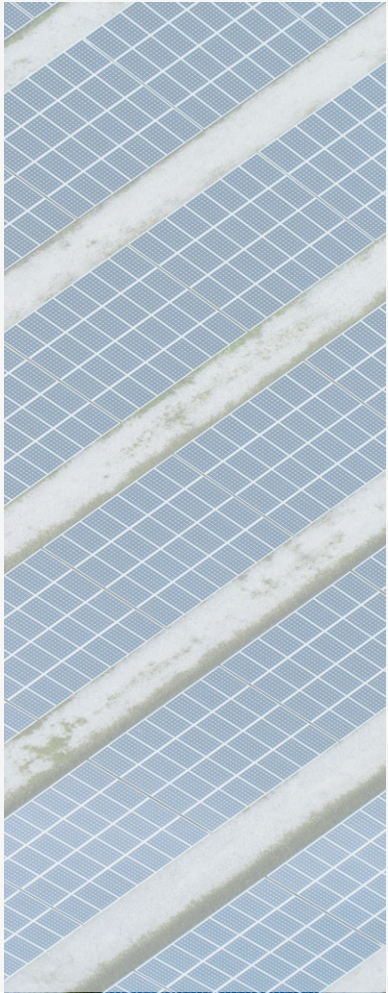
1. Why this report and why now?

