INDEPENDENT MARKET REPORT

Assessing The Specialty Chemicals Market

Date: 23rd Jan 2025

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ABBREVIATIONS

APAC: Asia Pacific

Bn: Billion

CAGR: Compound Annual Growth Rate

EU: Europe

EUR: Euro

INR: Indian Rupees

KT: Kilo Ton

LATAM: Latin America

MEA: Middle East and Africa

Mn: Million

MMTPA: Million Metric Ton Per Annum

MTPA: Metric Ton Per Annum

NA: North America

RFS: Restated Financial Statements

USD: United States Dollar

1 Macroeconomic Overview – Global

1.1 Global Gross Domestic Product (GDP) Growth

Following a robust 6.47% post-COVID-19 pandemic growth rebound in CY2021, the global economy recorded a sharp slowdown in CY2022, as the Russo-Ukrainian war led to soaring inflation and tight monetary conditions. This constrained purchasing power and dampened consumer and business sentiment. Consequently, growth decelerated to 3.46% in CY2022.

Global GDP growth slowed further and stood at 3.18% in CY2023, with the economy only picking up pace in the second half of CY2023, as inflationary concerns eased, and economic activity grew gradually. However, restrictive credit conditions and increasing geopolitical fragmentation – exacerbated by the CY2023 Israel-Hamas war - caused some growth pullback. Global economic growth was highly divergent in CY2023, with advanced economies – barring the United States (US) – posting subdued performance as opposed to their developing counterparts.

Exhibit 1.1-1: Real GDP Growth (%), Global and Select Economies, CY2018 - CY2028F

	'18A	'19A	'20A	'21A	'22A	'23A	'24E	'25F	'26F	'27F	'28F
World	3.63	2.84	-2.69	6.47	3.46	3.21	3.18	3.23	3.16	3.14	3.09
Advanced Economies	2.28	1.80	-3.94	5.72	2.62	1.63	1.74	1.77	1.77	1.74	1.73
Emerging Markets and Developing Economies	4.66	3.61	-1.77	7.02	4.06	4.32	4.16	4.21	4.06	4.03	3.94
India	6.50	3.90	-5.80	9.70	7.00	8.20	6.80	6.50	6.50	6.50	6.40

Note: A: Actual, E: Estimate, F: Forecast

Please note that India's data has been converted to calendar year (January-December) from fiscal year (April-March) by means of excluding the fourth quarter (4Q) across the above given chart.

Source: International Monetary Fund (IMF) World Economic Outlook - April 2024, Frost & Sullivan

Despite elevated interest rates, US economic growth remained resilient throughout CY2023, mainly driven by strong consumer spending. Meanwhile, elevated interest rates, high food and fuel prices, raw material shortages, consistent manufacturing weakness, and weak exports significantly lowered growth momentum of major European Union (EU) economies such as Germany, France, Italy, and Spain in CY2023. Further, the United Kingdom's (UK) GDP growth rate recorded a decline in CY2023, amid a persistent cost-of-living crisis, low industrial productivity, and structural fragility in the labor market.

On the brighter side, emerging and developing Asian economies such as India, Vietnam, Indonesia, and the Philippines were some of the bright spots in the CY2023 global economic landscape, as high domestic consumption, fiscal and monetary policy stability, steady investment inflows, robust labor markets, and diversified industrial economies of scale provided an impetus. China, meanwhile, witnessed constrained economic activity in CY2023, as property market concerns, sluggish domestic demand, elevated local government debt levels, and deflation weighed. Developing Middle Eastern economies such as Saudi Arabia and the United Arab Emirates (UAE) also posted modest economic growth during the year, as economic diversification picked up steam. However, energy market volatility – exacerbated by oil production cuts amidst falling oil prices – caused some pullback to growth.

Global economic growth is expected to remain stable in CY2024, with advanced economies forecasted to grow by 1.74% and emerging markets and developing economies forecasted to grow by 4.16%. While this growth momentum is considerably higher than the pandemic slowdown across regions, tight monetary conditions, constricting trade possibilities, geopolitical upheaval, elevated inflationary pressures, and adverse climate events continue to impact global economic growth.

The global economy might also face additional headwinds such as a lower-than-expected Chinese growth rebound, as the country continues to witness a property market crisis, rising public debt levels, and sluggish consumer demand. Another near-term risk to the global economy is an escalation in the Middle East conflict – which could lead to spillovers such as high energy prices and disrupted critical trade routes and supply chains.

However, momentum is expected to pick up gradual pace over the medium to long-term as receding price pressures and monetary policy loosening will support an uptick in consumer spending. Moreover, the normalization of trade conditions and input costs is expected to improve investment sentiment over the coming years. Over 2025-2028, the world economy is expected to grow at an average of 3.15%, with momentum tilted towards developing countries.

Medium- and Long-term Growth: Despite a Dimmer-than-expected Start to CY2024, Gradually Easing Price Pressures and Policy Rate Cuts Will Support Momentum. The global economy is expected to grow by 3.18% in CY2024 owing to substantial growth in emerging markets and developing economies. Weakness continues to prevail in advanced economies such as the UK, Japan, and the Eurozone. While easing price pressures and a normalization of monetary policy during the second half of CY2024 will provide some respite, mounting geopolitical tensions and sluggish trade flows are causing short-term setbacks.

Over the long-term, a rapidly aging population, falling birth rates, worker shortages, and extreme climate conditions will be major drags on global economic growth. However, structural reforms, fiscal and monetary policy prudence, and growing adoption of digital and green energy initiatives will Support global economic growth.

1.2 Macroeconomic Overview of India

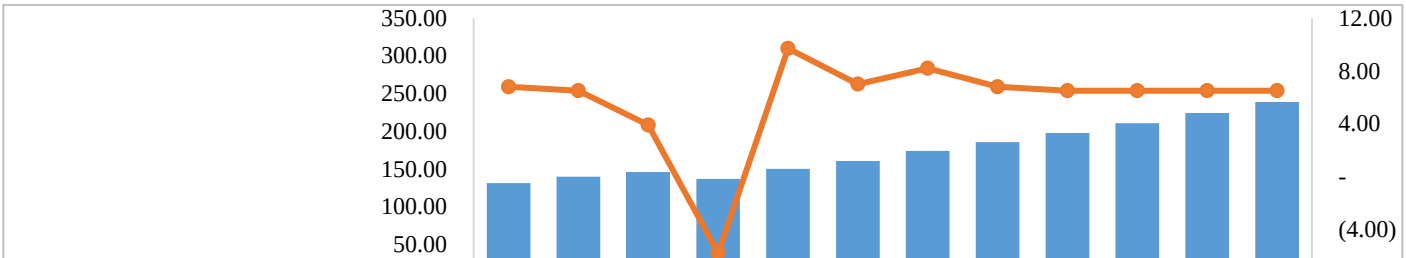
1.2.1 GDP Growth and Outlook

Following the COVID-19-induced 5.80% GDP contraction in FY2021, the Indian economy posted a robust rebound of 9.70% in FY2022. The Indian government, - as part of its proactive fiscal and monetary policies - introduced several stimulus measures such as loan moratoriums, credit guarantees, and direct cash transfers to support businesses and households during the year. These measures helped sustain domestic consumption and mitigate the economic impact of the pandemic in FY2022. Recovery within manufacturing and the services industry – particularly within segments such as information technology, healthcare, and e-commerce – provided further impetus.

GDP growth fell to 7.00% in FY2023, mainly due to the Russo-Ukrainian war and the resultant supply disruptions, which led to sharp increases in food and fuel prices. To curtail these high price pressures, the Reserve Bank of India (RBI) adopted a restrictive monetary policy – raising the repo rate to 6.25% by the end of FY2022. The repo rate was further increased to 6.50% by the end of FY2023, as price pressures remained elevated and consumer spending and business confidence were subdued. While elevated borrowing costs, challenging external conditions, and slower income growth weighed on momentum in H1 FY2024, a modest easing in global commodity prices supported economic activity in H2 FY2024. GDP growth stood at 8.20% in FY2024, underpinned by the government's strong capex push across sectors such as infrastructure, construction, renewables, transport, and mobility.

The Indian economy is projected to grow at an average of 6.50% between FY2025 and FY2029, with a focus on developing digital infrastructure, increasing export potential, fostering inclusive socio-economic growth, expanding manufacturing capacity utilization, and boosting income growth and domestic demand. Moreover, the country's growing emphasis on building green energy generation capabilities, strengthening its start-up ecosystem, encouraging value-addition in small and medium-sized enterprises, and bolstering digital technology uptake will sustain long-term economic growth.

Exhibit 1.2.1-1: GDP at Constant Prices (INR Trillion) and Real GDP Growth Rate (%), India, FY2018 to FY2029F



	FY18A	FY19A	FY20A	FY21A	FY22A	FY23A	FY24A	FY25E	FY26F	FY27F	FY28F	FY29F
GDP at constant prices (INR Trillions)	131.45	139.93	145.35	136.95	150.22	160.71	173.89	185.72	197.79	210.65	224.34	238.92
Real GDP, % change	6.80	6.50	3.90	(5.80)	9.70	7.00	8.20	6.80	6.50	6.50	6.50	6.50

Note: A: Actual, E: Estimate, F: Forecast, India's data is represented in fiscal years. For e.g. FY18 data refers to April 2017 to March 2018, Base year: FY2011-12; Source: IMF World Economic Outlook - April 2024, Frost & Sullivan

India's Strong Growth Path: Conducive Policy Support & Strong Fundamentals will Drive Long-term Investment Attractiveness

In the past decade, the Indian government has extensively focused on boosting domestic manufacturing capabilities. Initiatives like Make in India, Aatmnirbhar Bharat, and Production Linked Incentive (PLI) schemes are playing an active role in establishing India as a manufacturing powerhouse, especially with the rising focus on China+1 strategies post-pandemic.

Continued policy support has yielded positive results. For instance, since inception until November 2023, the PLI schemes attracted INR 1.03 lakh crore in investments and generated 6.87 lakh direct and indirect jobs.

Mobile Manufacturing and Specified Electronics Components is one of the 14 sectors covered by the PLI. According to the data released by the India Cellular and Electronics Association, mobile phone production grew by a mammoth 2000% between FY2014-15 to FY2023-24, rising from INR 18,900.00 crore to INR 4.10 lakh crore, with estimated mobile phone exports in FY2023-24 reaching INR 1.20 lakh crore.

The government has also set a vision for the chemicals and petrochemicals sector. By FY2034, the aim is to bolster domestic production capabilities, reduce import dependence, and attract foreign investments. The government plans to introduce PLIs with 10-20% output incentives for the agrochemical sector and foster end-to-end manufacturing ecosystems through cluster development.

To conclude, with real GDP growth forecast to remain above ~ 6.00% in the long-term, India will remain a global growth frontrunner and enter the league of the top 3 largest economies by FY2030.

1.3 Overview of Policies for Oil & Gas

1.3.1 India

The Hydrocarbon Exploration and Licensing Policy (HELP): The Hydrocarbon Exploration and Licensing Policy (HELP) was introduced by the Government of India in FY2016 as a significant reform in the oil and gas sector. This policy aims to enhance domestic production of hydrocarbons by providing a more investor-friendly regime for exploration and production. Following are the key features of HELP policy - single license for all hydrocarbons, revenue sharing model, pricing & marketing freedom, low royalty rates, further concession in royalty rates for early production, exploration rights on all retained areas for full contract life, flexibility for multiple FDP revisions, simplified dispute resolution mechanism, management committee role revised to reduced no. of approvals, etc.

Impact of HELP policy: The HELP policy has positively impacted the Indian oil & gas ecosystem.

- Increased bidding activity and participation from a diverse set of companies
- In contrast to the former NELP law, which had an intricate process and excessive government control, HELP offers a straightforward revenue sharing mechanism
- Attracted new entrants, including global oil and gas majors, to the Indian hydrocarbon sector
- The number of exploration blocks offered and awarded under HELP has increased, leading to higher exploration activities
- Companies are investing in advanced technologies for better exploration and extraction efficiency
- Boost in exploration and production activities has led to more job creation and local economic development.

Investment Plan for Indian Gas Sector

The Indian gas sector is a crucial component of the country's energy strategy, aiming to ensure energy security, economic growth, and environmental sustainability. Recently government announced investment plan of USD 67.00 billion in the natural gas supply chain over next 5-6 years. The objective is to increase share of natural gas in India's energy basket from 6.30% to 15.00% by FY2030. With broader aim to become self-sufficient by FY2047, the Government of India has implemented various policies to encourage investment in this sector. Policies like open acreage licensing policy, discovered small fields policy, national gas grid expansion (One Nation, One Gas Grid initiative), city gas distribution policy, sustainable initiatives, and clean energy policies, etc. are driving the growth of the oil & gas sector.

1.3.2 Other Key Countries

US:

The US provides various tax incentives in the oil and gas industry, including intangible drilling costs deduction and the percentage depletion allowance, which allow companies to reduce their taxable income. The intangible drilling costs typically represent 70.00% to 85.00% of a well's total cost and can be deducted 100.00% against taxable income in the first year of investment. Percentage depletion allowance is designed to encourage investors to engage in investments such as oil and gas production by applying the cost depletion deduction.

US maintains a strategic petroleum reserve to manage oil supply disruptions and stabilize markets. There is financial support from department of energy in US to fund research of hydraulic fracturing and enhanced oil recovery. The federal government frequently auctions oil and gas leases on public lands and waters, encouraging exploration and production. Recent policies have aimed to streamline the permitting process as well.

Europe:

Norway has a stable regulatory environment with incentives for exploration and development, including a favorable tax regime for oil and gas activities. In CY2020, the government introduced temporary tax incentives to encourage petroleum investment in the country. Companies can deduct all exploration costs in the year they are incurred. To maximize the extraction of gas from small fields, the Netherlands provides tax allowances and other incentives for developing small fields. The Dutch government, through EBN (Energie Beheer Nederland), participates in exploration and production projects, sharing both costs and profits, which reduces the financial burden on private companies.

China:

China's Five-Year Plans outline strategic priorities for the energy sector, including the development of domestic oil and gas resources to enhance energy security. China provides subsidies for unconventional gas exploration, such as shale gas and coalbed methane, as well as tax incentives for companies investing in upstream activities. The government supports NOCs like CNPC, Sinopec, and CNOOC through preferential policies and financing to boost domestic production and overseas investments.

MEA:

The Basic Law of Saudi Arabia (Royal Decree No. A/90 dated 27/8/1412 H (1 March 1992)) entrusts all oil and gas resources of the Kingdom to the government. The Ministry of Energy, Industry, and Mineral Resources is responsible for formulating and executing oil and gas policies with Vision 2030 aimed at diversifying away from oil dependence.
In Iran, the Petroleum Act of 1987, amended in CY2011, governs the ownership of petroleum resources and defines the authority and responsibilities granted to the Ministry of Oil. Iran's oil sector is heavily state controlled, with sanctions impacting foreign investment, but the country seeks self-reliance in energy through policies like the economy of resistance.

In UAE, Article 23 of the UAE constitution states that natural resources and wealth within each emirate are considered public property of that specific emirate. The primary law regulating oil and gas operations in the emirate is Abu Dhabi Law No. 8 of 1978 on the Conservation of Petroleum Resources. The UAE seeks to balance state control (via ADNOC) with strategic partnerships and foreign investments, emphasizing technological advancement and sustainable energy transition.

LATAM:

In Brazil, Federal Law No. 9,478/1997 (the Petroleum Law), enacted on August 6, 1997, created a new regulatory framework for oil and gas activities and established key regulatory bodies, including the Brazilian National Oil, Natural Gas and Biofuels Agency (ANP) and the National Energy Policy Council (CNPE). Brazil's oil and gas sector is managed by the National Agency of Petroleum, ANP, with a focus on liberalizing the industry and encouraging foreign investment through competitive bidding.

Mexico's oil and gas sector underwent significant reform to open up the market to private investment and competition, moving away from the state monopoly held by Pemex through CY2013. By the end of CY2018, the Secretariat of Energy (Secretaría de Energía or SENER) finalized its review of the investment plans for the 107 contracts granted to private companies. The Comisión Nacional de Hidrocarburos (CNH) is tasked with regulating, supervising, and evaluating all exploration and production activities related to hydrocarbons in the country.

Southeast Asia:

Indonesia's oil and gas sector is regulated under Oil and Gas Law No. 22/2001, which centralizes control in the government and mandates that all hydrocarbon resources are state-owned, with operations managed by the Special Task Force for Upstream Oil and Gas Business Activities.

The Petroleum Development Act 1974 (PDA 1974) serves as the principal legislation governing Malaysia's oil and gas sector. PETRONAS, established under the Petroleum Development Act 1974, is responsible for managing Malaysia's petroleum resources. As a key authority, PETRONAS also advises the government on oil and gas issues, regulations, and incentives to foster a favourable environment for upstream investment.

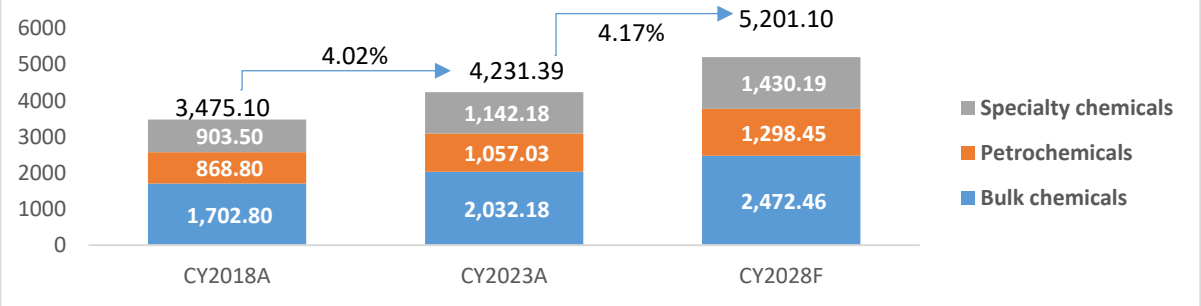
Thailand's oil and gas industry is regulated under Petroleum Act B.E. 2514 (1971), which grants the Ministry of Energy authority over exploration, production, and establishes a framework for concession agreements with private companies.

2 Overview of Specialty Chemicals Market

2.1 Global Chemical Industry Overview

The global chemicals market was valued around USD 4,231.39 Bn in CY2023. India accounted for ~3.00% market share in the global chemicals market in CY2023. Bulk chemicals accounted for 48.03% market share; specialty chemicals accounted for 26.99% market share while petrochemicals accounted for 24.98% market share in CY2023. The global chemicals market is expected to grow at 4.17% CAGR, to reach USD 5,201.10 Bn by CY2028.

Exhibit 2.1-1: Global Chemicals Market by Value in USD Bn (CY2018, CY2023, CY2028)



Note: A: Actual, F: Forecast, Source: Frost & Sullivan

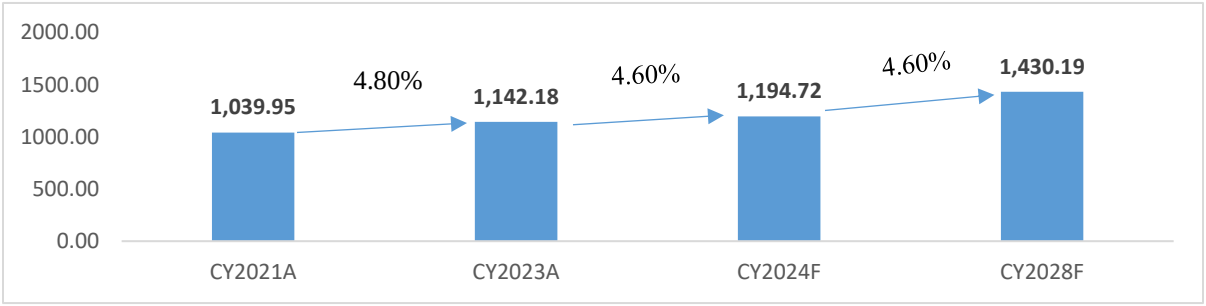
Exhibit 2.1-2: Growth Rate CAGR during CY2018-23 and CY2023-28 in %

	Bulk Chemicals	Petrochemicals	Specialty Chemicals
CY2018-23	3.60%	4.00%	4.80%
CY2023-28F	4.00%	4.20%	4.60%

2.2 Global Specialty Chemicals Market

Specialty chemicals are low-volume and high-value products which are sold based on their quality or utility. The market for global specialty chemicals has increased from USD 1,039.95 billion in CY2021 to USD 1,142.18 billion in CY2023. It is estimated to increase to USD 1,430.19 in CY2028 owing to increase in demand from end use industries such as automotive, construction, electronics, pharmaceuticals and food and beverages. Economic growth and urbanization, stringent environmental regulations, increased investments in research and development by major players will impact demand. Shifting consumer demand, driven by climate change awareness and decarbonization commitments, is significantly increasing the demand for specialty chemicals. Many specialty chemical manufacturers are backward integrated. In coming years, it is expected that vertical integration in the value chain will increase the market consolidation. The market will become more competitive, leading to further consolidation of the organized market.

Exhibit 2.2-1: Global Specialty Chemicals Market by Value in USD Bn (CY2021, CY2023, CY2024, CY2028)



Note: A: Actual, F: Forecast, Source: Frost & Sullivan

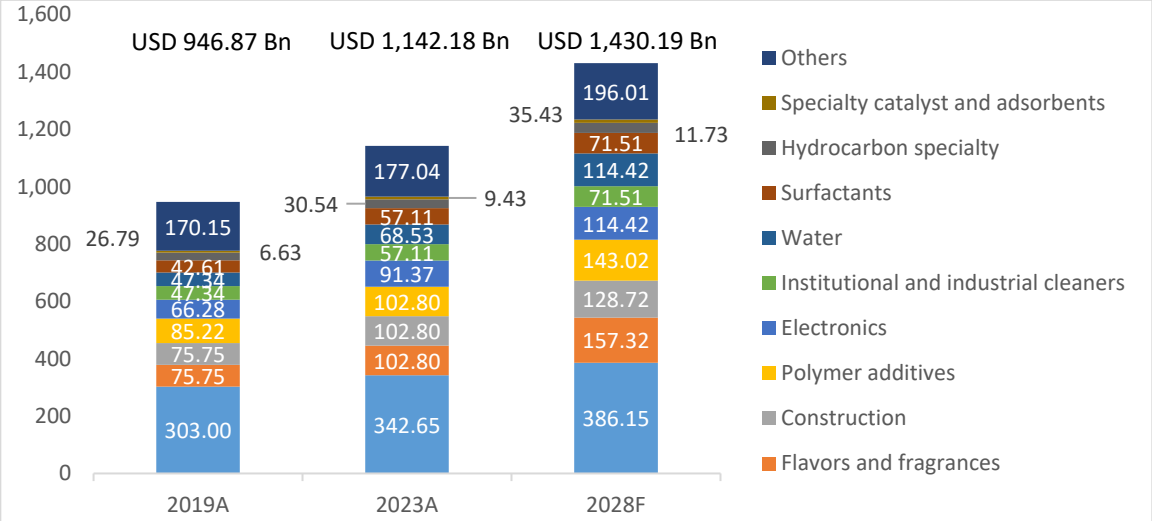
2.3 Category Wise Segmentation of Global Specialty Chemicals Market (CY23 and CY28)

Specialty chemicals market is segmented based on application categories, including dyes and pigments, construction chemicals, electronics chemicals, food additives, surfactants, polymer additives, water treatment chemicals, specialty chemicals for hydrocarbons, fuel additives, specialty catalysts and adsorbents, among others. Dyes and pigments accounted for 30.00% share of

global specialty chemicals in CY2023. It is essential component in various industries, including textiles, paints and coatings, plastics, printing inks, and cosmetics. Construction chemicals accounted for 9.00% market share while electronics chemicals accounted for 8.00% market share in CY2023. Rapid urbanization and infrastructure projects in emerging economies are driving the demand for construction chemicals. The trend towards smaller and more powerful electronic devices is driving the demand for high-purity electronic chemicals.

In the next 5 years, the market share of flavors and fragrances is estimated to grow from 9.00% in CY2023 to 11.00% in CY2028. Rising consumer preference for natural and organic products is driving the demand for natural flavors and fragrances. The market share of water treatment chemicals is estimated to grow from 6.00% in CY2023 to 8.00% in CY2028. The trend towards lightweight materials in automotive and aerospace sectors is boosting the demand for polymer additives that enhance polymer performance. Increasing industrial activities and urbanization are driving demand for water treatment chemicals. Specialty chemicals for hydrocarbons accounted for 2.67% in global specialty chemicals market in CY2023. Specialty catalyst and adsorbent accounted for 0.83% of the global specialty chemicals market in CY2023.

Exhibit 2.3-1: Category Wise Segmentation of Global Specialty Chemicals Market by Value in USD Bn (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast; Source: F&S

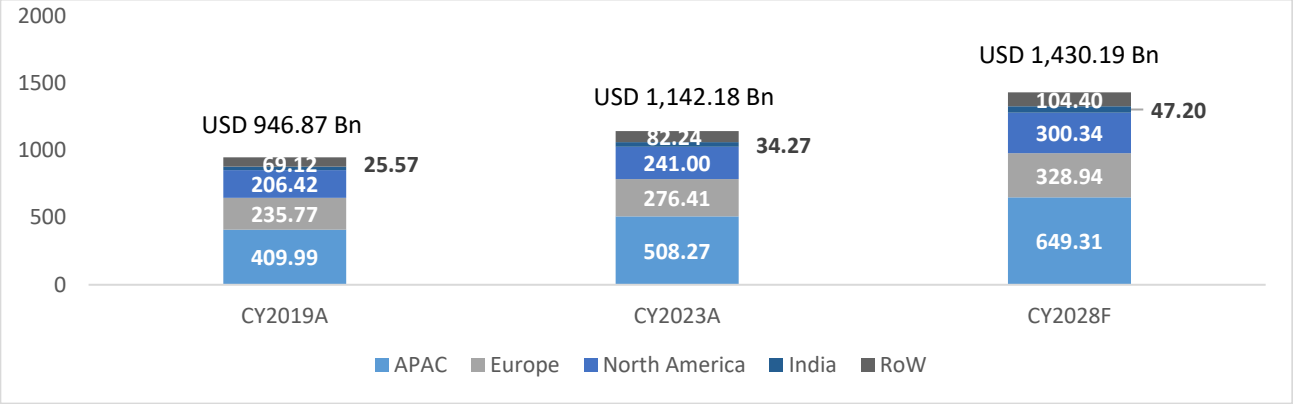
2.4 Regional Segmentation of Global Specialty Chemicals Market (CY19, CY23 and CY28)

The Asia Pacific (APAC) dominates the market across the world, with a share of 44.50%, owing to the huge customer base, leading to high demand for specialty chemicals, increasing industrial production, and robust growth of the construction sector in the region. APAC is followed by Europe and North America. With a high population base and majority of countries being underdeveloped or developing nations in Asia Pacific (APAC), there is high rate of construction activities resulting in higher demand for construction chemicals and paints & coatings additives.

Europe is a significant market for specialty chemicals, characterized by high demand from automotive, construction, and consumer goods industries. It has steady growth driven by innovation and regulatory compliance. Europe has strong emphasis on sustainability and green chemistry. There are strict regulations that are influencing the market dynamics. In CY2023, Europe accounted for 24.20% of global specialty chemicals demand.

The North American specialty chemicals market have moderate growth rate, with increasing focus on sustainable and high-performance chemicals. There is strong industrial base in sectors such as automotive, aerospace, construction, etc. which is driving the demand of specialty chemicals. High investment in research and development is leading to innovation in specialty chemicals. There are stringent environmental regulations which are driving demand for eco-friendly and sustainable chemicals. In CY2023, North America accounted for 21.10% of global specialty chemicals demand.

Exhibit 2.4-1: Global Specialty Chemicals Market by Value by Geography in USD Bn (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast, Source: Frost & Sullivan

Geography	CAGR 2019-23 in %	CAGR 2023-28 in %
APAC	5.52%	5.02%
Europe	4.06%	3.54%
North America	3.95%	4.50%
India	7.60%	6.61%
Rest of the world	4.44%	4.89%

Source: Frost & Sullivan

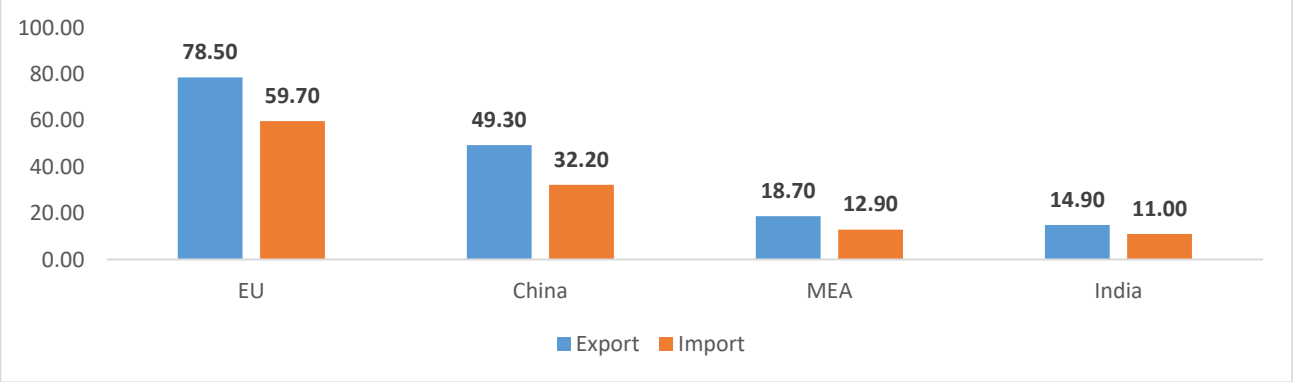
Trade analysis:

Europe is largest exporter of specialty chemicals in CY2023 with export value of USD 78.50 billlion. It also imported USD 59.70 billion worth of specialty chemicals in CY2023, with key suppliers being the China, and India.

China exported around USD 49.30 billion worth of specialty chemicals in CY2023, primarily to Asia, the US, and Europe. Major exports included specialty polymers, agrochemicals, and construction chemicals. Competitive pricing, large-scale production, and expansion of international partnerships enhanced China's exports last year. However, environmental regulations and quality control issues pose challenges for the growth of China's specialty chemical industry.

India exported around USD 14.90 billion worth of specialty chemicals in 2023, predominantly to Asia, the US, and Europe. Competitive manufacturing costs, strong R&D, and government support for the chemical sector bolstered India's export growth. India has emerged as a significant player in the global specialty chemicals market, leveraging its cost-effective manufacturing capabilities, skilled workforce, and robust research and development infrastructure. The China +1 strategy, adopted by many multinational companies, aims to reduce dependence on China by diversifying their supply chains to other countries, including India for specialty chemicals. This strategy has had a profound impact on India's specialty chemicals industry over the last 2-3 years. As companies continue to diversify their supply chains, India's specialty chemicals industry is poised for further growth and increased global influence.

Exhibit 2.4-2: Import Export Analysis of Specialty Chemicals by Key Countries in CY2023, (USD Bn)



Source: Frost & Sullivan

2.5 Growth Drivers for Global Specialty Chemicals Industry

Economic growth and urbanization, shift towards sustainable and green chemicals, technological advancements and innovation, R&D investments and strategic collaborations, etc. are key important drivers of for growth of global specialty chemical industry. The global specialty chemicals industry is characterized by the production of high-value, performance-enhancing chemicals tailored for specific applications and entering this industry poses significant challenges due to various barriers.

2.6 Major Challenges in Global Specialty Chemicals Industry

The global specialty chemicals industry, despite its significant growth and innovation, faces several challenges that can impact its overall performance and sustainability. These challenges arise from various factors, including regulatory pressures, environmental concerns, market dynamics, and technological advancements. Raw material price volatility, Regulatory compliance, Shift towards bio-based chemicals and carbon footprint reduction, Economic and geopolitical factors, etc. are key challenges for growth of global specialty chemicals industry.

2.6.1 Barriers to Entry in Key Product Segments

The specialty chemicals industry presents significant entry barriers, including customer validation and approvals, expectations from customers for process innovation and cost reductions, high quality standards, stringent specifications, availability of raw material, price fluctuations and regulatory compliance. Entering this market poses significant challenges due to various barriers. Following are the key global inhibitors for focused product segments:

- Specialty chemicals for hydrocarbons:
    - Fluctuations in oil prices impacting the profitability of exploration and production activities
    - Environmental risks leading to increased scrutiny and regulatory restrictions
    - Growing emphasis on renewable energy sources and the transition to a low-carbon economy
    - Geopolitical instability
- Industry chemicals:
    - Organometallic titanates catalysts:
        - Significant pressure to continually optimize production processes and reduce the operating costs
        - Regulatory compliance
        - Technological complexity
        - Supply chain risks
    - Optical brighteners:
        - Environmental and regulatory issues
        - Raw material availability and price volatility
        - Technical challenges for development
        - Adoption of sustainable practices
    - 3,5 Xylenols:
        - Regulatory hurdles in export markets
        - Technological and production challenges
        - Market competition and price fluctuations

2.7 Key Regulations Impacting Global Specialty Chemicals Industry

- The regulations are designed to ensure the safety of workers, consumers, and the environment. Compliance with the regulations is critical for companies operating in the global specialty chemicals market. REACH (Registration, evaluation, authorization, and restriction of chemicals) and restriction of hazardous substances directive in Europe, toxic substances control act, occupational safety and health administration (OSHA) regulations, environmental protection regulations, globally harmonized system of classification and labelling of chemicals are few examples of important regulatory frameworks.

- REACH in Europe aims to protect human health and the environment from the risks posed by chemicals. It requires companies to register and provide detailed information about the chemicals they produce or import into the EU. Non-compliance of REACH can result in restricted market access in the EU. It encourages the development of safer and more sustainable chemicals. Another regulatory framework, Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS), restricts the use of certain hazardous substances in electrical and electronic equipment to protect human health and the environment.

- The toxic substance Control Act in US provides the environmental protection agency the authority to impose restrictions on chemical substances, as well as requirements for testing, record-keeping, and reporting. It aims to ensure that chemicals do not pose an unreasonable risk to health or the environment. Another US regulator FDA regulates chemicals used in food, drugs, cosmetics, and medical devices to ensure they are safe for use.

- Globally Harmonized System is a global system for standardizing and harmonizing the classification and labeling of chemicals. It aims to ensure that information on chemical hazards is consistently communicated around the world. Apart from these various national and international regulations aim to protect the environment from the harmful effects of chemical production, use, and disposal.

2.8 Major Trends in Global Chemical and Specialty Chemicals Industry

The global chemical and specialty chemicals industry is dynamic and rapidly evolving, influenced by technological advancements, regulatory changes, market demands, and sustainability goals. Following are the key global trends for focused product segments:

- Specialty chemicals for hydrocarbons:
    - Increased demand for performance enhancing chemicals and green & safer chemistries.
    - High focus on higher & efficient output
    - Focus on technical consulting and customer service with regular performance tracking of the chemicals, and an instant response to any technical or non-technical queries.
    - High focus on reduced carbon footprint and environmental safety
- Industry chemicals:
    - Organometallic titanates catalysts:
        - Growing focus towards green and sustainable catalysts
        - Adoption of advanced technologies utilizing nano catalysts, enzyme catalysts, and hybrid catalysts
        - Development and use of bio-based catalysts
        - Customization of catalysts for specific applications
    - Optical brighteners:
        - Increasing demand in textiles and apparel
        - Growth in detergent and cleaning products
        - Technological advancements and R&D
        - Advancements in plastic and polymer applications
    - 3,5 Xylenols:
        - Increasing demand in pharmaceuticals, agrochemicals, and polymer additive applications
        - Technological advancements and innovation
        - Global and domestic manufacturing capabilities

2.9 India’s Opportunity in Specialty Chemicals

India’s chemical industry is one of the most diversified globally, and the specialty chemicals segment represents a significant growth area. With the global shift towards sustainability, technological advancements, and changing market dynamics, India is uniquely positioned to capitalize on these opportunities. Following are the key opportunity drivers for India:

- Growing domestic demand: The rise in domestic demand for specialty chemicals is driven by the growth of end-user industries such as pharmaceuticals, personal care, and textiles. Increased healthcare spending and the expansion of the pharmaceutical industry boost demand for specialty chemicals used in drug formulation and manufacturing. The pharmaceutical industry is expected to increase from USD 59.20 billion in FY2024 to USD 130.00 billion in FY2030 with CAGR of 14.01%. The textile industry is forecasted to growth with CAGR of 10.00% to reach USD 350.00 billion in FY2030 from USD 197.60 billion in FY2024.

- Export potential: India has a significant opportunity to increase its share in the global specialty chemicals market through exports. India's cost advantage due to lower labor and production costs makes it an attractive supplier of specialty chemicals.

- Government initiatives and support: Supportive government policies and initiatives are crucial in fostering the growth of the specialty chemicals sector. The production linked incentive scheme incentivizes domestic manufacturing of specialty chemicals, boosting production capacity and competitiveness. The outlay of PLI scheme is around 1.97 Lakh Crore for 14 key sectors. Till Nov 2023, over Rs. 1.03 lakh crore of investment was completed through PLI scheme.

- Technological advancements: Adoption of advanced technologies such as digitalization, automation, and green chemistry is transforming the specialty chemicals industry in India. The technology integration improves production efficiency, reduces waste, and lowers costs. Investment in R&D and technological advancements can lead to the development of innovative and high-performance specialty chemicals. Green chemistry and eco-friendly processes align with global sustainability goals, attracting environmentally conscious customers.

Comparison of India with others

- Low operating costs: India's operating costs are significantly lower compared to developed countries, providing a competitive advantage in manufacturing. The labor costs in India are much lower than in Western countries, reducing overall production expenses. The labor cost in India was around USD 1.00 / hour while it was USD 5.00 / hour in China in CY2023. With a large and young workforce, India offers high productivity at lower wages. Availability of locally sourced raw materials minimizes transportation costs and import dependencies. India's extensive agricultural sector provides a steady supply of feedstock for bio-based specialty chemicals.

- Skilled labor: India produces a significant number of engineering graduates annually, many of whom specialize in chemical engineering. Skilled researchers and scientists contribute to innovative product development and process improvements. A skilled workforce drives innovation and enhances the quality of specialty chemicals. Technical expertise ensures efficient and high-quality production processes.

- Utilities and infrastructure: India has been making significant strides in improving its utilities and infrastructure, which are critical for the specialty chemicals industry. Improvements in the energy sector ensure a stable and reliable power supply to industrial units. Increasing investment in renewable energy sources supports sustainable manufacturing practices. A well-developed logistics network, including ports, railways, and roadways, facilitates efficient transportation of raw materials and finished goods. Modern warehousing infrastructure supports storage and distribution needs. The power cost in India was around USD 0.11 / kWh while it was USD 0.24 / kWh for Germany, USD 0.19 / kWh for Japan, USD 0.14 / kWh for France, and USD 0.10 / kWh for China in CY2023.

- Capital costs: India offers several financial incentives and a favorable investment climate that reduce capital costs for setting up and expanding specialty chemical operations. Various subsidies and grants are available for setting up manufacturing units, especially in designated industrial zones. Tax incentives and exemptions for certain categories of investments lower the overall capital expenditure. Also, liberalized FDI policies attract foreign investments, providing access to international capital. A robust banking and financial sector support easy access to credit and funding.

- Intellectual property rights: India has strengthened its IPR regime to provide better protection and enforcement, encouraging innovation and investment in the specialty chemicals sector. Robust patent laws (e.g. Patents (Amendment) Rules, 2021) protect innovations and proprietary technologies, ensuring that companies can safeguard their intellectual property. Effective enforcement mechanisms deter infringement and provide legal recourse for violations. India's compliance with the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement aligns its IPR standards with global norms. Increased awareness and support for IPR among businesses and researchers foster a culture of innovation.

2.10 Indian Specialty Chemicals Market Structure

The Indian specialty chemicals market is a rapidly growing sector, driven by increasing demand from various industries. However, a significant portion of this market is unorganized (20.00%). This unorganized segment comprises numerous small and medium-sized enterprises (SMEs) that operate without formal regulatory oversight. There is variability in product quality due to lack of standardized processes and quality control measures. The unorganized sector often engages in aggressive price competition, leveraging lower

production costs to attract customers. The Indian specialty chemicals industry was valued at USD 34.27 billion in CY2023. Organized sector accounted for 80.00% market share while unorganized sector accounted for 20.00% in CY2023. Unorganized players are present in sectors like flavors & fragrances and surfactants. However, there are not many unorganized competitors active in segments like oilfield chemicals, fuel additives, specialty catalysts & adsorbents, etc.

2.11 India's Growth Against China in Specialty Chemicals

The COVID-19 pandemic exposed vulnerabilities in global supply chains, particularly the heavy reliance on China for specialty chemicals. Lockdowns, factory shutdowns, and logistical challenges in China led to supply shortages and increased prices worldwide. Companies across the globe started adopting the "China+1" strategy to mitigate risks associated with over-dependence on China. India emerged as a favorable alternative due to its growing manufacturing capabilities, strategic location, and government support.

The Indian government introduced the PLI scheme to boost domestic manufacturing and attract investments in specialty chemicals. Incentives were provided for setting up new manufacturing units and expanding existing capacities. Reforms introduced to improve the ease of doing business, such as simplifying regulatory processes and enhancing infrastructure. There is focus on making India a global manufacturing hub, including the specialty chemicals sector. India possesses competitive advantages in manufacturing capabilities. It offers a skilled and cost-effective labor force, reducing overall production costs. There is ample availability of raw materials essential for specialty chemicals manufacturing. There have been improvements in operational efficiencies and adoption of advanced manufacturing technologies.

India have also focused on expanding infrastructure. There is development of industrial clusters and chemical parks to facilitate efficient manufacturing and supply chain management. Efforts are in place for Enhancing logistics infrastructure, including ports, highways, and rail networks, improving connectivity, and reducing transportation costs. This has allowed India to improve its export volumes in the last couple of years. The US-China Trade war led specialty chemical players to look beyond China as a raw material supplier and manufacturing hub. In order to reduce the risk in their supply chains, global companies are concentrating on a China+1 approach. Because of its cost advantage over China and its supportive laws and reforms, including the enabling of 100.00% foreign direct investment in the chemical industry, India is uniquely positioned to gain from the shift away from China. The labor cost in India was around USD 1.00 / hour while it was USD 5.00 / hour in China in CY2023. The power cost in India is competitive to the cost in China (The power cost in India was around USD 0.11 / kWh while it was USD 0.10 / kWh for China in CY2023). The market for specialty chemicals in India is estimated to grow at CAGR 6.61% through CY2028. This is significantly higher than global average of CAGR 4.60%.

2.12 Market Attractiveness for Key Product Segments

Oilfield Specialty Chemicals

Oilfield specialty chemicals are chemicals used in the oil and gas industry to facilitate the extraction, processing, and transportation of oil and gas. These chemicals play a vital role in improving the efficiency and productivity of oilfield operations. The market includes a variety of chemicals such as drilling fluids, stimulation chemicals, production chemicals, cementing chemicals, and enhanced oil recovery chemicals. The market for oilfield specialty chemicals was valued at USD 26.00 billion in CY2023 and is expected to grow at a CAGR of 2.90% to reach USD 30.00 billion by CY2028. Rising demand for energy and the need for new oil and gas reserves drive exploration activities, increasing the demand for oilfield specialty chemicals. Exploration of unconventional resources such as shale gas and oil sands present significant growth opportunities for specialty chemicals.

Paints and coatings

The paints and coatings industry utilizes specialty chemicals to enhance the properties of coatings, such as durability, aesthetics, and protection. Rapid urbanization and infrastructure development in emerging economies drive demand for architectural and industrial coatings. Increasing automobile production and the demand for high-performance automotive coatings boost the market. The demand for specialty chemicals in paints and coatings was around USD 34.30 billion in CY2023. It is estimated to reach USD 42.20 billion by CY2028

Specialty refinery process chemicals

Specialty chemicals play a critical role in refinery process chemicals due to their ability to enhance various aspects of the refining process. Specialty chemicals are used to optimize refinery processes, leading to better efficiency and higher yields of desired products. These chemicals help stabilize complex refining processes, ensuring consistent operation and minimizing disruptions. The demand of specialty refinery process chemicals is projected to grow from USD 1.70 billion in CY2023 to USD 2.00 billion in CY2028 with CAGR of 3.30%.

Fuel additives

Fuel additives are chemical compounds added to fuels to enhance their performance, efficiency, and quality. These additives play a crucial role in improving fuel properties such as combustion efficiency, engine performance, and emissions control. The global fuel

additives market includes various types of additives, such as deposit control additives, cetane improvers, lubricity improvers, antioxidants, corrosion inhibitors, and anti-icing agents.

The global market for fuel additives was valued at USD 2.40 Bn in CY2023, growing at a CAGR of 2.70% from CY2019. The market witnessed discrepancies like COVID 19 and the Russia-Ukraine war that impacted the fuel demand and further impacting the additives uptake. The market is expected to reach USD 2.81 Bn by CY2028, with a CAGR of 3.20%.

Pulp and paper

The pulp and paper industry utilizes specialty chemicals to improve product quality, enhance production efficiency, and meet environmental regulations. Key chemicals include bleaching agents, sizing agents, retention aids, and biocides. The demand for specialty chemicals is being driven by growth in packaging, hygiene products, and specialty papers. The global market for pulp and paper was valued at USD 359.10 billion in CY2023 and is estimated to be USD 370.00 billion by CY2027.

Modified acids

Modified acid emits fewer harmful fumes and reduces health risks. Modified acids are more biodegradable and have lower vapor pressure, minimizing environmental hazards. These acids can be diluted more effectively, have higher thermal stability, and offer better corrosion protection, making them more efficient for industrial applications such as oilfield stimulation and scale treatment. The global market of hydrochloric acid is forecasted to increase from USD 2.21 billion in CY2023 to USD 2.96 billion in CY2028 with CAGR of 6.00%. The global addressable market of modified hydrochloric acid is forecasted to increase from USD 0.44 billion in CY2023 to USD 0.62 billion in CY2028 with CAGR of 7.00%.

Other Specialty Chemicals (Organometallic titanates and zirconates, Optical brighteners, 3,5 Xylenols)

Organometallic titanates and zirconates can be used as catalysts in diverse segments of the plastics industry. The demand is projected to increase from USD 0.08 billion in CY2023 to USD 0.10 billion in CY2028.

Optical brighteners are used to enhance the brightness and appearance of fabrics by absorbing ultraviolet light and re-emitting it as visible blue light, counteracting yellowing and giving a whiter and brighter appearance. Optical brighteners are added to paper products to improve their whiteness and brightness. In detergents and cleaning products, these are included in detergents to make clothes appear cleaner and brighter by masking yellowing and dullness. The market for optical brighteners is estimated to grow from USD 0.07 billion in CY2023 to USD 0.09 billion in CY2028 in India.

3,5-Xylenol serves as a key intermediate in the synthesis of antioxidants, pharmaceuticals, and agrochemicals. There is a steady demand for 3,5-Xylenol in India driven by its use in industry disinfectants like Para Chloro Meta Xylenol, herbicides, drugs like metaxalone, acetretin & etretinate, etc. The market for 3, 5 xylenols is estimated to increase from USD 0.008 billion in CY2023 to USD 0.01 billion in CY2028 in India.