2. Table of Contents

3. Report coverage and themes explored

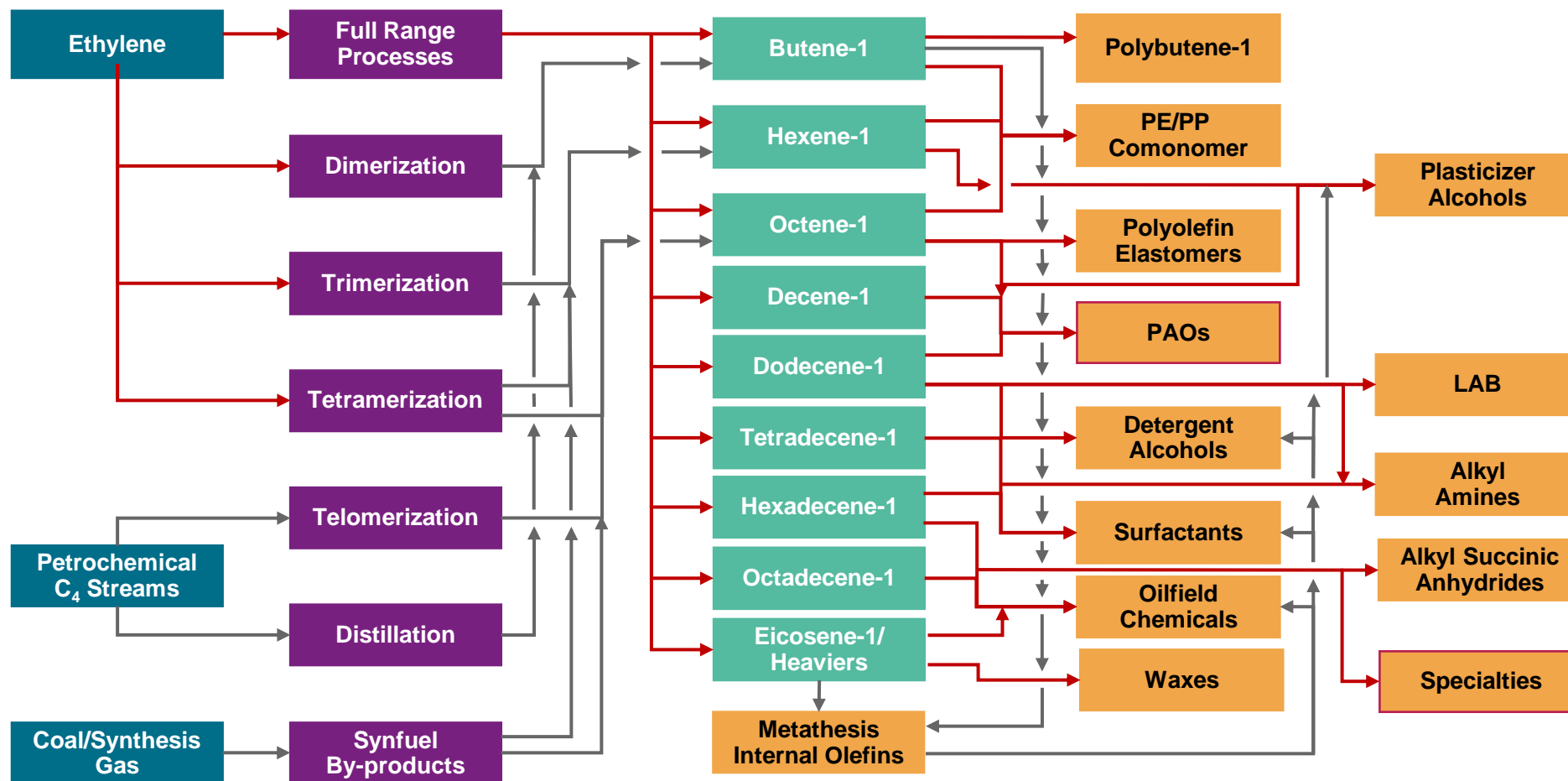
4. Report content summary

The LAO business is one of the most complex chemicals business today as one platform can provide building blocks for commodities, covering polyolefins and specialties covering multiple nice business as well larger volume products like surfactants.



- Linear alpha-olefins (“LAO”s) are building blocks for multiple value chains. LAOs are straight chain hydrocarbons characterized by a double bond in the terminal or alpha position.
- Production of LAOs are based on ethylene oligomerization which yields an entire range of even-numbered carbon chain-length LAOs from butene-1 to $C_{26}+$. Such processes are referred to as ‘full range’ or ‘FR’ technologies. Some technologies, so-called, ‘on purpose’ processes can manufacture one or more fractions selectively.
- The physical properties of LAOs depend on the chain length. Butene-1 is a gas at room temperature while the C_6 - C_{18} fractions are clear, colorless liquids. Heavier fractions $C_{20}+$ LAO fractions are waxy solids and can be shipped in heated iso tanks as liquids too.
- The utility of specific LAOs is related to the reactivity of the double bond and chain length. Several chemistries are possible, some of which become easier at longer chain lengths.
- The industry is facing considerable change through a combination of technology development, globalization, and sustainability concerns along specific LAO value chains.

LAOs are made via different technologies, some serving multiple downstream industries, while on-purpose technologies are more focused serving mainly polyolefins



Today, the LAO business is a 7.0 million metric ton global industry, growing ahead of average GDP, around 3% over the next decade. Different growth rates across fractions are leading to challenges in future industry development.

LAOs serve multiple applications across many industries with complex value chains. Each downstream business faces challenges and opportunities for LAO development

Applications	LAO Fractions										
	C4	C6	C8	C10	C12	C14	C16	C18	C20	C22	C24+
Polybutene-1 and PP	💧										
HDPE Comonomer	💧	💧	💧								
LLDPE Comonomer	💧	💧	💧								
Elastomer Comonomer	💧	💧	💧								
Plastomer Comonomer	💧	💧	💧								
Polyalpha Olefins			💧	💧	💧	💧					
Surfactants			💧	💧	💧	💧	💧	💧			
Lubricant Additives			💧	💧	💧	💧	💧	💧	💧	💧	
Oilfield Chemicals						💧	💧	💧	💧	💧	
Waxes										💧	💧
Specialty Chemicals	💧	💧	💧	💧	💧	💧	💧	💧	💧	💧	💧

The complexity of the business comes from LAOs serving multiple industries; from large volume commodity polymer producers to small volume specialty chemicals producers, across a broad base, each with their own specifications of logistics, volumes consumed etc. Each segment or sector served has their own challenges and opportunities.