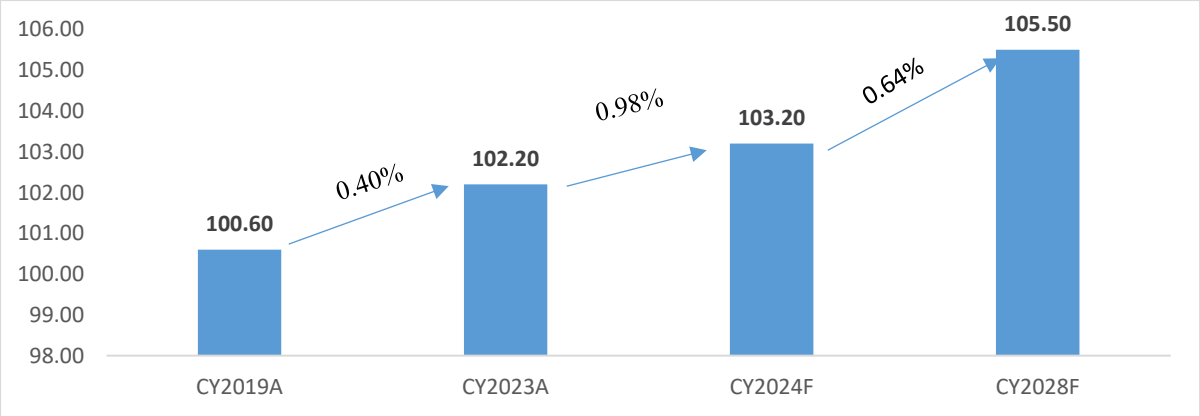
3 Global Oil and Gas Industry

Global Oil Industry Overview:

The global oil industry plays a crucial role in meeting the world's energy demand, powering economies, and supporting various sectors from transportation to manufacturing. The oil industry has experienced significant growth over the years, driven by global energy demand, technological advancements, and geopolitical factors. The global demand of oil has increased from 100.60 mb/d in CY2019 to 102.20 mb/d in CY2023. It is estimated that the global oil demand will increase to 105.50 mb/d by CY2028. At the end of CY2023, there were 1,337.00 operational onshore oil rigs and 240.00 offshore oil rigs. The number is estimated to decline with a CAGR of 1.00% through 2030 owing to pressure of sustainability. Middle East region is the biggest producer of oil globally. In CY2024, it is expected to invest USD 175.00 billion for energy related projects. Producers of hydrocarbon products will be well positioned to benefit from these investments.

The oil and gas industry are facing significant headwinds due to the rapid growth of electric vehicles (EVs) and renewable energy sources. Despite these challenges, certain areas within the oil and gas value chain are expected to continue growing, driven by evolving market dynamics, technological advancements, and shifting consumer preferences. The rise of EVs and renewables pose a direct threat to oil demand, particularly in the transportation sector. However, oil and gas sector has higher energy density compared to most renewable energy sources. This makes it highly efficient for applications requiring substantial energy output, such as heavy industries, aviation, and maritime transport. The existing global infrastructure for oil and gas extraction, transportation, and refining is extensive and well-developed. Replacing or significantly altering this infrastructure for a complete transition to renewables is a monumental task that will take decades. During this transition period, oil and gas will continue to play a critical role in meeting global energy needs.

Exhibit 3-1: Global Oil Market by Volume in Mb/d (CY2021, CY2023, CY2024, CY2028)

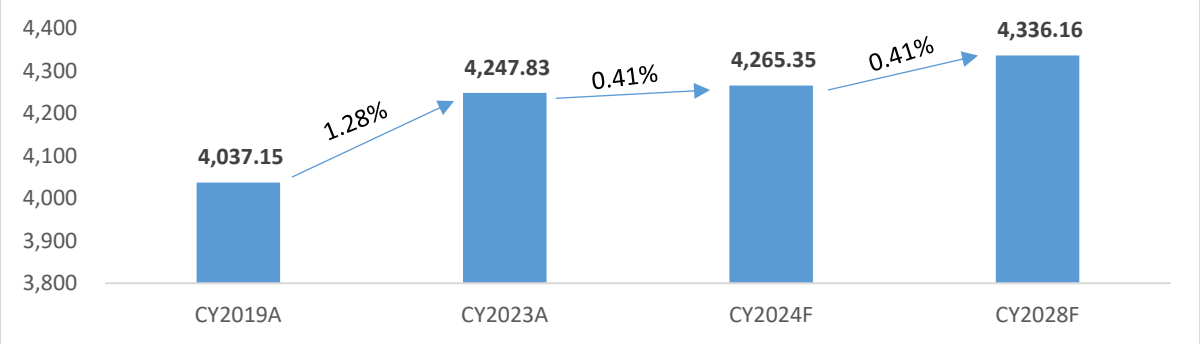


Note: A: Actual, F Forecast, Source: Frost & Sullivan

Global Gas Industry Overview:

The global demand of gas has increased from 4,037.15 BCME in CY2019 to 4,247.83 BCME in CY2023 with CAGR of 1.28%. It is estimated that the global gas demand will increase to 4,336.16 BCME by CY2028 from 4,265.35 BCME in CY2024 with CAGR of 0.41%. Rapid economic growth, particularly in developing countries, drives higher energy consumption across industrial, commercial, and residential sectors. There has been increased demand from industries such as chemicals, fertilizers, and manufacturing that use natural gas as a feedstock and energy source. However, potential for stricter regulations on methane emissions and hydraulic fracturing impacting natural gas production. Decreasing costs of renewable energy technologies such as wind and solar make them more attractive alternatives than natural gas.

Exhibit 3-2: Global Gas Market by Volume in BCME (CY2019, CY2023, CY2024, CY2028)



Note: A: Actual, F: Forecast, BCME: billion cubic meters equivalent, Source: Frost & Sullivan

3.1 Regional Segmentation of Global Oil and Gas Industry

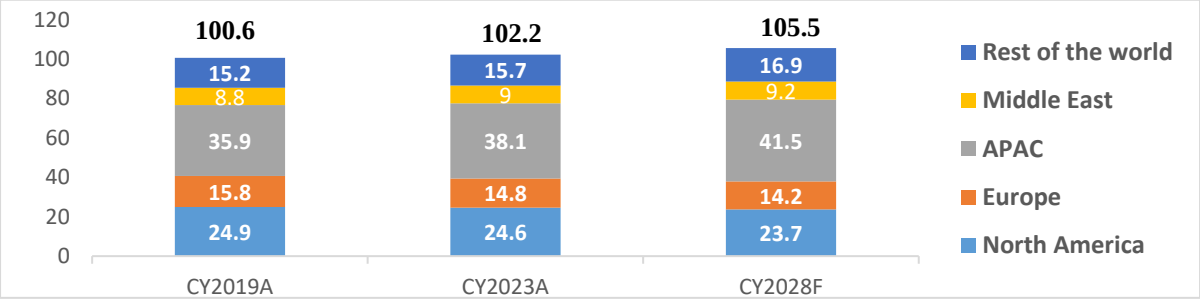
3.1.1 Regional Segmentation of Global oil industry

APAC is the leading demand center of oil globally. It accounted for 37.28% of global oil demand in CY2023. China is largest consumer of oil and natural gas in the region. It has significant demand for oil and gas products for transportation, industry, and power generation sectors. The demand for oil is estimated to increase from 38.10 mb/d in CY2023 to 41.50 mb/d in CY2028.

North America is 2nd biggest contributor to the demand of oil globally. It accounted for 24.07% of global oil demand in CY2023. It is estimated that the market in North America will decrease from 24.60 mb/d in CY2023 to 23.70 mb/d in CY2028.

Europe demand for oil products was 14.80 mb/d in CY2023. It accounted for 14.48% of the global oil market. It is estimated that the demand of oil will reduce from 14.80 mb/d in CY2023 to 14.20 mb/d in CY2028.

Exhibit 3.1.1-1: Regional Segmentation of Global Oil Market by Volume in Mb/d (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast, Mb/d: Million barrels per day, Source: Frost & Sullivan

3.1.2 Regional Segmentation of Global Gas Industry

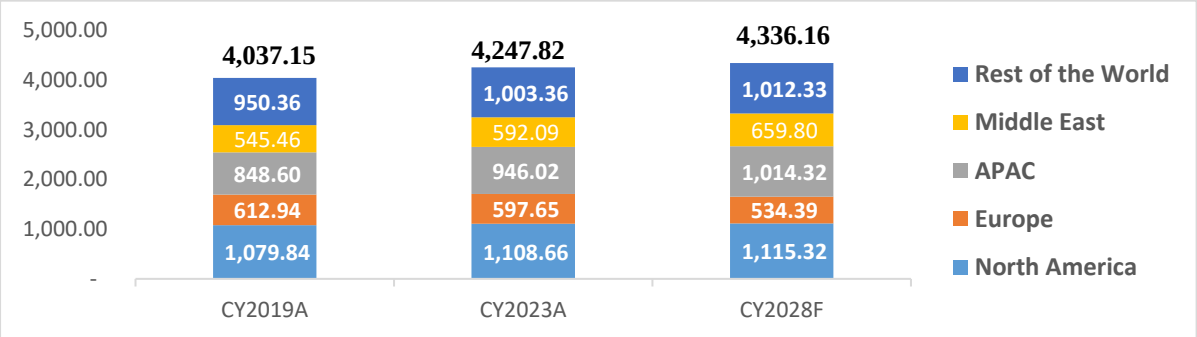
North American region accounted for 26.1% of global gas demand in CY2023. The demand for gas in this region has increased from 1,079.8 BCME in CY2019 to 1,108.7 BMCE in CY2023. Transition from coal to natural gas for electricity generation have driven the demand of natural gas in North America. It is estimated that the demand for gas in North America will increase to 1,115.3 BCME by CY2028.

APAC region accounted for 22.3% of global gas demand in CY2023. The demand for gas in this region has increased from 848.6 BCME in CY2019 to 946.0 BMCE in CY2023. It is estimated that the demand for gas in APAC region will increase to 1,014.3 BCME by CY2028.

Europe accounted for 14.1% of global gas demand in CY2023. The demand for gas in this region has decreased from 612.9 BCME in CY2019 to 597.6 BMCE in CY2023. The same trend is expected to follow through CY2028. The demand will be reduced to 534.4 BMCE in CY2028.

Middle East accounted for 13.9% of global gas demand in CY2023. The demand for gas in this region has increased from 545.5 BCME in CY2019 to 592.1 BMCE in CY2023. Investment in natural gas pipelines and LNG terminals supported domestic and export demand. It is estimated that the demand for gas in APAC will increase to 659.8 BCME by CY2028.

Exhibit 3.1.2-1: Regional Segmentation of Global Gas Market by Volume in BCME (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast, BCME: billion cubic meters equivalent, Source: Frost & Sullivan

3.2 Growth Drivers and Industry Trends of Global Oil and Gas Industry

- Increasing global energy demand: Urbanization and industrialization in countries like China and India are leading to higher consumption of oil and gas for transportation, manufacturing, and electricity generation.

- Technological advancements**:** Innovations in exploration and production technologies, such as hydraulic fracturing (fracking), horizontal drilling, and 3D seismic imaging, have significantly increased the efficiency and output of oil and gas extraction. These advancements have enabled the extraction of previously unreachable reserves by lowering production costs and boosting supply.

- Development of LNG infrastructure: The growth of liquefied natural gas (LNG) infrastructure is transforming the global gas market. It allows natural gas to be transported across regions, making it accessible to countries without pipeline infrastructure.

- Significant investment in offshore exploration: Significant investments are being made in offshore exploration and production, driven by the discovery of large reserves in areas like the Gulf of Mexico, Brazil's pre-salt fields, and the North Sea. Advances in offshore drilling technology have reduced risks and costs, making these projects more economically viable. Global offshore exploration investment is projected to increase from USD 20.70 billion in CY2023 to USD 28.00 billion in CY2027 with CAGR 7.84%.

- Rising demand for petrochemicals**:** Growing demand for petrochemical products, driven by increasing consumer goods production and agricultural activities, boosts the need for oil and gas feedstocks. The market for petrochemicals has increased from USD 868.80 billion in CY2018 to USD 1,057.03 in CY2023 with CAGR of 4.00%. The market will grow to USD 1,298.45 billion in CY2028 with CAGR of 4.20%.

3.3 Restraints of Global Oil and Gas Industry

- Environmental concerns**:** Regulatory pressures and public opposition to fossil fuel projects can lead to stricter environmental standards and higher compliance costs, potentially slowing down project approvals and increasing operational costs.

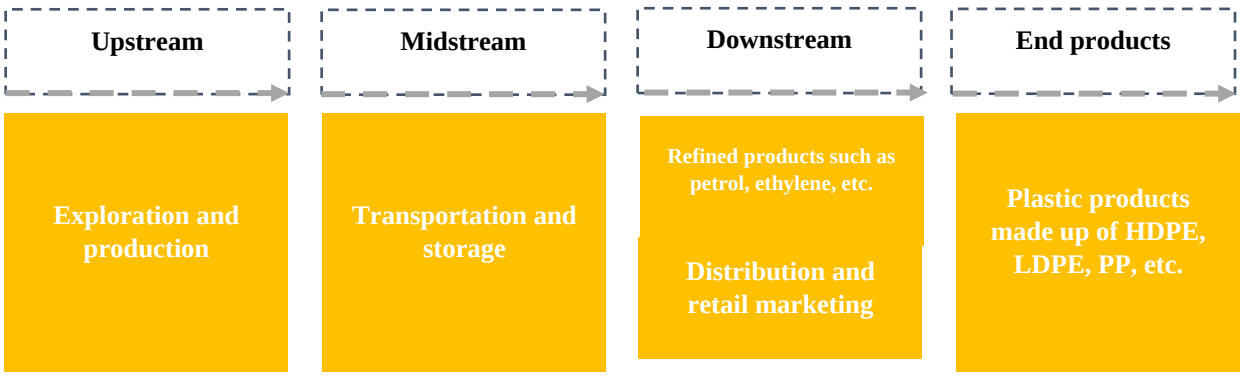
- Market volatility**:** Oil and gas prices are highly volatile, influenced by geopolitical events, supply-demand imbalances, and market speculation. Price fluctuations can affect the profitability of exploration and production projects, making long-term investment plans challenging for companies.

- Aging infrastructure: Much of the global oil and gas infrastructure, including pipelines, refineries, and storage facilities, is aging and requires significant investment for maintenance, upgrades, and replacements. The cost of updating and maintaining this infrastructure can be substantial.

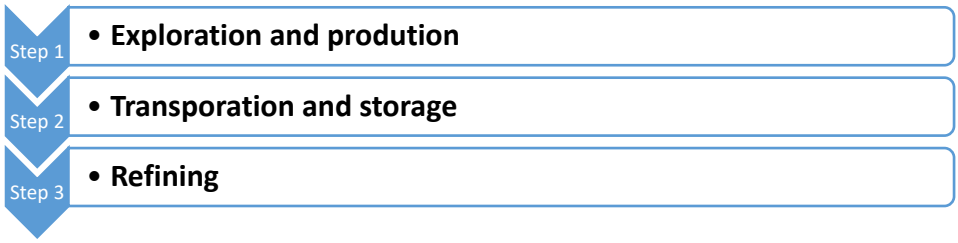
- Capital intensity: Oil and gas projects require substantial capital investment for exploration, drilling, infrastructure development, and maintenance. The high upfront costs and long payback periods can be a barrier to entry and limit the ability of smaller companies to compete with established players.

- Reduction in demand for transportation fuels: As EVs and hybrid vehicles become more prevalent, there will be a significant reduction in the demand for gasoline and diesel. This shift is driven by advancements in battery technology, declining costs of EVs, and supportive government policies.

3.4 Overview of Value Chain and Major Processes Required in Oil and Gas



Major processes involved in value chain:



Complexity and Resilience of the Oil & Gas Industry

- The oil and gas industry operates on a global scale, involving intricate supply chains, massive infrastructure investments, and advanced technologies. Offshore platforms, extensive pipeline networks, and mega-refineries illustrate the industry's vast scale and engineering prowess.
- Ensuring compliance with stringent environmental regulations and adopting sustainable practices is essential for long-term resilience. Refineries and production facilities invest in technologies to reduce emissions, manage waste, and improve energy efficiency to comply with regulations like the Clean Air Act in the US and the European Union's emissions trading system.
- The oil and gas industry relies on cutting-edge technologies and advanced engineering solutions to explore, extract, transport, refine, and distribute hydrocarbons. This includes deepwater drilling, hydraulic fracturing, horizontal drilling, and enhanced oil recovery (EOR) techniques.
- The concept of "peak oil"—the point at which global oil production reaches its maximum rate before gradually declining has been a subject of intense debate and analysis for decades. While IEA predicts peak oil demand by CY2030, OPEC projects rising oil demand driven by increasing energy needs in emerging economies. The policymakers are continuing to evaluate their approach to energy transition driven by energy shortages. Based on OPEC projections, global oil demand will be around 116.00 Mb/d in CY2045 rising from 102.20 Mb/d in CY2023. Despite the rise of renewable energy, oil and gas will remain crucial, accounting for substantial portions of global energy consumption providing reliable energy, economic benefits, and energy security. Their role in energy security is underscored by strategic reserves and diverse supply sources. In CY2024, the Indian government announced a USD 15.00 billion investment in several oil & gas projects which involve drilling 43.00 wells**.**

3.5 Key Regulations Impacting the Global Oil and Gas Industry

United states

- Environmental regulations**:** In US, there are environmental regulations such as national environmental policy act, clean air act (CAA), clean water act (CWA), etc. National environmental policy act requires federal agencies to assess the environmental impacts of their actions, including issuing permits for oil and gas projects. The clean air act is a comprehensive federal law that regulates air emissions from stationery and mobile sources. The Clean Water Act regulates the discharge of pollutants into U.S. waters and sets quality standards for surface waters.
- Safety and health regulations: This includes occupational safety and health act (OSH Act) and process safety management (PSM) Standard. Administered by the occupational safety and health administration (OSHA), the OSH Act sets standards to ensure safe and healthy working conditions.
- Licensing and permitting: Bureau of land management (BLM) regulations and federal energy regulatory commission (FERC) are part of Licensing and Permitting laws. The BLM oversees oil and gas operations on federal lands. Companies must obtain leases and permits from the BLM, which include environmental protection requirements and stipulations for land reclamation.
- Intangible drilling costs deduction: The US tax code allows the deduction of intangible drilling costs, which can account for a significant portion (60-80%) of drilling expenses. This incentivizes exploration and development by reducing upfront costs for operators.

Europe

- Environmental regulations**:** In EU, there are environmental regulations such as European union emission trading system (EU ETS), industrial emissions directive (IED), water framework directive (WFD), etc. The EU ETS is a foundation of the EU's policy to combat climate change and reduce greenhouse gas emissions cost-effectively. The IED aims to reduce harmful industrial emissions across the EU through an integrated approach. It sets out rules on the operation of industrial

activities, focusing on reducing emissions to air, water, and land, and on waste management. The WFD establishes a framework for the protection of inland surface waters, transitional waters, coastal waters, and groundwater.

- Safety and health regulations: Seveso III directive and offshore safety directive are part of safety and health regulations. The Seveso III directive aims to prevent major accidents involving dangerous substances and to limit their consequences for human health and the environment. It requires companies to adopt a safety management system, conduct risk assessments, and prepare emergency plans. Offshore Safety Directive ensures high safety standards for offshore oil and gas operations. It mandates risk assessments, emergency response plans, and the use of best available techniques.

- Licensing and permitting: Hydrocarbons directive, environmental impact assessment (EIA) directive are part of licensing and permitting regulations. The hydrocarbons directive establishes a framework for granting and using authorizations for the prospection, exploration, and production of hydrocarbons. The EIA Directive requires companies to assess the environmental impacts of certain public and private projects before they are allowed to proceed.

- EU's Oil Stocks Directive (2009/119/EC) specifies that member states must maintain strategic petroleum reserves, ensuring energy security and stability. This creates opportunities for investments in storage facilities and infrastructure.

China

- Environmental regulations**:** In China, environmental protection law, air and water quality standards, are important regulations in this category. China's environmental protection law mandates environmental impact assessments (EIAs) for oil and gas projects. It sets emission standards, waste disposal requirements, and penalties for environmental violations.

- Safety and operational standards: China's Work Safety Law and related regulations set standards for workplace safety, hazard prevention, and emergency response in the oil and gas industry.

- Energy law: China's Energy Law governs the exploration, production, transportation, and consumption of energy resources, including oil and gas. It outlines licensing requirements, operational standards, and environmental protection measures.

- China’s 14th Five-Year Plan for a modern energy focused on expansion of natural gas capacity to over 230.00 BCM by CY2025 from 220.00 BCM in CY2022. This will attract significant investments for development of infrastructure. Through 14th Five-Year Plan, China intends to double the length of gas transmission pipelines by 2025, largely by expanding provincial networks.

- In CY2019, China introduced subsidies and tax incentives for shale gas exploration and production to stimulate domestic production and reduce reliance on imports. Policies that encourage technological innovation and the application of advanced drilling and fracking technologies were introduced to enhance shale gas production efficiency.

India

- Environmental regulations**:** In India, Environmental Protection Act 1986 governs the laws related to environmental regulations. This act provides the framework for environmental protection in India. It mandates environmental impact assessments (EIAs) for oil and gas projects, sets standards for air and water quality, and regulates waste management.

- Safety and operational standards: Oil Industry Safety Directorate (OISD) and Petroleum and Natural Gas (Safety in Offshore Operations) Rules, 2008 are important laws that governs safety and operational standards for oil & gas industry. The OISD is responsible for formulating and enforcing safety standards in the oil and gas industry. It develops safety guidelines, conducts audits, and investigates accidents to promote safe operations. Petroleum and Natural Gas rules govern safety in offshore oil and gas operations, covering aspects such as platform integrity, well control, emergency response, and worker safety.

- Regulatory Frameworks: Hydrocarbon Exploration and Licensing Policy (HELP) and Directorate General of Hydrocarbons (DGH) are important frameworks related to oil and gas industry in India. The DGH is the regulatory authority responsible for overseeing upstream oil and gas activities in India. It ensures compliance with exploration and production contracts, monitors operational performance, and enforces safety and environmental standards.

- Licensing and permitting: Petroleum and Natural Gas Rules, 1959 outline the procedures for obtaining licenses and leases for exploration, development, and production of petroleum and natural gas. They cover aspects such as bidding rounds, lease terms, and operational obligations.

- Under New domestic natural gas pricing guidelines, the government of India has implemented reforms to provide marketing and pricing freedom for natural gas. This includes linking domestic gas prices to international benchmarks, making the market more competitive and attractive for investors.

- Strategic petroleum reserves program: The program involves the construction of strategic oil storage facilities to enhance energy security. This creates opportunities for infrastructure development and storage management, attracting investments in the sector. It encourages PPPs for building and managing strategic reserves, facilitating private sector participation and investment.

- In FY2018, Ministry of Petroleum and Natural gas has introduced policy framework to promote and incentivize EOR methodologies in India. The government supported EOR projects through favorable policies and faster approval processes, aimed at maximizing recovery from existing fields and extending their productive life.

3.6 Impact of EV and Renewable Energy on Global Oil and gas Industry

The rise in demand for electric vehicles (EVs) and renewable energy sources is leading to significant changes in the global energy market, particularly affecting the oil and gas industry. These changes are driven by a combination of technological advancements, environmental policies, and shifting consumer preferences.

- Reduction in transportation fuel demand: The growing adoption of EVs is directly reducing the demand for gasoline and diesel, which are primary products of crude oil refining. As more consumers and businesses opt for EVs, the consumption of conventional fuels decreases. Many governments are implementing policies and incentives to promote EV adoption and reduce carbon emissions.

- Diversification strategies: Oil and gas companies are diversifying their portfolios to include renewable energy projects and alternative fuels to hedge against declining oil demand. BP has rebranded itself as an integrated energy company, investing heavily in renewable energy projects. The company aims to increase its renewable energy capacity to 50.00 GW by CY2030, signaling a strategic shift away from oil and gas.

- Stranded assets and increased financial risks: The shift to EVs and renewables increases the risk of stranded assets for oil and gas companies, where investments in fossil fuel infrastructure may not be recoverable. ExxonMobil has faced significant pressure from investors to address climate risks and transition to cleaner energy sources. The company is exploring investments in carbon capture and storage (CCS) and renewable energy projects to mitigate the risk of stranded assets.

- Increased investment in renewable energy: The rise of renewable energy sources like solar, wind, and hydropower is decreasing the reliance on fossil fuels for electricity generation. This shift is driven by declining costs of renewable technologies and growing environmental concerns.

- Reevaluating EV adoption: Several countries and major automakers are re-evaluating their electric vehicle (EV) targets amid growing concerns about the sustainability of the EV industry. Key issues such as the environmental toll of mining metals for batteries, challenges in battery disposal and recycling are prompting this reassessment. While there are mandates on recycling of EV parts across regions, there are no material specific recycling targets. As the EV industry continues to mature, these unresolved challenges are expected to slow the pace of its growth.

3.7 Increased Complexity of Exploration and Production: Transition from Secondary to Tertiary Drilling

The oil and gas industry has been evolving to meet the increasing global energy demands, often requiring the development of more sophisticated and complex exploration and production techniques. Tertiary drilling or enhanced oil recovery (EOR) involves more advanced techniques to extract additional oil after primary and secondary methods have been exhausted. Advanced EOR techniques typically involve larger volumes of chemicals compared to primary and secondary recovery, leading to increased overall demand for oil and gas chemicals. Each reservoir has unique characteristics, necessitating customized chemical formulations and blends to optimize recovery processes. This drives the development and use of a broader range of specialized chemicals.

3.8 Increase in Focus on ESG and Compliance to Stringent Regulations

Environmental, Social, and Governance (ESG) considerations have become increasingly important for the oil and gas industry, driven by global sustainability goals, investor expectations, and regulatory requirements. Companies in this sector are facing growing pressure to enhance their ESG performance and comply with stringent regulations.

- Environmental considerations: Oil and gas companies are under pressure to reduce their carbon footprint and mitigate climate change impacts. This includes reducing greenhouse gas emissions from operations and supporting the transition to low-carbon energy sources. Companies are investing in technologies like carbon capture and storage (CCS), methane detection and reduction, and renewable energy projects.

- Investor and stakeholder expectations: Investors and stakeholders increasingly demand transparent ESG reporting and disclosures from oil and gas companies. This includes reporting on environmental impacts, social performance, governance practices, and sustainability initiatives. Companies publish annual sustainability reports, participate in ESG ratings and indices, and engage with investors on ESG-related matters.

3.9 Global New Refinery and Petrochemicals Projects Announcements

Following are key announcements of new projects across the world (non-exhaustive list):

Company Name	Timelines (Near term: Till CY2027, Medium term: Till CY2030)	Country	Project details
Pacific Future Energy	Medium term	Canada	Proposed development of 200,000 Bpd bitumen to fuels near-zero net-carbon refinery located in northwest British Columbia.
Canadian Natural Resources	Near term	Canada	The company expects to increase in production by end of CY2024. It has plans to drill 8.00% more wells with investment of USD 4.01 billion in the same year.
Dow	Medium term	Canada	Dow to spend USD 6.50 billion investment for Path2Zero project in Canada. It will have net-zero scope 1 and 2 emissions integrated ethylene cracker and derivatives facility in Alberta
Ithaca Energy and Equinor	Medium term	UK	Companies to invest USD 3.80 billion for development on the UK Continental Shelf. Recoverable resources are estimated at around 300.00 million barrels of oil from phase 1 and 2.
Shell	Near term	UK	Shell to invest in the Victory gas field in the UK North Sea with planned capacity of 150.00 million standard cubic feet per day of gas
Equinor	Medium term	UK	Equinor to develop a huge oil and gas field near Shetland in Scotland. The site has potential to produce 500.00 million barrels of oil.
ADNOC	Near term	UAE	ADNOC invested USD 548.00 million to expand Zakum field's gas production capacity from 430.00 million to 700.00 million standard cubic feet per day
ADNOC	Medium term	UAE	In CY2023, ADNOC awarded USD 16.94 billion worth of contracts for the ultra-sour Hail and Ghasha project. It will be a net zero CO2 project with expected gas production to start in CY2025, producing more than 1.50 billion cubic feet per day by the year 2030
Saudi Aramco	Near term	KSA	Saudi Aramco to expand oil production capacity by 300,000 barrels per day, reaching a total of 800,000 bpd at Marjan Field.
Saudi Aramco	Near term	KSA	Saudi Aramco is planning to increase production capacities of key oilfield sites. Additional capacity of 25,000.00 b/d at Dammam and 250,000.00 b/d capacity at Berri is planned to go live by CY2025. A 600,000.00 b/d boost at Zuluf facility is planned to go live by CY2026.
Equinor	Medium term	EU	Equinor is planning a phase 3 development of the giant Johan Sverdrup field in the Norwegian North Sea.
Equinor, Lundin, Petoro	Medium term	EU	Companies are planning to invest USD 5.90 bn to USD 7.40 bn offshore oilfield development of Wisting oilfield. The site is expected to produce 500.00 million barrels of oil equivalent
CNOOC	Near term	China	CNOOC completed development of Bozhong 19-6 gas field in May 2024 and it is planning to produce 5,800.00 barrels of oil equivalent per day by CY2026
CNPC and Sinopec	Near term	China	China to drill conventional resources at ultra-deep wells below the surface of northwest Xinjiang's Tarim basin region.

Petronas	Near term	Malaysia	Petronas is in process to construct Kasawari conventional gas site in Malaysia. The plant is planned to go-live by CY2024.
Valeura Energy	Medium term	Thailand	The company discovered three oil assets in the offshore Gulf of Thailand. It is also planning for further exploration drilling in other parts of country.

Source: Company website and other secondary sources

3.10 New Refinery and Petrochemicals Projects in India

Following are key announcements of investment for new projects in India (Non-exhaustive list):

Company Name	Timelines (Near term: Till FY2027, Medium term: Till FY2030)	Project details
Nayara Energy	Near term	In FY2019, company announced plans to invest INR 7,100.00 crore to increase refinery capacity from the 20.00 MMTPA to 46.00 MMTPA. It also has plans to build petrochemical units by FY2024.
HPCL	Near term	HPCL to start new refinery in Barmer, Rajasthan with capacity of 9.00 MTPA by CY2024. It is also planned to produce 2.40 million ton of petrochemical products at the production site.
BPCL	Near term	BPCL plans to increase Bina refinery capacity from 7.80 MMTPA to 11.00 MMTPA by FY2027 with investment of INR 50,000.00 crore.
IOCL	Near term	The company have plans to invest INR 36,225.00 crore for expansion of Panipat refinery by December 2025. The plan is to increase capacity from 15.00 MMTPA to 25.00 MMTPA.
CPCL	Near term	At an estimated cost of INR 31,580.00 crore, Chennai Petroleum Corporation Limited (CPCL) and IOCL are developing a 9.00 MMTPA refinery project in Nagapattinam, Tamil Nadu. Tentative timeline for project completion is December 2024.
Reliance Industries	Medium	Reliance industries announced investment of INR 75,000.00 crore in expanding oil to chemicals capacities for next 5 years in India.
IOCL	Medium term	IOCL to invest INR 61,077.00 Crore at Paradip petrochemical complex for production of derivative products including polypropylene, HDPE, LLDPE, etc. It is yet to announce go-live date of the project. The company's refinery expansion plans from 15.00 to 25.00 MMTPA is under conceptualization.
ONGC	Medium term	ONGC to invest INR 1.00 lakh crore for expansion in production capacities to 8.00 MMTPA by FY2030.
Haldia petrochemicals	Medium term	The company planning to invest INR 83,540.00 Crore (USD 10.00 billion) to build oil to chemicals project with capacity of 3.50 MMTPA by FY2028 in Cuddalore, Tamil Nadu.
Ratnagiri Refinery & Petrochemicals Ltd.	Medium term	Ratnagiri Refinery & Petrochemicals Ltd. is joint venture initiative of BPCL, IOCL HPCL. The objective of this JV is development of refinery complex at Ratnagiri by FY2027. The refinery capacity will be 60.00 MMTPA and total investment will be INR 3.00 lakh crore

Source: Company website and other secondary sources

3.11 Key Challenges Impacting Companies offering Specialty Chemicals for Hydrocarbons

Companies offering specialty chemicals for hydrocarbons may face several key challenges that can impact their operations, profitability, and growth.

- Volatility in oil prices: Fluctuating oil prices can lead to uncertainty in investment decisions for exploration and production activities. Low oil prices often result in reduced spending by oil companies, which directly affects the demand for oilfield specialty chemicals. Many of the oilfield specialty chemicals manufacturers were impacted by price volatility

in last couple of years. On the other hand, Dorf Ketal remains unimpacted by the price volatility of crude oil owing to strong supply chain strategies.

- Stringent environmental regulations: Compliance of stringent environmental regulations requires significant investment in environmentally friendly and compliant products, which can increase operational costs.
- Technological and R&D challenges: The need for continuous innovation to develop more effective and environmentally friendly chemicals requires substantial investment in research and development. Developing and applying advanced oilfield specialty chemicals requires specialized technical expertise, which can be a barrier for smaller companies and new entrants.
- Supply chain disruptions: The availability and cost of raw materials required for producing oilfield specialty chemicals can be affected by geopolitical issues, trade restrictions, and supply chain disruptions.
- Economic factors: Economic slowdowns or recessions can reduce overall energy demand, impacting exploration and production activities and, consequently, the demand for oilfield specialty chemicals. Exchange rate volatility can affect the cost competitiveness of companies operating in different regions.

3.12 Overview of Specialty Chemicals for Hydrocarbons Industry

The global market of specialty chemicals for hydrocarbons encompasses oilfield chemicals, refinery and petrochemical process chemicals, and fuel additives. The market was valued at USD 30.54 billion in CY2023 and is expected to grow at a CAGR of 3.01% to reach USD 35.43 billion by CY2028.

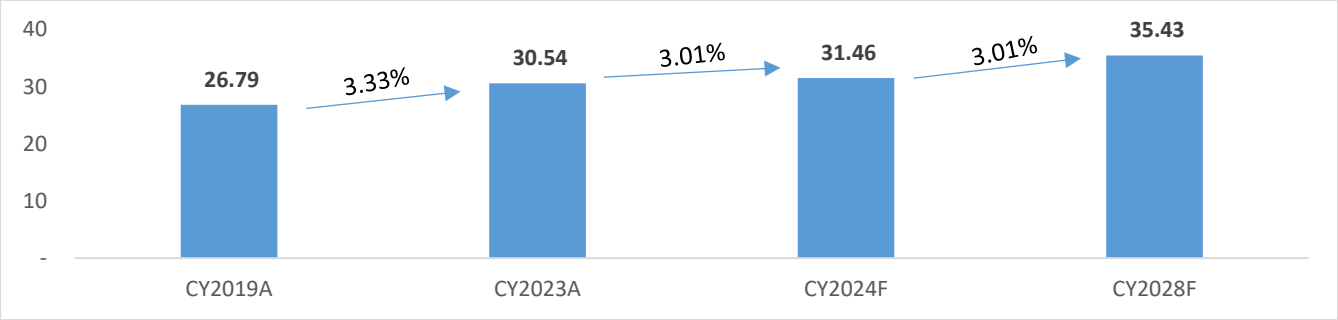
Oilfield specialty chemicals are formulated specialty chemical compounds or blends of unique chemistries that are used to improve the production rates, ensure asset integrity, and flow assurance of operational activities at oilfield, refineries and petrochemicals site. Oilfield specialty chemicals such as surfactants, polymers, and alkalis are used in EOR techniques to improve the extraction of oil from reservoirs.

The specialty refinery process chemicals market plays a crucial role in optimizing the efficiency, safety, and environmental sustainability of the oil and petrochemical industries. It encompasses a diverse range of chemical compounds and additives utilized in various processes, from crude oil refining to the production of high-value petrochemicals.

Fuel additives are chemical compounds formulated with the purpose of improving efficiency through enhancement of the combustion process (as antioxidants) and reduce harmful emissions through complete burn.

Modified acid emits fewer harmful fumes and reduces health risks. Modified acids are more biodegradable and have lower vapor pressure, minimizing environmental hazards. These acids can be diluted more effectively, have higher thermal stability, and offer better corrosion protection, making them more efficient for industrial applications such as oilfield stimulation and scale treatment. It can be used for scale treatments, injection wells, spearheads and other high-heat applications. The market increased from USD 0.34 billion in CY2019 to USD 0.44 billion in 2023 with CAGR of 6.50%. The addressable market of modified acid is forecasted to increase from USD 0.44 billion in CY2023 to USD 0.62 billion in CY2028 with CAGR of 7.00%.

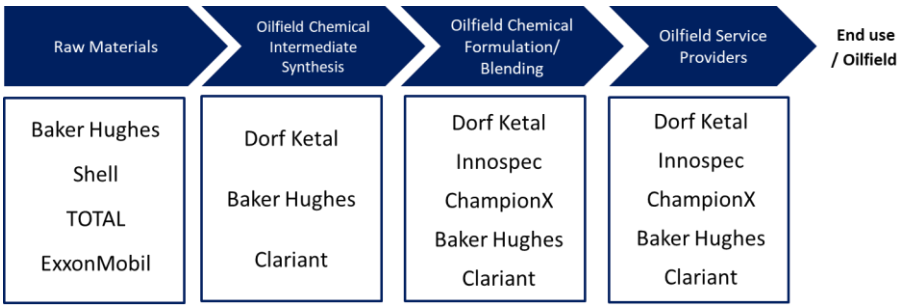
Exhibit 3.12-1: Global Market of Specialty Chemicals for Hydrocarbons by Value in USD Bn (CY2019, CY2023, CY2024, CY2028)



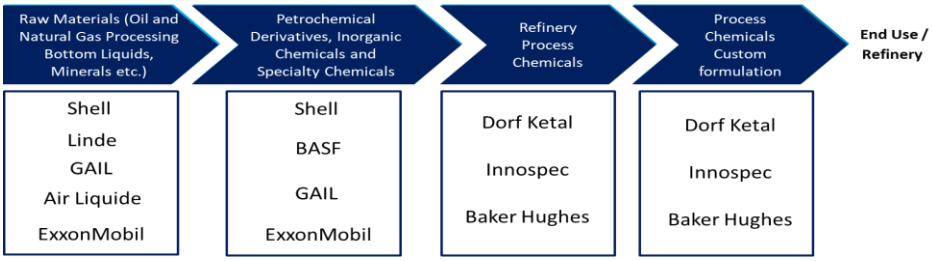
Note: A: Actual, F: Forecast, Source: Frost & Sullivan

Value Chain Mapping of Specialty Chemicals for Hydrocarbons Industry

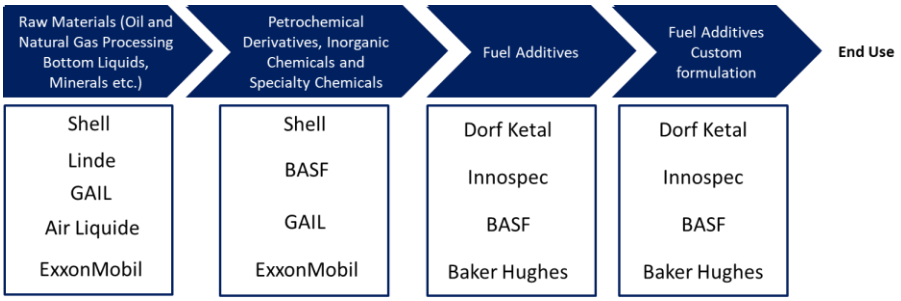
Oilfield specialty chemicals:



Specialty refinery process chemicals:



Fuel additives:



Note: The companies listed are examples of market participants and do not represent an exhaustive list.

3.13 Market Segmentation by Categories (End Use) and Function

Market Segmentation by Categories:

1. **Global Oilfield Specialty Chemicals Market:**

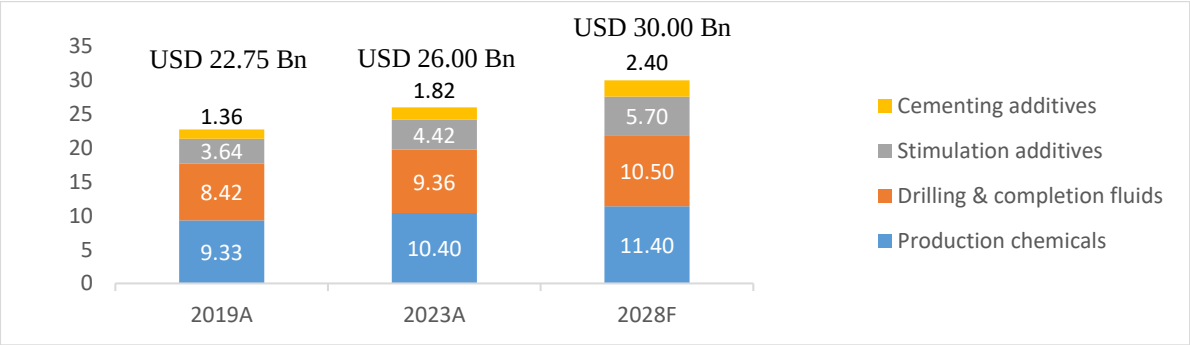
Production Chemicals: These chemicals have recently surpassed drilling fluids as the top market segment & are expected to continue their growth trajectory with ~40.00% of the market share in CY2023.

Drilling and completion fluids: These fluids are used to lubricate the drill bit and control the formation pressure & temperature. They form one of the largest categories by value, with a share of 36.00%. The market for these chemicals is directly associated with new well drilling activities.

Stimulation additives: Stimulation additives are used in various well stimulation techniques, such as hydraulic fracturing (fracking) and acidizing, to enhance the flow of hydrocarbons from the reservoir to the wellbore. The market share of stimulation additives was around 17.00% in CY2023.

Cementing additives: Cementing additives are used in well cementing operations to ensure a strong and durable bond between the casing and the wellbore, providing zonal isolation and structural integrity. The market share of cementing additives was around 7.00% in CY2023.

Exhibit 3.13.1-1: Global Oilfield Specialty Chemicals Market by Value in USD Bn, Split by End Use Categories (CY2019, CY2023, CY2028)



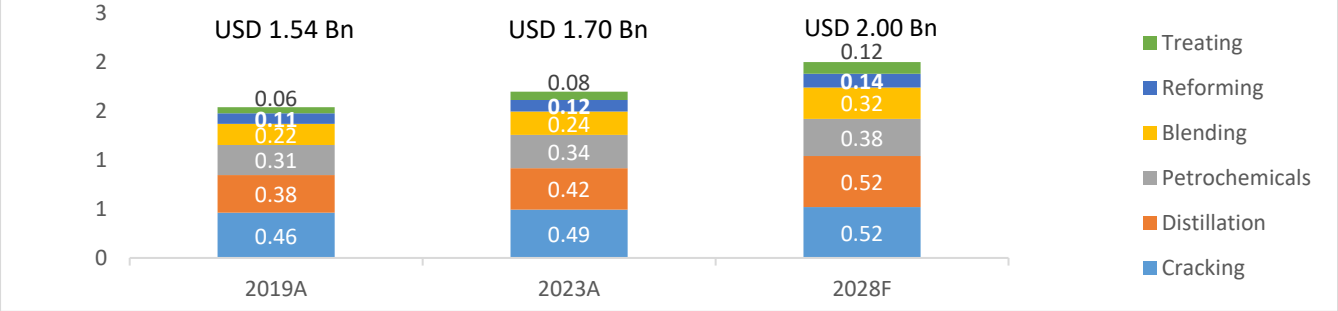
Categories	CAGR CY2019-23 in %	CAGR CY2023-28 in %
Production Chemicals	2.76%	1.85%
Drilling and Completion Fluids	2.69%	2.32%
Stimulation Additives	4.98%	5.21%
Cementing Additives	7.46%	5.69%

Note: A: Actual, F: Forecast; Source: Frost & Sullivan

2. Global Specialty Refinery Process Chemicals Market:

There is extensive utilization of refinery process chemicals in cracking application. The cracking segment accounted for the leading 29.00% market share followed by distillation with 25.00% market share, petrochemicals with 20.00% market share, blending with 14.00% market share, reforming with 7.00% market share and treating with 5.00% market share in CY2023.

Exhibit 3.13-1: Global Specialty Refinery Process Chemicals Market by Value in USD Bn, Split by End Use Categories (CY2019, CY2023, CY2028)



Categories	CAGR CY2019-23 in %	CAGR CY2023-28 in %
Cracking	1.63%	1.10%
Distillation	2.50%	4.15%
Petrochemicals	2.50%	2.28%
Blending	2.50%	6.13%
Reforming	2.50%	3.33%
Treating	8.38%	7.17%

Note: A: Actual, F: Forecast; Source: Frost & Sullivan

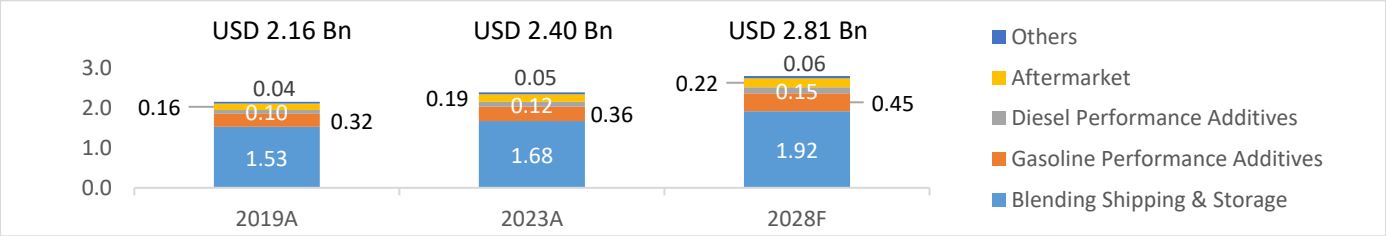
3. Global Fuel Additives Market:

Blending, shipping and storage additives include products used at the refinery stage to adjust specifications and prepare the fuel for transport and handling. Diesel, Gasoline and Jet fuels are treated at this level. In general, globally, Performance additives are added

by fuel marketers to differentiate their products in the market and acquire a premium. Aftermarket segment is niche and includes products bought by automotive owners directly to enhance the performance of their vehicles.

Overall, the global market for fuel additives will be driven by environmental standards, technological advancements, and evolving consumer preferences. Blending, shipping, and storage additives will see growth due to the need for optimized fuel handling and transport.

Exhibit 3.13-1: Global Fuel Additives Market by Value in USD Bn, Split by Use type (CY2019, CY2023, CY2028)



Categories	CAGR CY2019-23 in %	CAGR CY2023-28 in %
Blending Shipping & Storage	2.27%	2.78%
Gasoline Performance Additives	3.01%	4.26%
Diesel Performance Additives	4.88%	5.61%
Aftermarket	4.01%	3.46%
Others	3.93%	2.20%

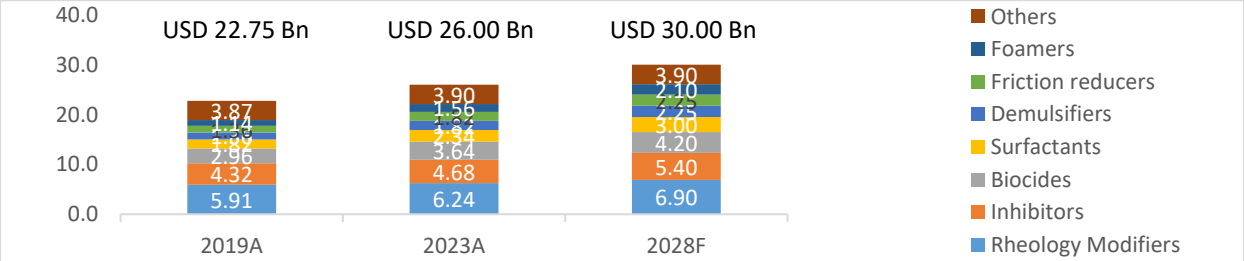
Note: A: Actual, F: Forecast; Source: Frost & Sullivan

Market Segmentation by Functions of Specialty Chemicals:

1. **Global Oilield Specialty Chemicals Market:**

Rheology modifiers are used to control the flow properties of drilling fluids. They adjust the viscosity, gel strength, and overall rheological properties of the fluid to improve its performance during drilling operations. It is commonly used in drilling muds to ensure the proper suspension of cuttings, prevent sagging, and enhance the carrying capacity of the fluid. Rheology modifiers accounted for 24.00% market share in total oilfield market in CY2023. Inhibitors are used to prevent or reduce undesirable reactions, such as corrosion, scale formation, and hydrate formation in pipelines and other oilfield equipment. Corrosion inhibitors protect metal surfaces in drilling and production equipment; scale inhibitors prevent the deposition of mineral scales; hydrate inhibitors prevent the formation of gas hydrates in pipelines. This category accounted for 18.00% market share in total oilfield market in CY2023. Biocides are chemicals that control the growth of harmful microorganisms in oilfield operations. It is used in drilling fluids, fracturing fluids, and production systems to prevent the growth of bacteria that can cause corrosion, souring of reservoirs (sulfate-reducing bacteria), and biofouling. It accounted for 14.00% market share in total oilfield market in CY2023. Surfactants reduce the surface tension between liquids or between a liquid and a solid, aiding in the mixing and spreading of fluids. These chemicals are used in various oilfield processes such as enhanced oil recovery (EOR), well stimulation, and drilling fluids to improve the wettability of surfaces, emulsify and disperse oils, and stabilize foams. This category accounted for 9.00% market share in total oilfield market in CY2023. Demulsifiers, Friction reducers, foamers, etc. accounted for 7.00%, 7.00% and 6.00% respectively. Demulsifiers break down emulsions (mixtures of oil and water) to separate the oil from the water. Friction reducers decrease the frictional resistance encountered by fluids flowing through pipelines or wellbores. Foamers are primarily used in gas wells to mitigate liquid loading, which occurs when liquids accumulate in the wellbore, restricting gas flow and reducing production efficiency.