Contents



1. Why this report and why now?

2. Table of Contents

3. Report coverage and themes explored

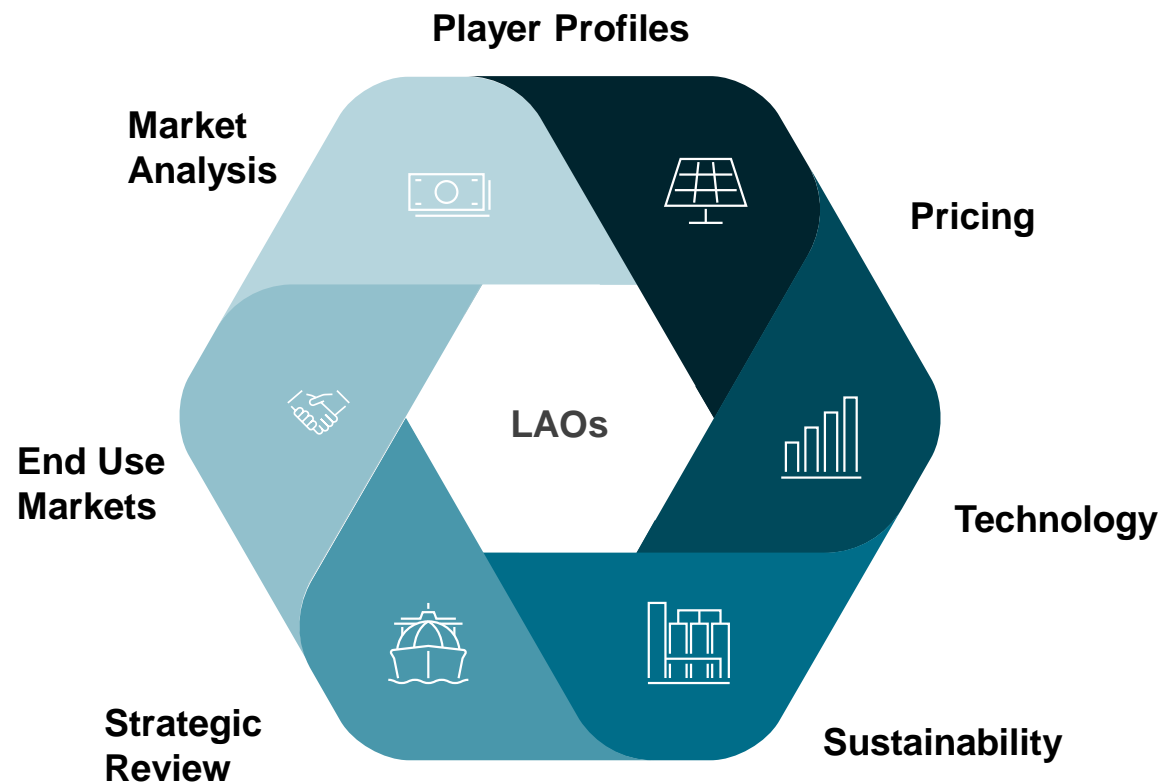
4. Report content summary

This comprehensive study will address the pivotal questions of LAO market and will leverage the rich in-house expertise pool and information sources.

Tentative Table of Contents

1	About LAOs
2	Technology Overview
3	Market Analysis : Lighter Fractions: C4,C6,C8
4	Market Analysis : Heavier Fractions: C10-C20+
5	Pricing for Key Regions
6	Leading Players in the LAO Industry
7	Strategic Issues / Sustainability
8	Key Study Takeaways

S&P Global Commodity Insights enjoys privileged in-house access to expertise and analytics across multiple relevant sectors of the industry and the economy in general.