Exhibit 3.13-4: Global Oilfield Specialty Chemicals Market by Value in USD Bn, Split by Function of Specialty Chemicals (CY2019, CY2023, CY2028)



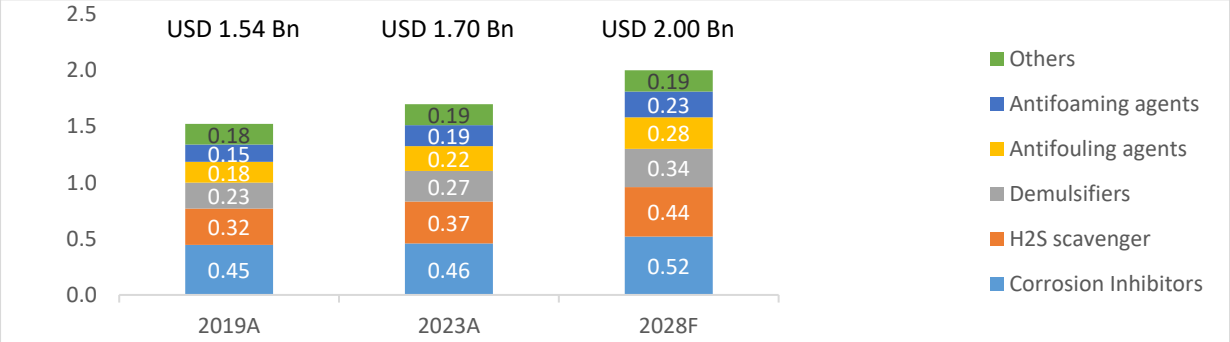
Functions	CAGR CY2019-23 in %	CAGR CY2023-28 in %
Rheology Modifiers	1.35%	2.03%
Inhibitors	2.01%	2.90%
Biocides	5.33%	2.90%
Surfactants	6.49%	5.09%
Demulsifiers	7.46%	4.33%
Friction reducers	7.46%	4.33%
Foamers	8.22%	6.12%
Others	0.21%	0.00%

Note: A: Actual, F: Forecast; Source: Frost & Sullivan

2. Global Specialty Refinery Process Chemicals Market:

Refinery and Petrochemical process chemicals, including corrosion inhibitors, scale inhibitors, H2S scavengers, demulsifiers, anti-fouling agents, polymer inhibitors, antifoaming agents, and sulfiding agents, play a pivotal role in the successful operation of refineries and petrochemical plants. These chemicals are strategically employed to ensure the integrity, safety, and efficiency of various processes within these facilities. Corrosion inhibitors accounted for 27.00% market share while H2S scavengers accounted for 22.00% market share in CY2023. Demulsifiers, antifouling agents, antifoaming agents also had significant market share of 16.00%, 13.00%, 11.00% respectively in CY2023.

Exhibit 3.13-5: Global Specialty Refinery Process Chemicals Market by Value in USD Bn, Split by Function of Specialty Chemicals (CY2019, CY2023, CY2028)



Functions	CAGR CY2019-23 in %	CAGR CY2023-28 in %
Corrosion Inhibitors	0.69%	2.55%
H2S scavenger	3.70%	3.33%
Demulsifiers	4.17%	4.59%
Antifouling agents	4.57%	4.87%
Antifoaming agents	4.97%	4.25%
Others	0.29%	0.35%

Note: A: Actual, F: Forecast; Source: Frost & Sullivan

3. Global Fuel Additives Market:

Deposit control additives (DCA) are used to keep the whole fuel system completely clean and free of extraneous matter. Some of the common DCA used are amides, amines, amine carboxylates, polybutene succinimides, polyether amines and polyolefin amines. They dominate the global market with 27.70% share.

Cetane improvers are required to maintain or increase cetane number, the key indicator of diesel fuel ignition quality. They form one of the largest demand categories with 19.60% market share in CY2023.

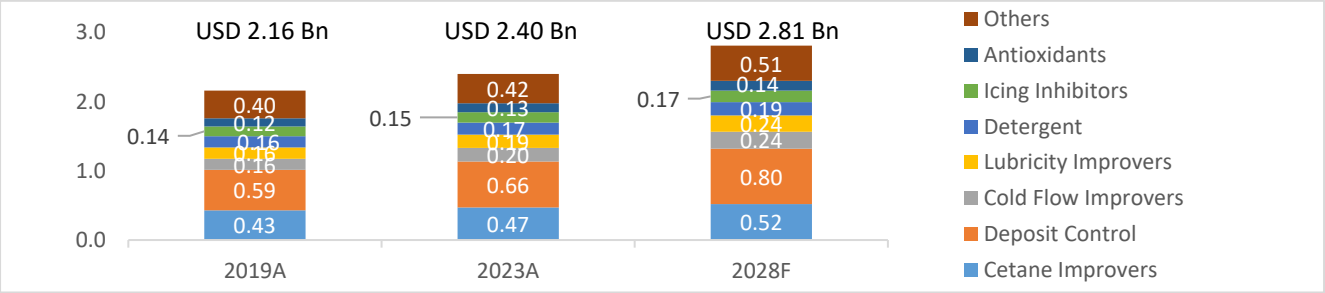
The global fuel additives market is expected to see robust growth driven by stringent environmental regulations and increasing demand for higher fuel efficiency. Key sub-categories such as deposit control additives and cetane improvers will see continued demand due to their roles in enhancing engine performance and meeting emission standards. Emerging markets in Asia-Pacific are anticipated to be significant growth drivers, bolstered by industrialization and vehicle sales.

Antioxidant is the largest gasoline distribution system additive which is used as a stabilizer in fuel to prevent oxidation. Gasoline contains unstable species such as olefins and dienes, and these can polymerize to form gums. The gums are carried forward into the engine system and can lead to malfunctioning and breakdown. Such problems can be avoided by introducing antioxidant chemicals into products within the refinery.

Cold flow improvers are additives to improve flow of diesel fuel in cold weather. In some instances, a cold-flow improver may improve operability by modifying the size and structure of the wax crystals that precipitate out of the fuel at low temperatures, permitting their passage through the fuel filter.

A lack of lubrication due to reduced sulfur levels in diesel fuels will cause injection pump failure hence lubricity improvers are added as an essential part of low Sulphur fuels.

Exhibit 3.13-6: Global Fuel Additives Market by Value in USD Bn, Split by Sub Categories (CY2019, CY2023, CY2028)



Functions	CAGR CY2019-23 in %	CAGR CY2023-28 in %
Cetane Improvers	2.28%	2.01%
Deposit Control	3.23%	3.79%
Cold Flow Improvers	5.34%	4.43%
Lubricity Improvers	3.99%	4.21%
Detergent	1.63%	2.03%
Icing Inhibitors	1.87%	2.20%
Antioxidants	2.20%	1.62%
Others	1.40%	3.78%

Note: A: Actual, F: Forecast; "Others" include- Static Dissipater Additives, Corrosion inhibitor, Antiknock Agents, etc; Source: F&S

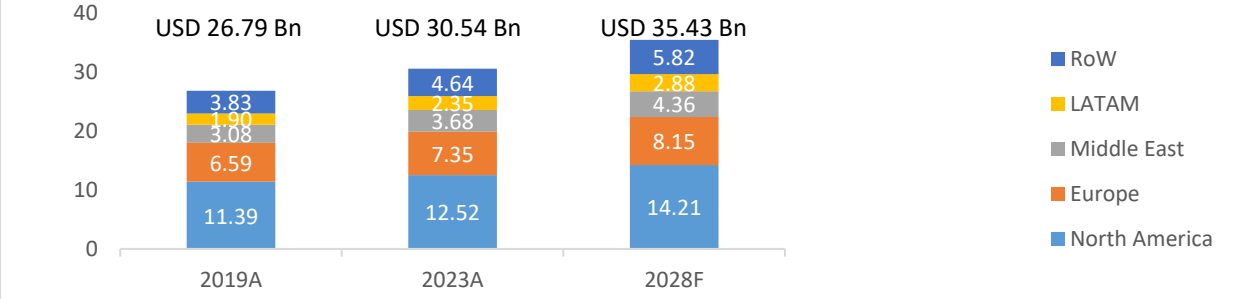
3.14 Market Segmentation by Region of Global Specialty Chemicals for Hydrocarbons Industry

North America, leads the global market of specialty chemicals for hydrocarbons due to unconventional oil & gas extraction i.e., exploitation of shale gas and oil reserves through horizontal drilling and hydraulic fracturing that requires a large amount of drilling & stimulation chemicals. So far 11,050 wells have been drilled in North America during Jan to June 2023. North America accounted for 40.99% market share in CY2023. In CY2028, the market share will decline to 40.11%.

Europe, including Commonwealth of Independent States (CIS) had a considerable share of 24.05% in CY2023 global market of specialty chemicals for hydrocarbons. However Western Europe is expected to have only six onshore rigs in operation even in 2023, same as in 2022. This could change further from 2024 onwards with UK government's recent decision to end its moratorium on hydraulic fracturing and discovery of reserves in Block 2 and Block 4 in the southern part of Albania.

Middle east accounted for 12.06% market share in CY2023. The market share is projected to become 12.31% in CY2028. The Middle East's demand of specialty chemicals for hydrocarbons is rising, driven by the region's expanding petrochemical industry and diversification into value-added products.

Exhibit 3.14-1: Global Market of Specialty Chemicals for Hydrocarbons by Value in USD Bn, Split by Region (CY2019, CY2023, CY2028)



Regions	CAGR CY2019-23 in %	CAGR CY2023-28 in %
North America	2.40%	2.57%
Europe	2.75%	2.10%
Middle East	4.57%	3.44%
LATAM	5.46%	4.16%
Rest of the world	4.91%	4.63%

Note: A: Actual, F: Forecast; Source: Frost & Sullivan

3.15 Industry Trends Impacting the Global Market of Specialty Chemicals for Hydrocarbons

Trend	Impact
Advance, Efficient & Greener Chemistries	There is an increased demand for performance enhancing chemicals and strong demand for green & safer chemistries. These are associated with requirements for better asset integrity, better flow assurance, lower failure rates, lower costs per barrel of fluid
High Focus on Higher & Efficient Output	It is being observed that the existing oil wells are maturing & there is a slowdown in new oil well drilling activities. Operators are increasingly focusing to enhance efficient production process and get higher output. This is resulting in an increasing demand for production chemicals.
Renewable Energy & ESG Demands	Reducing dependence on fossil fuels has become one of the major objectives for governments and value chain players across the globe. This has resulted in heightened focus on reduced carbon footprint and environmental safety, particularly in the oil & gas industry. Moving forward a strong demand for green and safe chemicals will become a mandatory norm across all applications.
Market consolidation	The industry of specialty chemicals for hydrocarbons is experiencing a trend toward market consolidation as companies seek to enhance their competitive edge through mergers and acquisitions. This trend is driven by the need to achieve economies of scale, expand product portfolios, enhance technological capabilities, and improve market reach. • In CY2016, Baker Hughes merged with GE Oil & Gas to form Baker Hughes Incorporated ("Baker Hughes"), a GE company (BHGE). • In CY2018, Halliburton acquired Athlon Solutions to improve portfolio of specialty water and process treatment chemicals. • In April 2024, SLB announced acquisition of ChampionX Corporation ("ChampionX") for improving market share in the industry.
Advancements in fuel additive formulations	Advancements in fuel additive formulations enhance fuel efficiency, reduce emissions, and improve engine performance, driving increased demand for specialty chemicals for hydrocarbons.

3.16 Growth Drivers and Restraints of the Global Specialty Chemicals for Hydrocarbons

Growth Drivers:

- Increasing energy demand: Growing global population and industrialization are driving the demand for energy, leading to increased oil and gas exploration and production activities. This, in turn, boosts the demand for oilfield and refinery process chemicals.
- Technological advancements: Innovations in drilling and extraction technologies, such as horizontal drilling, hydraulic fracturing, and enhanced oil recovery (EOR) techniques, require specialized chemicals to improve efficiency and effectiveness, driving market growth. Many existing oilfields are aging and require enhanced recovery techniques, which involve the use of various chemicals to maintain and boost production levels.
- Expansion of unconventional fossil fuels: The development of unconventional oil and gas resources, such as shale gas, tight oil, and oil sands, necessitates the use of specific specialty chemicals, fueling market growth.
- Offshore exploration**:** The expansion of offshore exploration activities, including deepwater and ultra-deepwater projects, drives the demand for advanced oilfield specialty chemicals to address the unique challenges of these environments. The oil exploration from deepwater projects is projected to increase from 10.00 Mb/d in CY2023 to over 16.00 Mb/d in CY2030. In coming 7 years, the exploration through water depths of over 1,600 m will drive the demand of oilfield chemicals.
- Sustainability initiatives: Increasing focus on sustainability and reducing the carbon footprint in the oil and gas industry drives the demand for green and biodegradable chemicals, which are essential for responsible and sustainable operations.
- Economic growth in developing regions: Rapid economic growth and urbanization in developing regions, particularly in Asia-Pacific and Latin America, are driving the demand for energy, which in turn boosts oil and gas exploration and production activities, leading to increased demand for oilfield specialty chemicals.

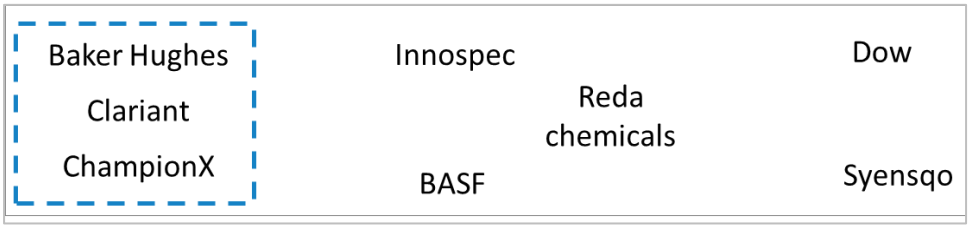
Restraints for the Growth of Specialty Chemicals for Hydrocarbons:

- Volatile oil prices: Fluctuations in oil prices can significantly impact the profitability of exploration and production activities, leading to reduced investments and lower demand for oilfield specialty chemicals.
- Alternative energy sources: The growing emphasis on renewable energy sources and the transition to a low-carbon economy can reduce the long-term demand for oil and gas, thereby impacting the demand for oilfield specialty chemicals.
- Geopolitical instability: Political instability and conflicts in key oil-producing regions can disrupt exploration and production activities, leading to uncertainties and fluctuations in the demand for oilfield specialty chemicals.

3.17 Key Players of the Specialty Chemicals for Hydrocarbons

The universe of specialty chemicals for hydrocarbons at global level includes Baker Hughes Incorporated, Clariant Ltd. (“Clariant”), ChampionX Corporation, Innospec Inc. (“Innospec”), Syensqo company (“Syensqo”), BASF SE (“BASF”), Dow Inc. (“Dow”), Reda Chemicals India Private Limited (“Reda”), JAY Chemical Industries Private Limited (“Jaychem”), Pure Chem Pvt. Ltd. (“Purechem”), CES Energy Solutions Corp. (“CES”), Sterling Auxiliaries Private Limited (“Sterling”), etc. Baker Hughes Incorporated, Clariant Ltd., Champion X Corporation, are the leading players in global production chemicals market in terms of revenue.

Exhibit 3.17-1: Universe of Players in Global Market of Specialty Chemicals for Hydrocarbons, CY2023



1. Baker Hughes Incorporated**:** Baker Hughes is likely to continue its focus on digital solutions and advanced chemical technologies to improve oil recovery and production efficiency. The company may also emphasize sustainability initiatives to align with industry trends. The company is investing in sustainable energy technology, including hydrogen, geothermal,

and CCUS to advance long-term solutions for a lower-carbon era. Investment of USD 0.80 billion was done for new energy portfolio. In terms of upstream capex investment, the company is planning to increase capex from CY2025 to CY2030 by CAGR 2.00% with annual capex spend over USD 500.00 billion through CY2030. Baker Hughes is focusing on increasing LNG capacity from 490.00 MTPA in CY2023 to 800.00 MTPA in CY2030.

- Strategy is based on three pillars: 1. Transforming current business to improve margins and cash flow through portfolio rationalization, cost improvement, and new business models 2. Driving organic and inorganic growth in high potential markets including industrial power and processes, industrial asset management, non-metallics, and chemicals 3. Strategic investments to drive lower carbon emissions in the energy and industrial sectors
- Differentiating factors: Baker Hughes is known for its cutting-edge chemical solutions tailored to optimize production, enhance recovery, and minimize environmental impact. It has strong presence in key oil and gas regions, providing localized support and expertise. It has commitment to develop environmentally sustainable chemical solutions and has strong track record of adhering to global environmental and safety standards.

2. ChampionX Corporation**:** It stands as a leading force in the global energy industry, distinguished for its unwavering commitment to innovation and excellence. With a rich heritage spanning decades, the company has evolved into a trusted partner for oil and gas operators worldwide, providing cutting-edge solutions that optimize production efficiency, enhance environmental stewardship, and ensure sustainable growth. Champion X specializes in delivering a comprehensive suite of integrated products and services, ranging from state-of-the-art artificial lift systems to advanced chemical technologies tailored for the unique challenges of oil and gas sector. In April 2024, it was announced that ChampionX will be acquired by SLB by Q1 CY2025. The investment plans and expansion strategy will be updated based on SLB strategies.

- Current business strategy involves 1. seeking opportunities to leverage production-optimization expertise into broader production solutions and remain focused on cost synergy initiatives 2. identifying opportunities to expand digitally enabled products 3. Leveraging global footprint to expand international sales 4. Building enterprise-wide continuous improvement program 5. Evolving portfolio for sustained growth.
- Differentiating factors: ChampionX has extensive portfolio of production chemicals covering all aspects of oil and gas production, from drilling to processing. It focuses on developing new technologies and formulations to address emerging challenges in the industry. It offers robust field services, including on-site support, monitoring, and optimization of chemical treatments with emphasis on proactive identification and resolution of production issues to minimize downtime and maximize output. It works closely with operators to develop and implement comprehensive chemical management programs.

3. Clariant Ltd**.:** Clariant's focus involves providing advanced chemical solutions tailored to enhance oil and gas production efficiency while prioritizing sustainability. Clariant's offerings include a variety of specialized products designed to address key challenges in the industry. These include corrosion inhibitors, scale inhibitors, and flow assurance chemicals. Clariant to invest USD 315-360 million in CY2025 with a focus on growth and regional expansion in China. The Group will direct more than one third of its growth capex to China to promote sustainable solutions in the world's largest specialty chemicals market. The plan is to generate >14 % of group sales in China by CY2025. It aims to grow sales by 4.00-6.00% annually, reach an EBITDA margin range of 19.00-21.00 % and generate a free cash flow conversion rate of around 40.00% by CY2025.

- In order to facilitate value creation and profitable growth, Clariant has taken strategic steps to accelerate innovation driven by sustainability, broaden its global footprint with a particular emphasis on China, and assure the disciplined execution of possible bolt-on acquisitions.
- Differentiating factors: Clariant invests heavily in research and development to create innovative chemical solutions. It holds numerous patents for unique chemical formulations and treatment methods. It is one of the pioneers in green chemistry to develop sustainable and biodegradable chemical products. It has robust global supply chain ensuring reliable delivery and support to clients worldwide. It develops customized chemical programs to meet the specific needs and challenges of each client.

Globally Baker Hughes Incorporated, ChampionX Corporation, Clariant Ltd. are among top players with % shares of 10.49%, 9.02%, 5.24% respectively. Dorf Ketal had 1.76% market share in CY2023. The companies have manufacturing and other operational facilities across North America, LATAM, EU, Africa, Middle East, and Asia. The production capacities of these key companies are highly integrated. These companies have swinging capacities, and the production levels vary on year-on-year basis. The avg. manufacturing capacity for specialty chemical blending is estimated to be more than 50.00KT in single manufacturing plant. Avg. utilization levels per plant are in the range of 75-85%.

Exhibit 3.17-2: Operating Matrices (CY2023)

Key parameters	Baker Hughes	Clariant	ChampionX	Dorf Ketal
Global presence	Operations in 120+ countries	Global reach across Asia Pacific, Europe, North America, LATAM, Middle East and Africa	Global reach in 60+ countries and has 40+ manufacturing locations	Significant presence in APAC, North America, Latin America regions
Mix of revenue from specialty chemicals for Hydrocarbons and others (estimated) in USD billion	3.20	1.60	2.76	0.54
Product coverage	Production chemicals, drilling and completion fluids, refinery specialty chemicals, etc.	Oilfield production chemicals, refinery process chemicals, refinery fuel additives, etc.	Production chemicals, drilling and completion fluids, etc.	Production chemicals, fuel additives, refinery process chemicals, etc.
Technical consulting	Yes	Yes	Yes	Yes
Green chemicals	No	No	Recently started using bio-based material for manufacturing chemical technologies products	Yes
EOR	Yes	Yes	Yes	Yes
Customized services	Yes	Yes	Yes	Yes
Digital solutions	Yes	Yes	Yes	No
Key customers	Petronas, Petrobras, bp, Eni, Equinor, etc.	International and national oil and gas companies, large integrated operators	International and national oil and gas companies, large integrated operators	International and national oil and gas companies
Revenue from key customers	During CY2023, no customer accounted for >10.00% share to the revenue of key competitors			

Source: Frost & Sullivan

In India, there are various manufacturers of specialty chemicals for hydrocarbons. Dorf Ketal, Thermax Ltd. ("Thermax"), Chemcon Speciality Chemicals Limited ("CSCL"), Imperial Oil field Chemicals Pvt. Ltd. ("Imperial"), Sicagen India Ltd. (Sicagen), etc. operates across various part of value chain. Most supplies in India are through tender process as the drilling and exploration companies are mostly PSU's. Dorf Ketal is the dominant player for specialty chemicals for hydrocarbons in India**.** Dorf Ketal had over 23.90% market share in India in CY2023.

Fuel additives:

The supply base for fuel additives is moderately fragmented with top 3 players with market share of ~30.00% in CY2023. Specialty chemical players with higher innovation capabilities dominate the market. These include companies like BASF, Innospec Fuel Specialties, and LANXESS. Dorf Ketal had a 7.78% share of the Global fuel additives market in CY2023. Dorf Ketal is largest player in India for fuel additives with a market share of 57.78% in CY2023.

Following table represents DK's product offering in comparison to the competitors:

Products	DK	BASF	LANXESS	Innospec
Cetane booster	✓	✓	×	✓
Octane booster	✓	×	×	✓
Deposit control additives	✓	✓	×	✓
Cold flow improvers	✓	✓	×	✓
Lubricity improvers	✓	✓	✓	✓
Antioxidants	✓	✓	✓	✓
Static current dissipators	✓	×	×	✓
Novel combustion improver	✓	×	×	×

Source: Company website and product datasheets

This market share also reflects the company's contribution to improving fuel quality, engine performance, and sustainability in the industry, highlighting its commitment to excellence and environmental responsibility in this vital sector.

The consolidation trend in the fuel additives market is driven by strategic motives such as increasing scale to achieve cost efficiencies, acquiring innovative technologies to stay competitive, and gaining access to established customer relationships to capitalize on high brand loyalty. Companies are merging and acquiring to expand their market presence and enhance their product portfolios.

The companies in this domain partner and work along with each other to gain higher market presence. For instance, in 2020 Clariant partnered with INTERTEC-Hess GmbH to support the scale-up of sustainable fuel production. In 2022, BASF partnered with Innospec to distribute a concentrated corrosion inhibitor (it is for use in fuel ethanol and fuel oxygenate blends) to ethanol plants in the USA.

Modified acid: BASF, Merck, Kemira, Olin Corporation, Tata Chemicals Ltd, ERCO, etc. are leading players of hydrochloric acid globally. In terms of modified hydrochloric acid, Fluid energy group (Acquired by Dorf Ketal) is the leading supplier in the world. Dorf Ketal accounted for 15.05% in addressable global market for modified hydrochloric acid in CY2023.

3.18 Market Presence Analysis of Dorf Ketal in Global Specialty Chemicals for Hydrocarbons Value Chain

Currently, the market in India is limited to export products with most companies having most of their production for export purpose. Most supplies in India are through tender process as the drilling and exploration companies are mostly PSU's. Strong technical capabilities around a specific chemistry have been the differentiating aspect for many suppliers.

Dorf-ketal is a renowned name in the specialty chemicals for hydrocarbons market in India. The company is engaged in the manufacturing of oilfield production chemicals, process chemicals for refinery and petrochemicals, fuel additives, etc. It operates across the value chain with intermediates/ingredients and formulations and engaged in service activities as part of the portfolio. Major products include- Corrosion Inhibition, Demulsifies, Water Clarifier, Biocides, Scale Inhibitors, H2S Scavenger, etc. Dorf Ketal is the only Indian player with cross-value chain integration. Dorf Ketal has been operating the Barmer field of Cairn Energy in Rajasthan.

Acquisition of Clariant's North American land oil business in 2022 provided access to 2000+ oilfield specialty chemical formulations, customers in North American market as well as oilfield service capabilities. ~65.00% of the company's sales are to major demand centers of North America, Middle East, and Brazil. Additionally, acquisition of Fluid Technology (Canada) provided unique solutions to the completion and stimulation market as well as scale removal and prevention technologies.

The company has established itself with focus on technology and R&D as the key differentiating factor. It has product patents, including those acquired from UOP Inc, DuPont and Johnson Mathey.

With state-of-the-art R&D headquartered in Taloja, India, and with parallel programs in Brazil, Singapore and Canada , the company's global research network has produced industry-leading results for over two decades. The strong market position is supported by customized solutions and support services. Dorf Ketal has strong positioning across value chain with presence in high margin nodes. Oilfield chemical intermediate synthesis offers to EBITDA margin of 15-25% while oilfield service offers up to 20.00% EBITDA margin. Clariant has presence in raw materials along with intermediates, chemical formulation and oilfield services. However, the EBITDA margin % for raw materials production is not attractive. Dorf Ketal has significant presence in chemical intermediates and oilfield services. The company have strengthened its business across value chain in oilfield services through mergers and acquisitions. One of the important acquisitions by Dorf Ketal was Clariant's North American Land Oil business in CY2023. The EBITDA margin in oilfield chemical formulations is up to 15.00%. Dorf Ketal is one of the leading players offering wide range of formulations globally.

3.19 Spend on Chemicals by Global Oil and Gas Players

Fluctuating oil prices significantly affect capital expenditure budgets, including spending on chemicals. Higher oil prices generally lead to increased investment in exploration and production activities, thereby boosting demand for oilfield specialty chemicals. The complexity of reservoir conditions, such as high temperature and high salinity, requires the use of advanced and often more expensive chemical solutions to maintain efficient production. Older oilfields and infrastructure may need more chemical treatments to maintain productivity and integrity, leading to increased spending. Companies continually seek ways to optimize costs, including negotiating better prices with chemical suppliers and investing in technologies that reduce chemical consumption.

Total expenditure for Shell were USD 290,556.00 million in CY2023. Expense on specialty chemicals for hydrocarbons was around USD 350.00-450.00 million which is around 0.14% of the total expenditure by the company. Similarly, for ExxonMobil the annual spent on specialty chemicals for hydrocarbons was around 0.63% of its total adjusted operating costs and for Chevron it was 0.26% of the total costs and deductions in CY2023. Cost of specialty chemicals for hydrocarbons represents a small component of oil & gas player's total cost of operations. These oil and gas giants have detailed and thorough management of change processes to protect against a problem in transition. Brand recognition is important to the key oil & gas players. It reflects trust that is necessary to have confidence that the change will meet and exceed expectations.

Exhibit 3.19-1: Estimated Spend on Specialty Chemicals for Hydrocarbons by Oil Players, CY2023

Company Name	Estimated spend on specialty chemicals for hydrocarbons (USD million) per annum
Saudi Aramco	2,900-3,000
PetroChina	600-700
Exxon	500-600
Petrobras	450-500
Chevron	450-500
TotalEnergies	~400
Shell	350-450
ConocoPhillips	300-350
BP	300-350

Note: Based on estimates of share of global oil production volume and global oilfield specialty chemicals demand in CY2023, Source: Frost & Sullivan

3.20 Impact of Enhanced Oil Recovery

Enhanced Oil Recovery (EOR) techniques are designed to increase the amount of oil that can be extracted from reservoirs beyond what is possible with primary and secondary recovery methods. EOR relies heavily on various chemicals to improve oil mobilization and recovery efficiency.

- Global energy demand: As global energy demand continues to grow, maximizing oil recovery from existing fields becomes increasingly important. EOR provides a solution to meet this demand, leading to higher consumption of the necessary chemicals.
- Greater chemical injection needs: Techniques such as polymer flooding, surfactant-polymer flooding, and alkaline-surfactant-polymer flooding require large quantities of chemicals. These methods involve injecting chemicals into the reservoir to reduce oil-water interfacial tension, improve sweep efficiency, and enhance oil displacement.

- Advancements in EOR technologies: Ongoing research and development are leading to more efficient and effective chemical formulations. Innovations such as nanoparticles, smart water, and advanced polymers can enhance oil recovery processes, driving demand for these new chemicals.

- Economic and Environmental Factors: EOR can be more cost-effective than drilling new wells, particularly in the context of fluctuating oil prices. As oil companies seek to maximize production from existing assets, the use of EOR chemicals will increase. Stricter environmental regulations may drive the adoption of EOR methods that minimize the environmental impact. Chemicals that reduce the need for new drilling and enhance recovery from existing wells align with these regulatory trends.

3.21 India Specialty Chemicals for Hydrocarbons Market Outlook

Compared to the global market, demand for specialty chemicals for hydrocarbons in India is low. The market was estimated at USD 0.54 billion for the year CY2023. This is mainly because the oil & gas production in India is <1% of the global market. The total production of specialty chemicals for hydrocarbons in India was valued at USD 1 billion for CY2023. The export value for specialty chemicals for hydrocarbons was USD 0.46 billion in CY2023. Dorf Ketal is leading exporter of such chemicals from India to countries like North America, Middle East, Russia, etc.

According to the IEA (India Energy Outlook 2021), primary energy demand is expected to nearly double to 1,123 million ton of oil equivalent, as India's gross domestic product (GDP) is expected to increase to USD 8.60 trillion by 2040. India's crude oil production in FY2023 stood at 29.20 MMT.

This is supported by the growing Oil & gas explorations & production rate by state owned NOCs i.e., ONGC, Indian Oil, etc. India plans to increase its exploration area of oil and gas to 1 million sq. km. by 2030 with a view to increase domestic output.

India's oil and gas production is expected to achieve a mid-decade peak around CY2028 and hence a significant year for oilfield specialty chemical demand. Below are few examples of announcements by key players to expand business operations and invest significant funds for increase in capacity:

- In May 2022, ONGC announced plans to invest USD 4.00 billion from CY22-25 to increase its exploration efforts in India. ONGC plans to work on 50% of the 1 million sq. km of prohibited areas released by the Government of India for exploration and production.

- In February 2023, Oil India Limited commenced the project for India's first exploratory oil well in Mahanadi Onshore Basin in Odisha under OALP. OIL currently owns and operates 13 drilling rigs and 14 work-over rigs, besides charter hiring drilling rigs based on operational requirement.

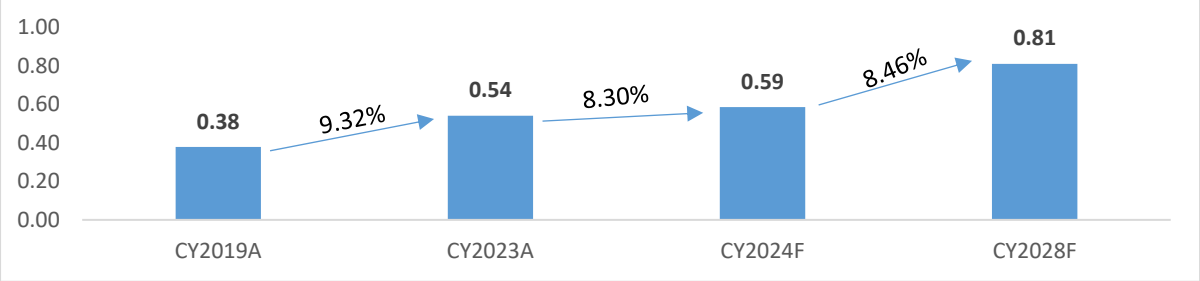
- IOCL announced to invest INR 30,800 crore in CY2025 for expansion of 7 refineries in India.

- HPCL to invest INR 12,500 crore for business expansion in FY25.

The market for specialty chemicals for hydrocarbons is estimated to increase from USD 0.54 billion in CY2023 to USD 0.81 billion in CY2028 with CAGR of 8.40%. The market for Fuel Additives in India was valued at USD 0.14 Bn in the year CY2023. Since the implementation of Bharat Stage IV emission norms across the country in 2017, the market for fuel additives have seen considerably higher growth. Further, The Central Government has mandated that every vehicle manufacturer, each two-wheels and four-wheels must manufacture, sell and register BS6 (BSVI) vehicles from 1 April 2020. India being a price sensitive market and as additives represent an additional cost, fuel marketers are always looking to reduce treat rates while also meeting fuel specifications.

Drivers of industry growth: Recent discoveries of oil and gas reserves in India, particularly in offshore regions, have led to increased exploration and production activities, which require significant amounts of oilfield specialty chemicals. The development of unconventional resources like shale gas and coal bed methane (CBM) necessitates the use of oilfield specialty chemicals for extraction, further driving market growth. The Indian government's initiatives like HELP to streamline policies and promote investment in the oil and gas sector encourage exploration and production activities, increasing the demand for oilfield specialty chemicals. The adoption of EOR techniques to boost production from mature oilfields is driving the demand for advanced oilfield specialty chemicals like polymers, surfactants, and alkalis.

Exhibit 3.21-1: India Market of Specialty Chemicals for Hydrocarbons by Value in USD Bn (CY2019, CY2023, CY2024, CY2028)



Note: A: Actual, F: Forecast, Source: Frost & Sullivan

3.22 Global Organometallic Titanates and Zirconates Market

3.22.1 Overview Global Organometallic Titanates and Zirconates Market

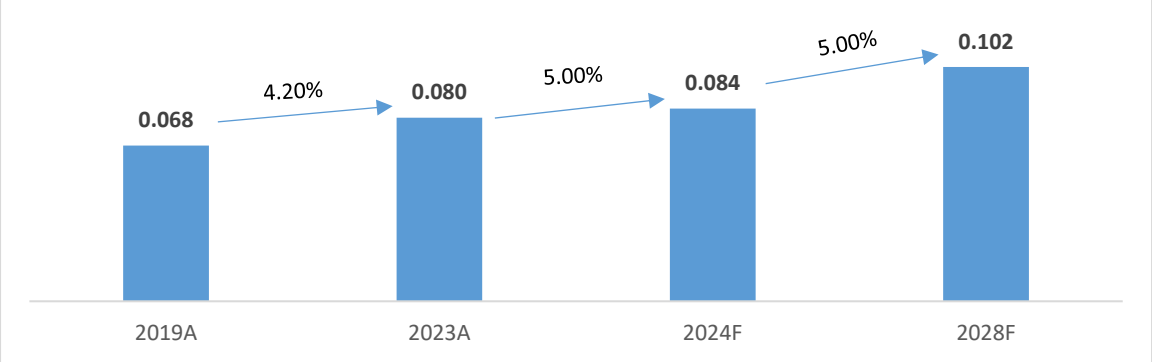
Organometallic titanates are chemical compounds containing organic groups bonded to titanium atoms within the same molecule. These compounds, featuring metal-to-carbon (Ti-C) bonds, have various applications in the oil and gas industry due to their unique properties. In the petrochemical sector, organometallic titanates are used for below functions:

1. **Catalysis**: They act as catalysts or co-catalysts in chemical reactions, improving reaction rates and selectivity in the production of specific chemicals and materials.
2. **Cross-Linking Agents**: These compounds enhance the mechanical and chemical properties of elastomers, sealants, and adhesives used in the industry.

The global market for organometallic titanates and zirconates is projected to grow from USD 0.08 billion in CY2023 to USD 0.10 billion in CY2028 with CAGR of 5.00%. The global market for organometallic titanates and zirconates is experiencing growth driven by several key factors, including the rising demand in coatings, adhesives, and sealants across industries like automotive, aerospace, and construction. The expansion of the electronics and semiconductor sectors, particularly in APAC, is further fueling this growth, as these compounds are essential in the production of high-performance materials. Additionally, advancements in nanotechnology, and rapid industrialization in emerging economies are contributing to the market's expansion.

The market in India for organometallic titanates and zirconates is really small compared to global market. For CY2023, the market in India was around USD 0.73 million.

Exhibit 3.22.1-1: Global Organometallic Titanates and Zirconates Market by Value in USD Bn, Split by Applications (CY2019, CY2023, CY2024, CY2028)



Note: A: Actual, F: Forecast; Source: Frost & Sullivan

3.22.2 Market Segmentation by Applications

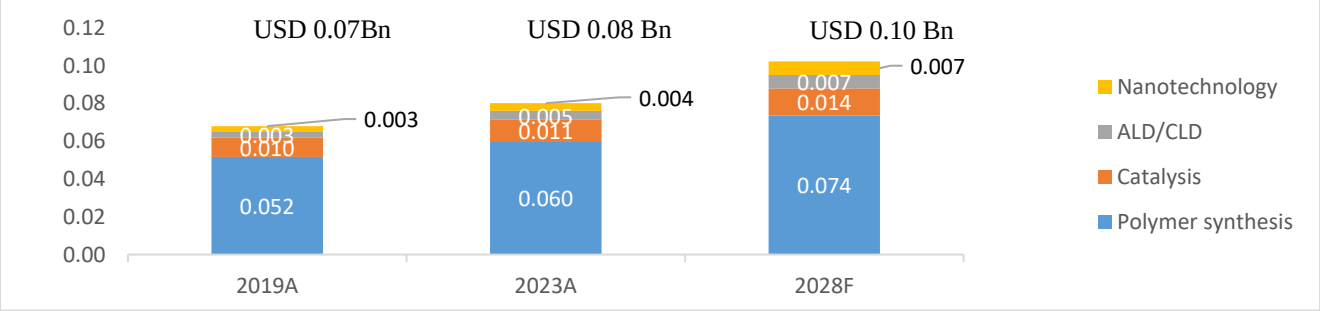
Organometallic titanates and zirconates are versatile compounds that find applications as catalysts in diverse segments of the plastics industry. One of their key roles is as direct catalysts in the manufacturing of Polycarbonate (PC), Polyethylene Terephthalate (PET) and Polybutylene Terephthalate (PBT), two widely used thermoplastic polymers with exceptional mechanical and thermal properties.

In the production of PBT, organometallic titanates and zirconates are used as catalysts in the esterification and polymerization processes. These catalysts aid in the formation of the PBT polymer chains, resulting in the creation of materials commonly found in beverage bottles, packaging films, and textile fibers. Their use ensures the production of PBT with the desired properties, such as clarity, strength, and resistance to heat and chemicals.

Additionally, organometallic titanates and zirconates serve as coordination catalysts for specific grades of Polyethylene (PE) and Polypropylene (PP), as well as in the manufacture of copolymers derived from these base polymers. These catalysts play a pivotal role in tailoring the properties of PE and PP, allowing manufacturers to produce materials suitable for various applications. For instance, metallocene catalysts enable the fine-tuning of factors like molecular weight and crystallinity, leading to the production of high-performance plastics ideal for both packaging and industrial uses. In summary, organometallic titanates and zirconates are invaluable catalysts in the plastics industry, serving as direct catalysts for PET and PBT production, as well as coordination catalysts for the customization of Polyethylene and Polypropylene and the synthesis of copolymers. Their versatility and ability to fine-tune properties continue to drive innovation in plastic materials, contributing to their widespread use in countless everyday products.

Polymer synthesis accounted for 75.00% market share in global organometallic titanates and zirconates market in CY2023. Catalysis accounted for 14.00% market share in global organometallic titanates market in CY2023. Atomic layer deposition (ALD) accounted 6.00% market share and nanotechnology accounted for 5.00% market share in global organometallic titanates market in CY2023.

Exhibit 3.22.2-1: Global Organometallic Titanates and Zirconates Market by Value in USD Bn, Split by Applications (CY2019, CY2023, CY2028)



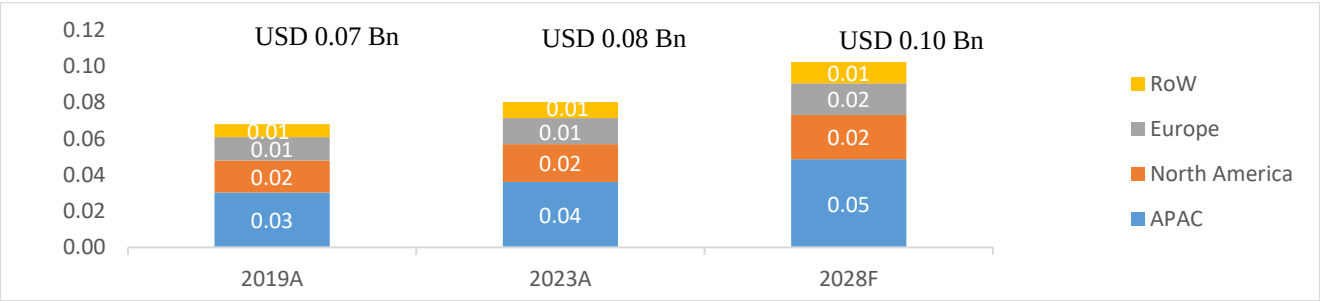
Applications	CAGR CY2019-23 in %	CAGR CY2023-28 in %
Polymer synthesis	3.86%	4.15%
Catalysis	2.42%	5.00%
ALD/CLD	9.06%	8.29%
Nanotechnology	10.18%	12.31%

Note: A: Actual, F: Forecast; Source: Frost & Sullivan

3.22.3 Market Segmentation by Region of Organometallic Titanates and Zirconates Market

In CY2023, the APAC region led the global organometallic titanates and zirconates market with a 45.00% share, followed by North America at 26.00% and Europe at 18.00%. This dominance is expected to continue, with APAC's market share anticipated to grow to 47% by CY2028.

Exhibit 3.22.3-1: Global Organometallic Titanates and Zirconates Market by Value in USD Bn, Split by Region (CY2019, CY2023, CY2028)



Regions	CAGR CY2019-23 in %	CAGR CY2023-28 in %
APAC	4.49%	6.14%
North America	4.20%	3.33%
Europe	2.80%	3.81%

ROW	5.42%	5.94%

Note: A: Actual, F: Forecast; Source: Frost & Sullivan

3.22.4 Dorf Ketal Positioning in Organometallics Titanates and Zirconates Market

In the organometallic titanates and zirconates market, Dorf Ketal provides products such as their Tyzor™ brand, which are used in various applications including the production of polyolefins, esterification, and transesterification reactions. Tyzor® Activate™ organometallic titanate catalysts replace the antimony used during PET manufacturing process. Small quantities of antimony remain in the plastic product, with the potential to enter into food and drinks. Chronic exposure to antimony compounds may lead to serious health issues including cancer, heart, liver and kidney problems. Dorf Ketal catalysts help in reducing the sever effects of antimony compounds.

Dorf Ketal had market share of 64.17% in global market of organometallic titanates and zirconates in CY2023. Other players like Borica had market share of 20.00% while Jian Bian had market share of 10.00% in CY2023. In India, Dorf Ketal is the dominant supplier and accounted for 95.11% market share in CY2023.

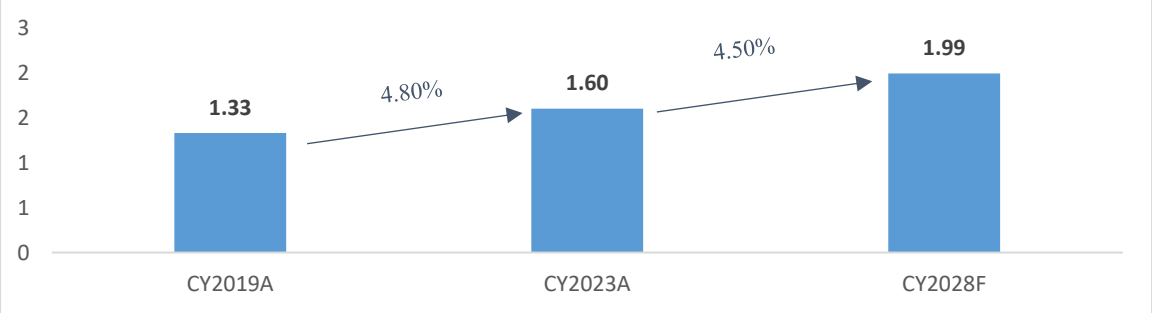
3.23 Overview of Other Specialty Chemicals Market

3.23.1 Overview of India Optical Brighteners Market

Optical brighteners are used to enhance the brightness and appearance of fabrics by absorbing ultraviolet light and re-emitting it as visible blue light, counteracting yellowing and giving a whiter and brighter appearance. It is used during the finishing process to improve whiteness and brightness. It's applied to polyester, nylon, and other synthetic fibers to enhance color brightness and quality. It is added to dyes and printing inks to provide vibrant and brighter colors. Optical brighteners are added to paper products to improve their whiteness and brightness, making them more visually appealing and suitable for printing and writing. In detergents and cleaning products, these are included in detergents to make clothes appear cleaner and brighter by masking yellowing and dullness. It is used in both liquid and powder detergents to improve the appearance of laundered clothes.

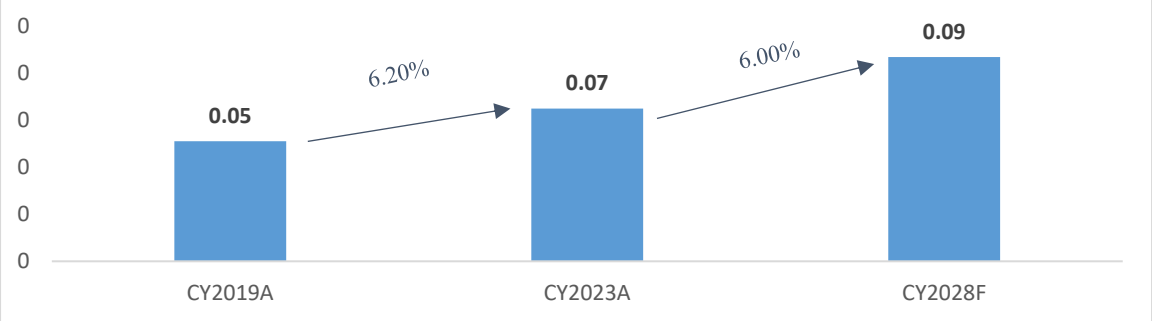
The global market for optical brighteners is projected to increase from USD 1.60 billion in CY2023 to USD 1.99 billion in CY2028. The market for Indian optical brighteners was valued at USD 0.07 billion in CY2023 and is estimated to increase to USD 0.09 billion in CY2028 with CAGR of 6.00%.