Contents

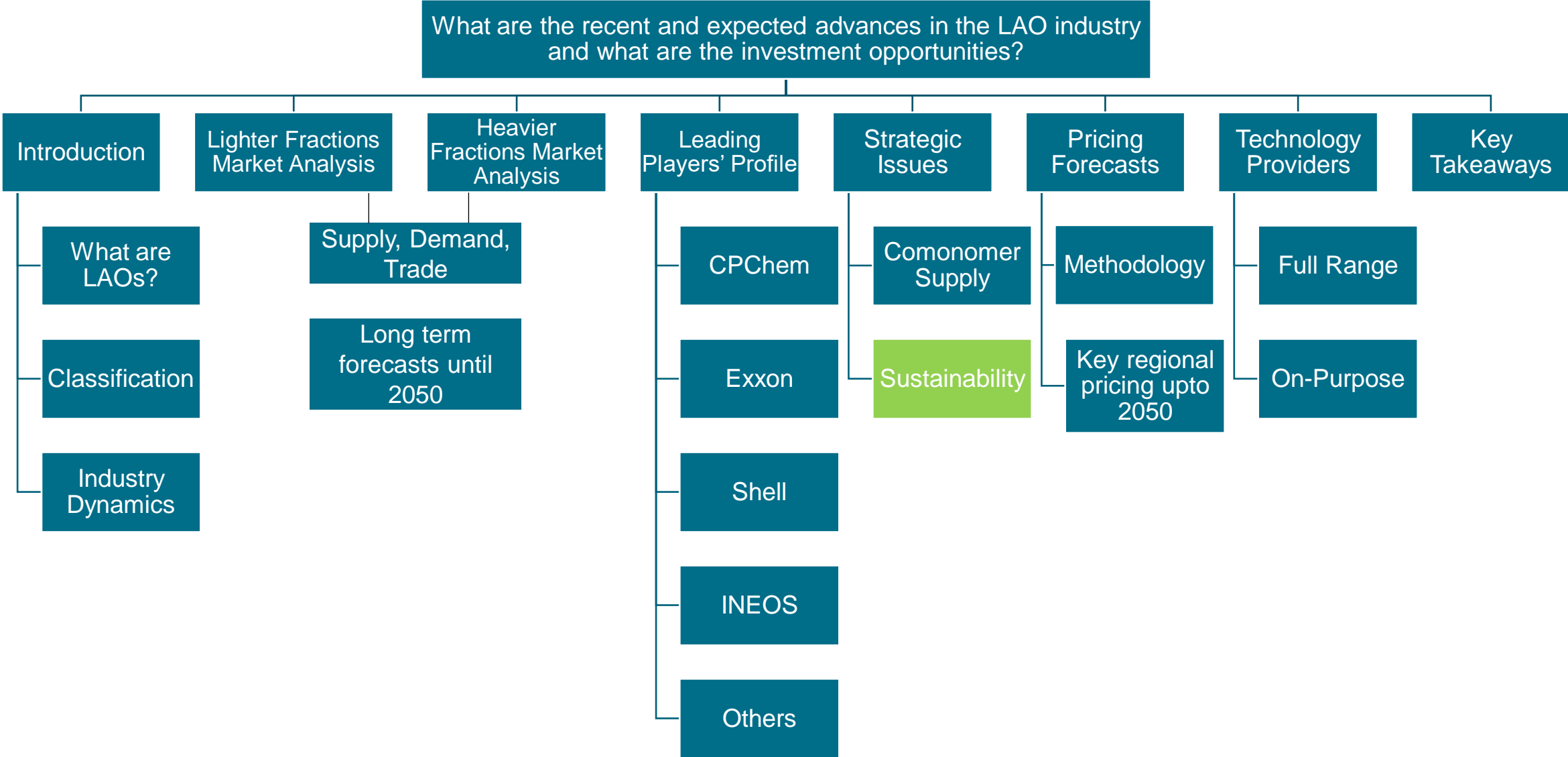
1. Why this report and why now?

2. Table of Contents

3. Report coverage and themes explored

4. Report content summary

Review of key question and study scope



The strategic report will be structured along these core business analysis components

1 Industry & Technology Overview (C4-C20+)

- Lighter Fractions
- Heavier Fractions

2 Supply, Demand & Trade Outlook through 2050

- C4-C8
- C10-C20+
- Commodity Chemical Comonomers
- Specialty Applications
- Others
- NAM, SAM
- WEP, CEP/CIS
- NEA, CHI, SEA, ISC
- MDE, AFR

3 Selected Pricing Assessments

- NAM
- WEP
- NEA

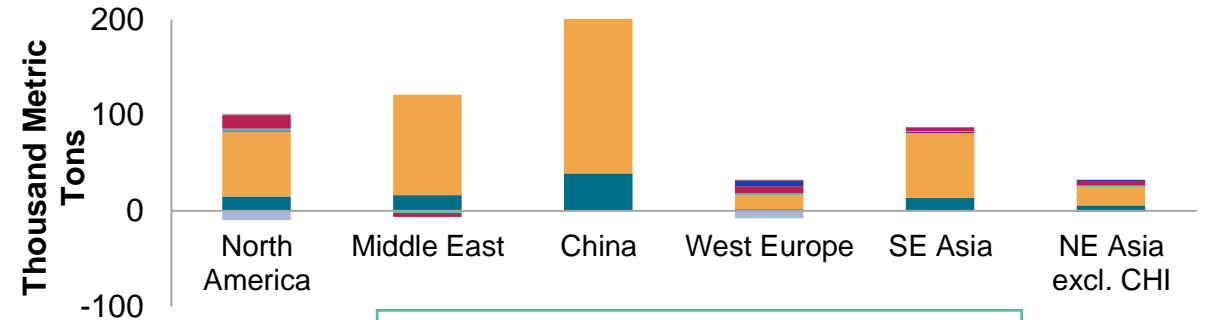
4 Key Strategic Issues

- Future supply of comonomer-range LAOs
- Sustainability/low-carbon routes

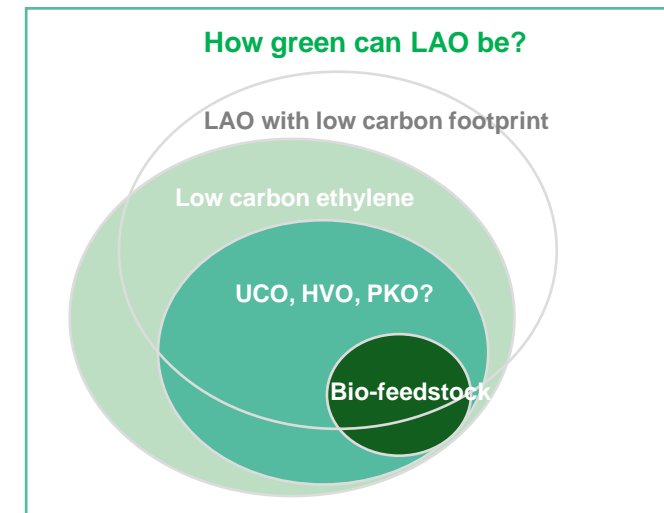
- Polyethylene comonomer demand from the lighter fractions dominates all regional demand profiles.
- Highest growth will be seen in emerging economies and feedstock advantageous regions.

Five year Demand Growth for Lower Fractions by Major Region

- HDPE Comonomer
- LLDPE Comonomer
- Polypropylene Comonomer
- Plastomer Comonomer
- Elastomer Comonomer
- PAO
- Polybutene-1
- Captive LIO
- Alkylamines



Source: S&P Global Commodity Insights.
© 2023 S&P Global.



20+ Potential LAO Applications Opportunities are covered in this Report

20+

Lighter Fractions

Commodity Comonomers

1. HDPE Comonomer
2. LLDPE Comonomer
3. PP Comonomer

POP/POE

4. Polyolefin Plastomer
5. Polyolefin Elastomer

Others

6. Polybutene-1
7. Captive LIO
8. Others

Heavier Fractions

Specialties Range

9. PAOs
10. Detergent Alcohols
11. LAB
12. Lubricant Additives
13. Plasticizer Alcohols
14. Alpha Olefin Sulphonates / Surfactants
15. Alkylamines
16. Aluminum Alkyls
17. Alkylphenates
18. Higher Oxo Acids
19. Alkenyl Succinic Anhydrides
20. Mercaptans
21. Chlorinated Organics
22. Oilfield Chemicals
23. Miscellaneous Applications
24. Waxes

This strategic Report is more than a listing of market dynamics and pricing, but delves into the important factors impacting this industry in a time of uncertainty and change



Short and long-term market dynamics by application, fraction and region, discussing the impact of divergent growth across different sectors leading to periodic supply pinch points and likely impact on pricing



What does it take to be successful in this business as a producer and what form of upstream/downstream integration is sensible?
How profitable is in the industry and how resilient is it to geopolitical events and market imbalances?