Exhibit 3.23.1-1: Global Optical Brighteners Market by Value in USD Bn (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast; Source: Frost & Sullivan

Exhibit 3.23.1-2: India Optical Brighteners Market by Value in USD Bn (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast; Source: Frost & Sullivan

Growth Drivers:

- Increasing demand in textiles and apparel: The expanding textile and apparel industry in India is a significant driver for the optical brighteners market. The market for textile and apparel industry is projected to increase from USD 197.60 billion in CY2023 to USD 350.00 billion in CY2029 with CAGR of 10.00%.
- Growth in detergent and cleaning products: The surge in the use of detergents and cleaning products in both domestic and industrial sectors is contributing to the demand for optical brighteners in India.
- Technological advancements and R&D: Development of new formulations and products that offer superior performance and comply with stringent environmental regulations are driving the demand of optical brighteners
- Expansion in paper and pulp industry: The growth of the paper and pulp industry, driven by increasing demand for high-quality paper products, is boosting the use of optical brighteners.
- Advancements in plastic and polymer applications: Increasing use of optical brighteners in plastics and polymers to improve their aesthetic appeal and brightness. Advancements in plastic applications are driving the demand of optical brighteners.

Challenges:

- Environmental and regulatory issues: There are stringent environmental regulations regarding the use and disposal of chemicals in various industries. Manufacturers are required to innovate and develop eco-friendly optical brighteners to comply with regulations. This directly impacts the overall operations expenditure.
- Raw material availability and price volatility: Fluctuations in availability and prices of raw materials used in the production of optical brighteners lead to unpredictable production costs and supply chain disruptions, affecting the stability of supply and pricing strategies.
- Technical challenges: Developing optical brighteners that are effective across a wide range of applications and materials is one of the key challenges in the industry. Significant R&D efforts are required to create versatile and high-performing products, which can be time-consuming and costly.
- Adoption of sustainable practices: To reduce environmental impact, there is pressure to switch to sustainable manufacturing processes and raw materials. This transition can be costly and require significant changes in production methods, infrastructure, and supply chains.

Key Players in India:

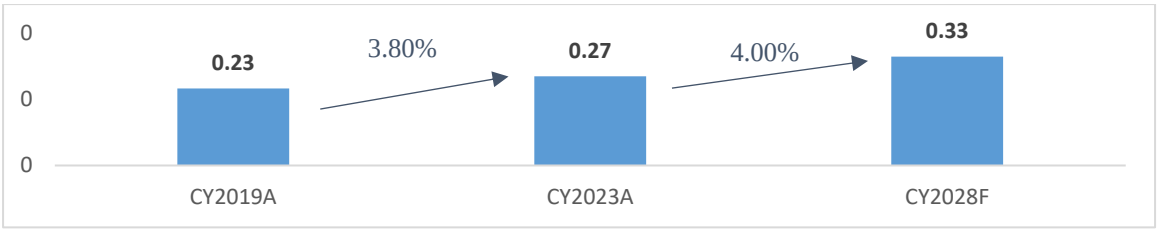
- Both domestic Indian manufacturers and international players serve the optical brightener market in India. Dorf Ketal (Khyati Chemicals), Deepak Nitrite Ltd., Paramount Minerals & Chemicals, Archroma India Pvt. Ltd., Daikaffil, Atul Ltd., Sarex textile chemicals, etc. are major manufacturers of optical brighteners in India. Dorf Ketal accounted for 16.30% market share in Indian optical brighteners market in CY2023. Deepak Nitrite was the leading manufacturer of optical brighteners in India with market share of 55.50% in CY2023. Dorf Ketal became second largest producer of optical brighteners in India after acquisition of Khyati chemicals in CY2022.

3.23.2 Overview of India 3,5 Xylenols Market

3,5-Xylenol, also known as m-xylenol, is a chemical compound used primarily as an intermediate in the production of various chemicals and compounds. 3,5-Xylenol serves as a key intermediate in the synthesis of antioxidants, pharmaceuticals, and agrochemicals. 3,5 xylenol is widely used as raw material for resin, pesticide, medicine, dye and fragrance applications. It is also used in the synthesis of highly efficient and broad-spectrum antibacterial drugs. The global market for 3,5 xylenols is projected to increase from USD 0.27 billion in CY2023 to USD 0.33 billion in CY2028 with CAGR of 4.00%.

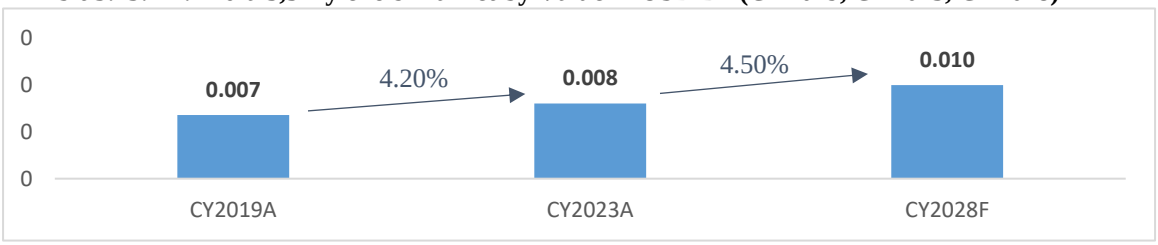
There is a steady demand for 3,5-Xylenol in India driven by its use in industries such as pharmaceuticals, agrochemicals, dyes and pigments, ore flotation agents, etc. Disinfectant like Para Chloro Meta Xylenol, herbicides, drugs like metaxalone, acetretin & etretinate, etc. are important applications of 3,5 Xylenol. In India, the market for 3, 5 xylenols is projected to increase from USD 0.008 billion in CY2023 to USD 0.010 billion in CY2028.

Exhibit 3.23.2-1: Global 3,5 Xylenols Market by Value in USD Bn (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast; Source: Frost & Sullivan

Exhibit 3.23.2-2: India 3,5 Xylenols Market by Value in USD Bn (CY2019, CY2023, CY2028)



Note: A: Actual, F: Forecast; Source: Frost & Sullivan

Growth Drivers:

- Industrial applications demand growth: 3,5-Xylenol serves as a crucial intermediate in the production of antioxidants, pharmaceuticals, agrochemicals, and polymer additives. The growing demand for these end products, driven by sectors such as healthcare, agriculture, and manufacturing, directly increases the demand for 3,5-Xylenol.
- Expansion of pharmaceutical and agrochemical sectors: The pharmaceutical and agrochemical industries in India are expanding, driven by increasing healthcare needs and agricultural productivity demands. It is integral in the synthesis of pharmaceutical ingredients and agrochemical formulations, bolstering its market demand. The pharmaceutical industry in India is projected to increase from USD 59.20 billion in CY2023 to USD 130.00 billion in CY2029 at CAGR 14.01%. On the other hand, the agrochemicals industry is projected to increase from USD 238.10 billion in CY2023 to USD 383.00 billion in CY2029 at CAGR 8.24%.
- Technological advancements and innovation: Ongoing research and development efforts aimed at enhancing the efficiency and versatility of 3,5-Xylenol in various applications. Innovations in production techniques and product formulations contribute to higher-quality outputs and expanded application possibilities, stimulating market growth.
- Global and domestic manufacturing capabilities: Local production capabilities and access to global suppliers ensure a stable supply of 3,5-Xylenol to meet growing industrial demands. This supports scalability and reliability in the supply chain, facilitating sustained market growth and customer satisfaction.

Challenges:

- Regulatory hurdles in export markets: There are challenges in navigating regulatory requirements and trade barriers in export markets for 3,5-Xylenol products. Compliance with international standards and regulations can pose logistical and administrative challenges, affecting market expansion and global competitiveness.
- Technological and production challenges: There are technical complexities and production challenges associated with synthesizing high-purity 3,5-Xylenol.
- Market competition and pricing pressures: There is intense competition from global and domestic manufacturers in the chemical industry for 3,5 Xylenol. Price competition can lead to margin pressures and the need for differentiation through product quality, reliability, and customer service.

Key Players:

- Dorf Ketal is key dominant player involved in manufacturing of 3,5 Xylenol in India. Dorf Ketal offers high-purity 3,5-xylenols, ensuring consistent performance in applications. It accounted for 79.10% market share in CY2023 in India. Globally Sasol, TCI chemicals, Deza, Dorf Ketal, Nanjing Datang Chemical, etc. were key players for 3,5 xylenols in CY2023.

4 Competition Benchmarking

4.1 Financial Analysis of Global Competitors:

Exhibit 4.1-1: Summary of Financial Benchmarking – Key Performance Parameters (FY2023)

Parameters	Baker Hughes	Clariant	ChampionX	Innospec
Operating Revenue (USD million)	25,506.00	4,865.30	3,758.29	1,948.80
EBITDA (USD million)	3,404.00	506.87	693.24	200.90
EBITDA Margin (%)	13.35%	10.42%	18.45%	10.31%
PAT (USD million)	1,970.00	236.76	318.72	139.10
PAT Margin (%)	7.72%	4.87%	8.48%	7.10%
RoE (%)	12.69%	9.77%	19.19%	12.10%
ROCE (%)	10.76%	6.80%	19.65%	13.53%
Total Borrowings (USD million)	6,020.00	1,499.50	600.49	-
Gross Fixed Asset Turnover Ratio (in X times)	2.41	1.22	2.42	3.73
Net Debt/Equity	0.22	0.39	0.23	-0.14
Net Debt/EBITDA	0.99	1.89	0.54	-0.79
Net Working Capital Days	12	50	38	61

Note: FY ending 31 December; Source: Annual reports, Frost & Sullivan

- Operating Revenue:

Exhibit 4.1-2: Operating Revenue of Key Competitors

Company Name	Operating Revenue in USD Million					Revenue Growth (Y-O-Y)	
	FY21	FY22	FY23	H1 FY24	CAGR (FY 21-23) %	FY22	FY23
Baker Hughes	20,502.00	21,156.00	25,506.00	13,557.00	11.54%	3.19%	20.56%
Clariant	4,782.11	5,439.39	4,865.30	2,438.37	0.87%	13.74%	-10.55%
ChampionX	3,074.99	3,805.95	3,758.29	1,815.41	10.55%	23.77%	-1.25%
Innospec	1,483.40	1,963.70	1,948.80	935.20	14.62%	32.38%	-0.76%

Note: FY ending 31 December; Revenue from Operations is as per the Restated Consolidated Financial Information for the relevant year; Revenue Growth has been calculated as incremental revenue from operations between the relevant year and the previous year as a percentage of revenue from operations of the previous year; Source: Annual reports, Frost & Sullivan

- EBITDA and EBITDA margin:

Exhibit 4.1-3: EBITDA and EBITDA margin of Key Competitors

Company Name	EBITDA in USD Million				EBITDA margin in %				EBITDA Growth (Y-O-Y)	
	FY21	FY22	FY23	H1 FY24	FY21	FY22	FY23	H1 FY24	FY22	FY23
Baker Hughes	2,415.00	2,246.00	3,404.00	2,052.00	11.78%	10.62%	13.35%	15.14%	-7.00%	51.56%
Clariant	681.44	281.49	506.87	380.48	14.25%	5.18%	10.42%	15.60%	-58.69%	80.07%

ChampionX	441.89	481.60	693.24	372.15	14.37%	12.65%	18.45%	20.50%	8.99%	43.95%
Innospec	174.80	227.40	200.90	112.70	11.78%	11.58%	10.31%	12.05%	30.09%	-11.65%

Note: EBITDA of the peers is Calculated by adding total tax expenses, finance costs and depreciation & amortization expenses to the profit after tax for the Year/ period and reducing the Other Income. Further in case of Clariant , Share of profit from Associates is reduced, to/from profit after tax in order to calculate the EBITDA.; EBITDA growth has been calculated as incremental EBITDA between the relevant year and the previous year as a percentage of EBITDA of the previous year; EBITDA Margin is calculated as EBITDA as a percentage of Revenue from Operations for the relevant year.
Note 2: Baker Hughes: Other revenue calculated, EBIT formula retained. Checked against operating profit for the company which has been reported as the same number calculated; Clariant: Other revenue calculated, EBIT formula retained. Checked against operating profit for the company which has been reported as the same number calculated; Innospec: Other revenue calculated, EBIT formula retained. Checked against operating profit for the company which has been reported as the same number calculated
Note 3: ChampionX: EBIT has been calculated since the operating profit has been mentioned only as part of reconciliation where a disclaimer has been provided that corporate and others includes non controlling interest. Corporate and other includes costs not directly attributable or allocated to reportable segments such as overhead and other costs pertaining to corporate executive management and other administrative functions, and the results attributable to noncontrolling interest. Additionally, the sales and expenses related to the Cross Supply and Product Transfer Agreement with Ecolab were included within Corporate and other from June 3, 2020, the date of the Merger, through June 30, 2023. Beginning, July 1, 2023, these sales and expenses are recognized in the Production Chemical Technologies segment; H1 FY24 is un-annualized; Source: Annual reports, Frost & Sullivan

- Restated PAT and PAT margin:

Exhibit 4.1-4: Restated PAT and PAT margin of Key Competitors

Company Name	PAT in USD Million				PAT margin in %			
	FY21	FY22	FY23	H1 FY24	FY21	FY22	FY23	H1 FY24
Baker Hughes	-330.00	-578.00	1,970.00	1,044.00	-1.61%	-2.73%	7.72%	7.70%
Clariant	319.39	-105.69	236.76	207.32	6.68%	-1.94%	4.87%	8.50%
ChampionX	114.24	156.56	318.72	168.55	3.72%	4.11%	8.48%	9.28%
Innospec	93.10	133.00	139.10	72.60	6.26%	6.78%	7.10%	7.76%

Note: Restated profit after tax for the Year us as per the Restated Consolidated Financial Information for the relevant year; Restated profit after tax for the Year margin has been calculated as Restated profit after tax for the Year as a percentage of Revenue from Operations for the relevant year; FY ending 31 December, Source: Annual reports, Frost & Sullivan

- Return on Equity and Return on Capital Employed:

Exhibit 4.1-5: RoE and RoCE of Key Competitors

Company Name	RoE in %				RoCE in %			
	FY21	FY22	FY23	H1 FY24	FY21	FY22	FY23	H1 FY24
Baker Hughes	-1.97%	-3.98%	12.69%	6.64%	5.58%	5.59%	10.76%	6.87%
Clariant	11.48%	-4.02%	9.77%	7.49%	8.88%	0.78%	6.80%	4.57%
ChampionX	6.51%	9.33%	19.19%	9.75%	7.90%	10.01%	19.65%	10.38%
Innospec	9.01%	12.78%	12.10%	6.07%	12.36%	17.25%	13.53%	7.33%

Note: Return on Equity has been calculated as Restated profit after tax for the Year as a percentage of Total equity at the end of the year; Return on Capital Employed is calculated as EBIT for the year as a percentage of Capital Employed. Wherein EBIT is calculated by adding total tax expenses & finance costs to the profit after tax for the Year/ period and reducing the Other Income and Capital Employed is calculated as Total Equity plus Current and non-current borrowings plus current and non-current lease liabilities; FY ending 31 December, H1 FY24 is un-annualized, Source: Annual reports, Frost & Sullivan

- Total Borrowings:

Exhibit 4.1-6: Total Borrowings of Key Competitors

Company Name	Total Borrowings in USD million			
	FY21	FY22	FY23	H1 FY24
Baker Hughes	6,727.00	6,657.00	6,020.00	5,895.00
Clariant	2,131.82	1,531.99	1,499.50	2,168.62
ChampionX	724.51	627.95	600.49	599.07
Innospec	0.10	-	-	-

Note: Total Borrowings is the sum of current and non-current borrowings; FY ending 31 December; Source: Annual reports, Frost & Sullivan

- Net debt / equity and Net Debt/EBITDA:

Exhibit 4.1-7: Net Debt / Equity and Net Debt/EBITDA of Key Competitors

Company Name	Net Debt / Equity				Net Debt/EBITDA			
	FY21	FY22	FY23	H1 FY24	FY21	FY22	FY23	H1 FY24
Baker Hughes	0.17	0.29	0.22	0.23	1.19	1.86	0.99	1.76
Clariant	0.60	0.43	0.39	0.74	2.46	3.98	1.89	5.40
ChampionX	0.33	0.28	0.23	0.18	1.32	0.97	0.54	0.83
Innospec	-0.10	-0.10	-0.14	-0.16	-0.61	-0.45	-0.79	-1.70

Note: Net Debt is calculated as sum of current & non-current borrowing and current & non-current leases as reduced by Cash and Cash Equivalents and Bank balances other then cash and cash equivalents; Net debt / equity is calculated as Net Debt as number of times of Total Equity; Net debt / EBITDA is calculated as net debt as number of times of EBITDA for the year; FY ending 31 December, H1 FY24 is un-annualized
Source: Annual reports, Frost & Sullivan

- Gross fixed asset turnover and Net working capital days:

Exhibit 4.1-8: Gross Fixed Asset Turnover And Net Working Capital Days of Key Competitors

Company Name	Gross Fixed Asset Turnover in X times				Net Working Capital Days			
	FY21	FY22	FY23	H1 FY24	FY21	FY22	FY23	H1 FY24
Baker Hughes	2.08	2.19	2.41	1.24	38	30	12	15
Clariant	1.22	1.38	1.22	NA	28	54	50	72
ChampionX	2.20	2.67	2.42	1.16	56	41	38	36
Innospec	3.21	4.21	3.73	NA	65	63	61	63

Note: Gross fixed assets turnover is calculated as Revenue from operations for the year as a number of times of Gross block of property plant and equipment of the company as at the respective year end; Net working capital days is calculated as current assets minus current liabilities divided by the revenue from operations and multiplied by 365 days. Wherein current assets is considered as Total Current assets as reduced by Cash and Cash Equivalents and Bank balances other than cash and cash equivalents and current liabilities is considered as Total current liabilities as reduced by the current borrowings and current lease liabilities; H1 FY24 is un-annualized, FY ending 31 December
Source: Annual reports, Frost & Sullivan

4.1.1 Operational Analysis of Global Competitors

- **Geography Wise Revenue (FY2023):**

Exhibit 4.1.1-1: Geography Wise Revenue of Key Companies

Company Name	Baker Hughes (Oilfield services)	Clariant	ChampionX	Innospec
North America	26.80%	29.00%	62.95%	65.31%
LATAM	17.97%		14.90%	2.62% (ROW)
EU, CIS, Africa	17.28%	41.00% (incl. Middle east)	6.80%	49.20%
Middle East and Asia	37.95%	30.00% (Asia only)	15.35%	Sales between areas -17.13%

Note: FY ending 31 December; Source: Annual reports, Frost & Sullivan

- Revenue breakdown by product segments in % (FY2023):

Exhibit 4.1.1-2: Revenue Breakdown By Product Segments in % (FY2023)

Company name	Revenue breakdown by product segments
Baker Hughes	Oilfield services and equipment: 60.23%, Industrial & Energy Technology: 39.77%
Clariant	Care Chemicals: 53.00%, Catalysts: 22.85%, Adsorbents & Additives: 24.15%
ChampionX	Production Chemical Technologies: 63.98%, Production & Automation Technologies: 26.69%, Drilling Technologies: 5.74%, Reservoir Chemical Technologies: 2.56%, Corporate and other: 1.03%
Innospec	Performance Chemicals: 28.82%, Fuel Specialties: 35.71%, Oilfield Services: 35.47%

Note: FY ending 31 December; Source: Annual reports, Frost & Sullivan

4.2 Financial Analysis of Indian competitors:

Particulars	Units	Dorf Ketal Chemicals India Limited				SRF Limited				Fine Organics Industries Limited				Vinati Organics Limited				Navin Fluorine International Limited				Gujarat Fluorochemicals Limited				Atul Limited			
		On the basis of Restated Financial Statements				On the basis of Consolidated Financial Statements				On the basis of Consolidated Financial Statements				On the basis of Consolidated Financial Statements				On the basis of Consolidated Financial Statements				On the basis of Consolidated Financial Statements				On the basis of Consolidated Financial Statements			
		Sep 30, 2024	FY24	FY23	FY22	Sep 30, 2024	FY24	FY23	FY22	Sep 30, 2024	FY24	FY23	FY22	Sep 30, 2024	FY24	FY23	FY22	Sep 30, 2024	FY24	FY23	FY22	Sep 30, 2024	FY24	FY23	FY22	Sep 30, 2024	FY24	FY23	FY22
Revenue from Operations	(Rs. In Million)	29,613.62	54,795.39	38,664.81	25,895.35	68,884.20	1,31,385.20	1,48,702.50	1,24,336.60	11,455.05	21,229.52	30,230.77	18,762.59	10,780.30	18,999.57	20,847.06	16,155.12	10,422.40	20,650.10	20,774.00	14,533.60	23,640.00	42,808.17	56,846.62	39,535.89	27,148.80	47,256.80	54,275.20	50,808.90
Revenue Growth (Year on year)	(in %)	NA	41.72%	49.31%	NA	NA	-11.65%	19.60%	NA	NA	-29.78%	61.12%	NA	NA	-8.86%	29.04%	NA	NA	-0.60%	42.94%	NA	NA	-24.70%	43.78%	NA	NA	-12.93%	6.82%	NA
Product wise Revenues																													
- Specialty Chemicals for Hydrocarbon	(Rs. In Million)	24,031.92	44.412.78	27,035.45	16,676.45	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
- Industrial Specialty Chemicals	(Rs. In Million)	5,581.70	10,382.61	11,629.36	9,218.90	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Revenue split by Regions																													
- USA	(Rs. In Million)	7,650.55	15,690.86	6,032.47	4,634.74	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
- India	(Rs. In Million)	6,407.06	12,702.20	10,208.96	5,987.58	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
- Brazil	(Rs. In Million)	3,710.06	7,673.56	6,001.11	4.077.62	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
-Others	(Rs. In Million)	11,845.95	18,728.77	16,422.27	11,195.41	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
EBITDA	(Rs. In Million)	4,751.90	9,504.20	7,311.67	3,818.07	11,414.60	25,841.10	35,292.00	31,032.00	2,903.45	5,308.27	8,293.09	3,634.78	2,581.40	4,697.20	5,954.21	4,340.82	2,077.00	4,504.00	5,503.00	3,548.00	5,570.00	9,073.63	19,652.87	11,684.82	4.659.70	6,463.90	7,786.80	9,196.00
EBITDA Growth (Year on year)	(in %)	NA	29.99%	91.50%	NA	NA	-26.78%	13.73%	NA	NA	-35.99%	128.16%	NA	NA	-21.11%	37.17%	NA	NA	-18.15%	55.10%	NA	NA	-53.83%	68.19%	NA	NA	-16.99%	-15.32%	NA
EBITDA Margin	(in %)	16.05%	17.34%	18.91%	14.74%	16.57%	19.67%	23.73%	24.96%	25.35%	25.00%	27.43%	19.37%	23.95%	24.72%	28.56%	26.87%	19.93%	21.81%	26.49%	24.41%	23.56%	21.20%	34.57%	29.55%	17.16%	13.68%	14.35%	18.10%
Restated profit after tax for the period/ Year	(Rs. In Million)	2,316.40	6,019.66	4,511.03	2,659.68	4,536.40	13,357.10	21,623.40	18,889.20	2,306.92	4,118.94	6,181.02	2,597.09	1,885.10	3,229.68	4,579.74	3,466.19	1,100.20	2,705.00	3,751.80	2,630.70	2,290.00	4,349.54	13,230.46	7,758.65	2,516.00	3,241.20	5,066.30	6,047.40