Given future developments, how will technology evolve beyond existing well-known approaches. Are there ways to make LAOs with a lower carbon footprint and how will this impact downstream applications?



How will the LAO industry respond to the challenges posed by sustainability, need for low carbon feedstocks & reduced emissions? How could this impact industry profitability and investor sentiment?

This strategic Report on the Linear Alpha Olefins Industry is an essential guide as to how the business may develop in response to demand drivers, globalization and sustainability

Context: Why this report?

- Changing industry & divergence in lighter fractions growing faster than heavy fractions
- Uncertainty from geopolitical events, e.g., impacting the energy market and demand for related fractions in the oilfield space.
- China's new entrants and technology could stimulate local market development.
- LAO downstream value chains are impacted by sustainability, e.g., plastics recycling and the circular economy.
- Periodic imbalances in LAO fraction supply for growth industries like POE/POP, PAO.
- Understanding LAO industry profitability and how best to succeed as a future producer or consumer.

What the report will address?

- Market dynamics for this complex industry with fractions grouped into lighter fractions (C₄, C₆, C₈) and Heavier fractions (C₁₀-C₂₀₊) and issues arising.
- Downstream demand covering 20+ applications from commodities through to specialty chemicals
- Industry globalization with new entrants with their own technology. Industry profitability, covering pricing, margin performance insight.
- How major players participate in the LAO and downstream business with lessons learnt.
- How sustainability could impact the industry from access to low carbon feedstocks to the impact on downstream industries.

Who will benefit from this report?

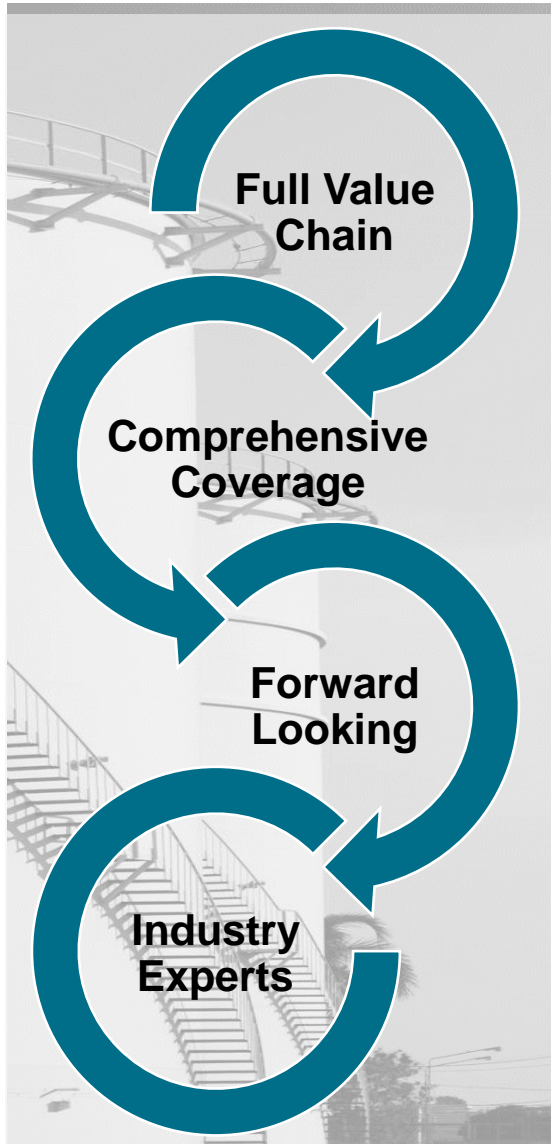
- **Existing LAO consumers**– understand LAO industry development and impact on consumers across value chains. Some customers face tightening supply for key fractions, leading to spikes in LAO spot pricing. Knowing where future pinch points may allow consumers to develop suitable procurement strategies to cut costs.
- **New entrants** – Develop views as a starting point for strategy decision on where, how, when to participate, as well as what business model should be adopted.
- **Investors** – Frame assumptions on potential investments and returns supporting new entrants, considering early financing viability
- **Technology developers** – Given changes in LAO market dynamics, LAO supply gaps are identified leading to opportunities for new process developments. In addition, with sustainability concerns lower carbon options can be considered.

Contents



-
1. Why this report and why now?
 2. Table of Contents
 3. Report coverage and themes explored
 - 4. Report content summary**
-

Chemicals consulting brings a comprehensive report on the linear alpha olefins business based on its experience from actual projects and wider S&P Global expertise



- Detailed market dynamics across 20+ applications, major regions, grouped under light fractions (C₄-C₈) and heavy fractions (C₁₀-C₂₀+) for 2020-2050 period, reviewing key issues from downstream value chains and their impact on the LAO industry.

- Form market and price/margin dynamics, to technology development, competitor profiling and the wider strategic impact of lower carbon initiatives and wider sustainability-related issues.

- The future of the industry, focused on the strategic impact of downstream industry developments as well as wider sustainability-related factors, is considered, together with how technologies will influence worldwide industry development and profitability.

- The report makes use of very recent experience in the sector, working with clients on real world projects. S&P Global team members cover multiple disciplines in LAOs and diverse downstream markets in polymers, elastomers, lubricants, surfactants and specialties.

Sustainability has become an increasingly influential driver in determining the future supply of comonomer-range LAOs, in the long-term pertaining to the UN Sustainability Goals



- Future supply of comonomer-range LAOs and sustainability/low-carbon routes are important strategic issues for the industry for the medium to long term
- These will gradually impact not only the LAO producers but also many players in downstream industries of commodity and specialties who respond to the wants and needs of the consumer.

Contacts

Tanya Duggal (North America)

Tanya.Duggal@spglobal.com

Marisabel Dolan (Latin America)

Marisabel.Dolan@spglobal.com

Ryan Monis (Europe)

Ryan.Monis@spglobal.com

Mohit Sood (Middle East)

Mohit.Sood@spglobal.com

Aman Arora (India)

Aman.Arora@spglobal.com

Juan Song (China)

Juan.Song@spglobal.com

Kitiya Atthayuwat (Asia excl. China)

Kitiya.Atthayuwat@spglobal.com



Disclaimer

S&P Global Commodity Insights (“SPGCI”) divisional independence. SPGCI is a business division of S&P Global Inc. (“S&P Global”). S&P Global also has the following divisions: S&P Dow Jones Indices, S&P Global Market Intelligence, S&P Global Mobility, and S&P Global Ratings, each of which provides different products and services. S&P Global keeps the activities of its business divisions separate from each other in order to preserve the independence and objectivity of their activities in accordance with the S&P Global Divisional Independence and Objectivity Policy. Client’s receipt of SPGCI reports, data and information under this Agreement may also affect Client’s ability to receive services and products from other S&P Global divisions in the future.

S&P Global Commodity Insights publishes commodity information, including price assessments and indices. S&P Global Commodity Insights maintains clear structural and operational separation between its price assessment activities and the other activities carried out by S&P Global Commodity Insights and the other business divisions of S&P Global to safeguard the quality, independence and integrity of its price assessments and indices and ensure they are free from any actual or perceived conflicts of interest.

Limitation of Advice and Reliance. The Deliverables should not be construed as financial, investment, legal, or tax advice or any advice regarding Client’s corporate or legal structure, assets or, liabilities, financial capital or debt structure, current or potential credit rating or advice directed at improving Client’s creditworthiness nor should they be regarded as an offer, recommendation, or as a solicitation of an offer to buy, sell or otherwise deal in any investment or securities or make any other investment decisions. The Deliverables should not be relied on by Client in making any investment or other decision. Client may not use the Deliverables to transmit, undertake or encourage any unauthorized investment advice or financial promotions, or to generate any advice, recommendations, guidance, publications or alerts made available to its own customers or any other third-parties. Nothing in the Deliverables constitutes a solicitation by SPGCI or its affiliates of the purchase or sale of any loans, securities or investments. SPGCI personnel are not providing legal advice or acting in the capacity of lawyers under any jurisdiction in the performance of Services or delivery of Deliverables.