Restated profit after tax for the period/Year Margin	(in %)	7.82%	10.99%	11.67%	10.27%	6.59%	10.17%	14.54%	15.19%	20.14%	19.40%	20.45%	13.84%	17.49%	17.00%	21.97%	21.46%	10.56%	13.10%	18.06%	18.10%	9.69%	10.16%	23.27%	19.62%	9.27%	6.86%	9.33%	11.90%
Return on Capital Employed*	(in %)	6.40%	19.33%	18.09%	15.16%	4.40%	11.58%	19.95%	21.16%	12.54%	24.66%	49.78%	31.79%	8.30%	16.09%	24.50%	21.05%	3.97%	9.44%	16.01%	15.62%	4.59%	7.73%	24.58%	16.64%	5.30%	7.47%	12.17%	16.14%
Return on Equity*	(in %)	9.09%	23.40%	22.35%	17.25%	3.78%	11.64%	20.94%	22.05%	10.88%	21.44%	40.10%	27.08%	7.32%	13.12%	20.65%	18.96%	4.46%	11.35%	17.17%	14.26%	3.73%	7.33%	23.97%	18.34%	4.44%	6.28%	10.74%	13.56%
Total Borrowings	(Rs. In Million)	32,073.73	15,336.03	14,325.03	4,930.18	51,491.60	49,202.40	43,540.60	35,393.50	-	-	272.04	585.28	76.70	46.46	2.01	183.99	13,579.70	13,399.40	8,486.50	1,044.70	20,830.00	19,957.85	14,782.43	15,527.16	2,126.80	2,318.50	469.80	1,383.80
Net Debt	(Rs. In Million)	25,833.96	10,356.20	10,649.52	2,941.14	50,919.30	46,230.00	38,610.70	31,958.40	(10,526.17)	(10,442.83)	(4,944.52)	(1,740.31)	(136.80)	(81.51)	(113.74)	141.03	13,533.90	13,409.20	8,259.90	249.90	19,560.00	18,975.03	13,541.36	14,027.89	1,460.80	1,642.50	2.10	752.50
Net Debt / Equity	(in Times)	1.01	0.40	0.53	0.19	0.42	0.40	0.37	0.37	(0.50)	(0.54)	(0.32)	(0.18)	(0.01)	(0.00)	(0.01)	0.01	0.55	0.56	0.38	0.01	0.32	0.32	0.25	0.33	0.03	0.03	0.00	0.02
Net Debt / EBITDA*	(in Times)	5.44	1.09	1.46	0.77	4.46	1.79	1.09	1.03	(3.63)	(1.97)	(0.60)	(0.48)	(0.05)	(0.02)	(0.02)	0.03	6.52	2.98	1.50	0.07	3.51	2.09	0.69	1.20	0.31	0.25	0.00	0.08
Gross Fixed Assets Turnover*	(in Times)	2.79	5.28	4.38	3.98	NA	0.81	1.19	1.20	NA	3.49	5.58	3.65	NA	1.05	1.86	1.52	NA	1.04	1.23	2.65	NA	0.76	1.33	1.11	NA	1.23	2.10	2.22
Net working capital days	(in Days)	146	120	154	154	85	68	57	63	89	78	80	85	118	147	134	141	159	176	178	138	184	199	146	138	111	103	82	122

** Not annualised for six-months period ended September 30, 2024.*

Notes:

(1) *For Peer Group Entities, all the financial information mentioned above is on a consolidated basis and is sourced from the audited annual financial statements and the unaudited limited reviewed financial statements for the six months ended September 2024*

(2) *'NA' refers to Not Applicable where the financial information is unavailable i.e. not reported by the peer group entities in either their annual audited or quarterly or half-yearly unaudited limited reviewed financial statements to the stock exchanges.*

(3) *Revenue from Operations for the year/ period as appearing in the respective financial statement of these companies*

(4) *Segment wise revenue is derived from sales register provided by our Company.*

(5) *Revenue Growth has been calculated as incremental revenue from operations between the relevant year and the previous year as a percentage of revenue from operations of the previous year.*

(6) *Earnings before Interest, Tax, Depreciation & Amortization ("EBITDA") is calculated by adding total tax expenses, finance costs and depreciation & amortization expenses to the restated profit after tax for the relevant periods and reducing the Other Income. EBITDA of the peers is calculated by adding total tax expenses, finance costs and depreciation & amortization expenses to the profit after tax for the Year/ period and reducing the other income. Further, in case of Fine Organics Industries Ltd, expenses in the nature of Exceptional items is added back and in case of Atul Ltd, Share of profit from Associates is reduced, to/from profit after tax in order to calculate the EBITDA for these peer companies*

(7) *EBITDA growth has been calculated as incremental EBITDA between the relevant periods and the previous year as a percentage of EBITDA of the previous year.*

(8) *EBITDA Margin is calculated as EBITDA as a percentage of Revenue from Operations for the relevant periods.*

(9) *Restated Profit after Tax for the Year is as appearing in the respective financial statement of these companies*

(10) *Restated Profit after tax for the Year margin has been calculated as Restated profit after tax for the Year as a percentage of Revenue from Operations for the relevant periods.*

(11) *Return on Capital Employed is calculated as EBIT for the year as a percentage of Capital Employed. Wherein EBIT is calculated by adding total tax expenses & finance costs to the profit after tax for the Year/ period and reducing the Other Income and Capital Employed is calculated as Total Equity plus Current and non-current borrowings plus current and non-current lease liabilities. Further, in case of Fine Organics Industries Ltd, expenses in the nature of Exceptional items is added back and in case of Atul Ltd, Share of profit from Associates is reduced, to/from profit after tax in order to calculate the EBIT for these peer companies.*

(12) *Return on Equity has been calculated as Restated profit after tax for the Year as a percentage of Total equity at the end of the periods.*

(13) *Total Borrowings is the sum of current and non-current borrowings.*

(14) *Net Debt is calculated as sum of current & non-current borrowing and current & non-current lease liabilities as reduced by Cash and Cash Equivalents and Bank balances other than cash and cash equivalents.*

(15) *Net debt / equity is calculated as Net Debt as number of times of Total Equity.*

(16) *Net debt / EBITDA is calculated as net debt as number of times of EBITDA for the relevant periods.*

(17) *Gross fixed assets turnover is calculated as Revenue from operations for the year as a number of times of Gross block of property plant and equipment of the company as at the respective period end.*

(18) *Net working capital days is calculated as current assets minus current liabilities divided by the revenue from operations and multiplied by 365 days or 183 days. Wherein current assets is considered as Total Current assets as reduced by Cash and Cash Equivalents and Bank balances other than cash and cash equivalents, current liabilities is considered as Total current liabilities as reduced by the current borrowings and current lease liabilities*

5 Positioning

Dorf Ketal is one of the R&D, and innovation-focused global manufacturer and supplier of specialty chemicals across the hydrocarbons and industrial supply chains, including the oil and gas, refining and petrochemicals industries, and customers with diverse applications across industrial segments. It holds leading market position with a diverse portfolio of specialty chemicals catering to various industries and geographies. Dorf Ketal is a comprehensive "wells to wheels" company, delivering solutions across every stage of the value chain. From extraction to end-use, they provide specialized products and services that optimize efficiency and performance at each node. The company is one of the largest global manufacturers of specialty chemicals, particularly for the hydrocarbon industry. It holds a significant market share in specialty chemicals for hydrocarbons and organometallic titanates, serving over 30.00% of the world's major refineries, 20.00% of ethylene plants, and 12.00% of global desalter operations. With 542 patent registrations outside India, including 99 U.S. patent registrations and 29 patent registrations in India, the company is one of the few India-based chemical company with global brand recognition. Company's key innovations include first-of-their kind technologies, such as ACtify, TANSCIENT, and HCR-7000. Dorf Ketal has a notable market presence with a diverse portfolio of products for specialty chemicals catering to various industries and geographies.

Dorf Ketal has built an established brand with a leading market position, as the only India-based chemical company with global brand recognition and the only process chemical company founded outside the United States with global brand recognition. Their key innovations include first-of-the kind technologies. As compared to the leading competitors and specialty chemical manufacturers in India (benchmarked in this report), Dorf Ketal delivered the highest growth in terms of revenue, EBITDA, PAT during the Financial Years 2022-2024. It also delivered highest ROE in the FY2024. Dorf Ketal long-term debt rating by CRISIL is AA, showcasing strong fundamentals and robust cash flow generation capabilities.

Established in 1992, Dorf Ketal is one of the major producers in the development, commercialization and application of specialty chemicals in India. In 2002, the company expanded to Latin America, which is one of the largest oil producing regions in the world. Latin America is one of the largest Oil & Gas markets and the fastest-growing region in the pulp industry, with strong potential for developing sustainable chemistries derived from plant-based sources like ethanol, soy, and other crops. Dorf Ketal established two manufacturing plants in Brazil. The company is innovation driven across categories of development, commercialization and marketing and has penetrated into a market that is largely dominated by larger and tenured specialty chemicals and additive manufacturers. It has a leadership position in Brazil, with a 34.14% market share in specialty chemicals for hydrocarbons and 72.78% market share in refinery process chemicals. In the calendar year 2023, the company ranked first by revenue market share in India and Brazil in oilfield, refinery chemicals and petrochemicals and fuel additives. It was also ranked first by revenue market share globally in modified acids, organometallic titanates and zirconates and PVF and were among the top five companies globally in fuel additives in the calendar year 2023.

Manufacturing sites are located across India, Brazil, and Canada in addition to contract manufacturing capabilities in the Netherlands. It also houses research and development facilities at India, Brazil, Singapore and Canada, with several marketing offices across the world. Customized, differentiated service and quick turnaround solutions for optimal performance and customer centricity is at the core of Dorf Ketal's values aiding its growth since 1992. Company's history of acquisitions have contributed to the strengthening the global product portfolio and geographic footprint. Acquisitions of Khyati Chemicals Private Limited and Fluid Energy Group bolstered company's presence in India, Brazil, and the Middle East markets. The acquisition of Khyati Chemicals Private Limited provided the entry into the optical brightening agents segment, and the acquisition of Fluid Energy Group provided entry into acid product categories.

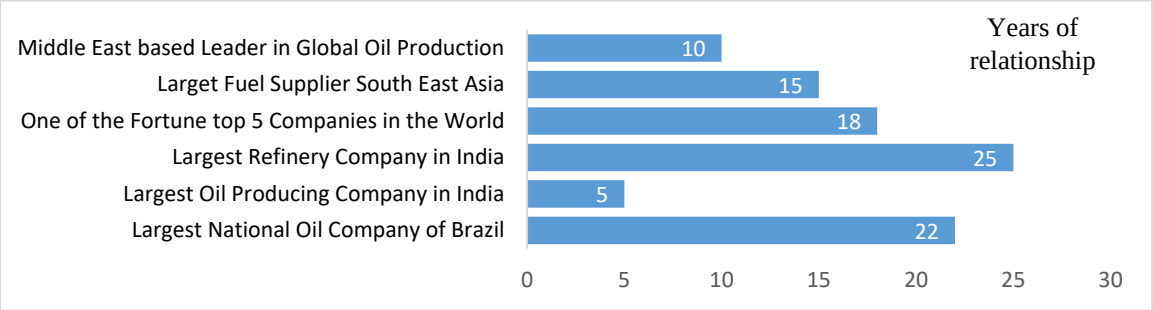
Dorf ketal is a trusted partner among refineries and other end users across upstream, downstream, and mid-stream for its high performance, efficient, and reliable results. Especially in the in the production of ethylene and butadiene. One out of three large refineries worldwide (400+ kbd) and two of every 10 of the world's ethylene plants rely on Dorf Ketal chemical treatment to extend run length and extract maximum value from opportunity crudes and changing feed stocks.

Dorf Ketal is India's largest manufacturer of formulated specialty chemicals catering to refineries, retail fuels, petrochemical plants, and ancillary units. Additionally, Dorf Ketal is the largest manufacturer of organometallic catalysts and cross linkers with 64.17% of global market share. Dorf Ketal is leading manufacturer of organic zirconates globally. In PVF (Polyvinyl Formamide), Dorf Ketal is the global leader with an 80.00% market share.

The company has focused on portfolio diversification and channel expansion over the years through strategic acquisitions and partnerships further strengthening its position in the formulated specialty chemicals market. Some of the new products launched in the last 5 years have significantly contributed to the company's revenue.

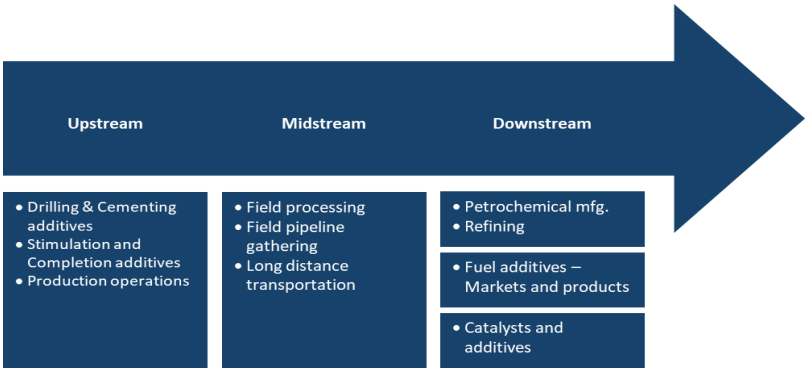
Dorf ketal has developed a strong foothold with its global presence across continents with diversified business interests. This is in addition to new product and technology developments and newer business acquisitions across midstream and downstream. Here are examples of DK's long-term partnerships with key customers:

Exhibit 5-1: Dorf Ketal Relationship with Customers



As a part of Govt of India's "Make in India" initiative, Dorf Ketal has successfully developed and deployed many products like multifunctional gasoline performance additives known as MFA, drag reducing agents known as DRA, conductivity improver, etc. In drag reducing agents, Dorf Ketal is only manufacturer in India and one of the three manufacturers in the world.

Exhibit 5-2: Dorf Ketal Value Chain Presence



Source: Dorf Ketal

5.1 Strategic Acquisitions, Partnerships and Expansions

As a logical extension and to create a global footprint, Dorf Ketal has acquired several companies and expanded its existing manufacturing footprint to further expand their market share. Through history of multiple strategic acquisitions, Dorf Ketal has focused on business scalability, high synergies and potential for high return ratios. This had led to new client acquisitions, high client stickiness and increasing wallet shares.

- Increasing market share over the years (corroborated by higher growth compared to global peers)
- Focus on sustainability and green chemistry
- Well diversified in terms of clientele, end use industry

Year	Partnerships, Acquisitions and Expansions	Rationale
2003	Acquired UOP refinery additives business	Product portfolio expansion
2003	Acquired UOP plastic additives business	Product portfolio expansion
2007	ExxonMobil Acquisition	Product diversification
2009	Acquired INTEC Polymer Organo Metallic titanates & DuPont's TYZOR™ Business	Product diversification
2011	Acquired IP from Johnsson Matthey Vertec	Product diversification and expansion
2018	Commissioned additional plant in Mundra, India	Specialty chemicals business expansion
2019	Commissioned new plant in Dahej, India	Specialty chemicals business expansion
2020	Expansion of 3,5 Xylenol plant	Specialty chemicals business expansion

2022	Acquired Khyati Chemicals	Optical brightening chemicals for pulp and paper, textiles related segments
2023	Partnered with Synthesis Water Solution	To drive innovation in the global water treatment market space
2023	Acquired Canada's Fluid Energy Group's global modified and synthetic acid business, including the Triton industrial business	Portfolio expansion in line with business goals
2023	Dorf Ketal acquired Clariant's North American Land Oil business	To bring additional strategic assets, innovative new technology, talented people, and strong customer relationships
2024	Acquired majority stake in Pune based Elixir Soltek	Portfolio diversification and channel expansion of the aftermarket business.
2024	Acquisition of Impact Fluid Solutions	Expand its suite of solutions for oil and gas production

Proprietary Solutions as a Result of R&D Initiatives

Dorf Ketal's commitment to R&D has resulted in several innovative proprietary solutions that are unique and stand out as one of it's kind across the world. The proprietary solutions are driving the new client acquisitions, high client stickiness and increasing wallet shares. Some of key R&D outputs include:

- Opportunity crude treatment
- Reactive adjunct
- Acid-free options for amine removal from crude units
- TANSCIENT – High temperature corrosion inhibitor
- MAXSCAV – Low cost high performance H2S scavenging
- COMPASS modelling system
- ACtify – Polymer control innovations
- ACtivate PET catalyst for low cost high performance PET resin manufacturing
- Good acid
- Metal removal for desalters
- Process simulation and monitoring tools
- Visbreaker antifoulant
- Milex and mph high performance packages for use in branded automotive diesel and gasoline

Dorf Ketal offers wide variety of innovative solutions. It's Reactive Adjunct Chemistry (green chemistry) is used in products for metal removal, H2S removal, amine removal and desalination. It directly helps in reducing the carbon footprint of customers. The company launched TANSCIENT products which has low phosphorus content for corrosion protection. The company has developed innovations that have resulted in reduction in emissions, and significant improvement in fuel economy, which have both economic and environmental benefits. Dorf Ketal has been able to create first-of-their-kind innovations that have been able to change the industry narrative with their applications.

Key Patents

Dorf Ketal holds 542 global patents outside India to its name. The company have 29 patents in India. All combined, Dorf Ketal is able to provide differentiated solutions with unique chemistry. Some of them include:

- Method of calcium removal from hydrocarbon feedstock
- Method of removal of carbonyl compounds along with acid gases from cracked gas in ethylene process
- Method for reducing foam in primary fractionator
- A new additive for inhibiting high acid corrosion in oil refineries a method of using the same
- An effective novel polymeric additive for inhibiting naphthenic acid corrosion and a method of using the same
- Additive composition for control and inhibition of polymerization of styrene and a method of preparation and use thereof
- Improved additive composition for control and inhibition of polymerization of aromatic vinyl monomers and method of use
- Hydrogen Sulfide scavenging additive compositions and methods comprising catalyst composition
- Catalyst composition of metal alkoxides used as polyester

Industry solutions through R&D

Industry challenge	**Dorf Ketal's Solution**	**Industry Impact**
Substantial carbon footprint and capital investment is required for setting up of polymer plants. Only 12% of total plastics produced is reused or recycled.	Certain grades of plastics can be directly recycled by blending/mixing.	Reduced capital expenditure, improve profitability and carbon footprint.
Operational and scheduling challenge due to poor efficiency	Suggested the use of Proprietary "Oil Capability Model".	Determined and predicted issues with crude blend that proactively suggested chemical treatment rates. Increased operational reliability and profitability

Refinery Fuel Additives

Refinery fuel additives encompass a broad spectrum of compounds, including corrosion inhibitors, desulfurization agents, and antifoaming agents among others. These specialized chemicals are essential for maintaining operational efficiency, product quality, and safety within the oil refining and petrochemical production processes.

The industry structure of refinery chemicals includes chemical manufacturers, refineries, petrochemical facilities, and engineering firms. It has to meet stringent quality standards, reduce operational costs, and minimize environmental impacts while producing high-value petrochemicals.

The Global landscape is dominated by 5-6 players that cumulatively account for 40.00% of share. Suppliers are focusing on technology innovation, Expansion through acquisitions and financial restructuring and investments to increase the refinery fuel additives market share.

BASF, Nalco Company, WR Grace Catalysts Technologies, GE Water, etc. are some of the key players in the industry. Other prominent players include Baker Hughes, Afton, Albemarle, Evonik, Dow, Dorf Ketal, Innospec, Lubrizol, LANXESS, Ecolab, Chevron, Xingyun Chem and Jiangsu Taihu New Materials.

Additives are marketed solely to industrial users, and the customers are a wide range of fuel companies within the crude industry. Cost savings will be most relevant to the refiner and in the competitive market to the consumer.

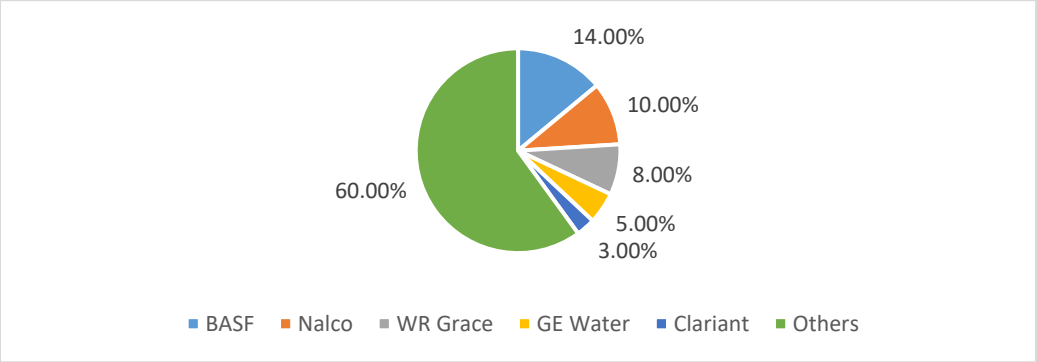
Dorf Ketal has been consistently working on strong research and development (R&D) capability to be able to meet the refinery needs of the world. Dorf Ketal in its ability to cater to the core requirements of the refineries have helped penetrate into some of the largest refineries and petrochemical facilities globally. Refinery products require heightened technical acumen, which

novice players in the industry will not be able to withstand. Dorf Ketal has been gaining traction in ASEAN countries and gaining strong foothold in other global markets as well.

Global refinery fuel additives market is valued at 0.72 USD Bn in CY2023. It is expected to reach 1.01 USD Bn in CY2029 growing at a CAGR of 7.00%. Dorf Ketal is one of the leading manufacturers of refinery fuel additives catering to some of the complicated and sophisticated refineries across the world.

Through innovation, Dorf ketal offers solutions to combat process challenges ranging from prevention, maintenance, and remediation of operating conditions that threaten the reliability of refinery and ethylene plants.

Exhibit 5.1-1: Competitive Scenario of Refinery Fuel Additives in CY2023 (0.72 USD Bn)



Source: Frost & Sullivan

Exhibit 5.1-2: Benchmarking of Key players in Refinery Additives Market

	Dorf Ketal	Nalco	WR grace	BASF	GE Water	Clariant
H2S Scavengers	✓	✓	×	✓	✓	✓
Scale Inhibitors	✓	✓	×	✓	✓	✓
Demulsifiers	✓	✓	✓	✓	✓	✓
Antifouling agents	✓	✓	✓	×	×	×
Coagulants/flocculants	×	✓	×	✓	×	✓
Biocides	✓	✓	✓	✓	✓	×
Antifoaming agent	✓	✓	×	✓	✓	✓
Corrosion Inhibitors	✓	✓	✓	✓	✓	✓

Source: Frost & Sullivan Research and Analysis

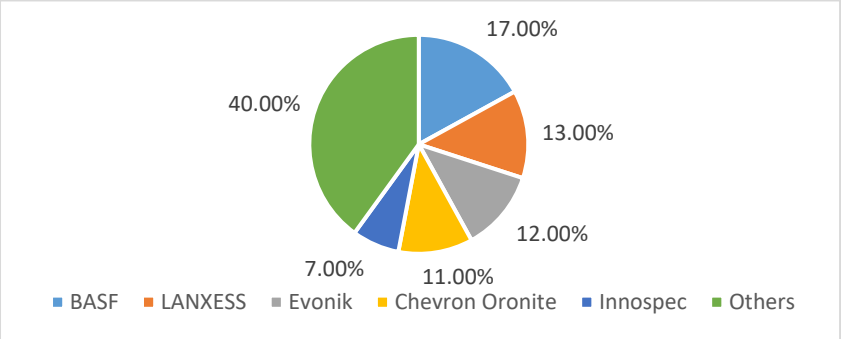
Diesel and Gasoline Fuel Additives

Diesel and gasoline fuel additives are an integral part of fuel additives basket products. The global diesel and gasoline fuel additives market is valued at 0.78 USD Bn in CY2023. It is expected to reach 1.06 USD Bn by CY2029 growing at a CAGR of 3.50%.

The diesel and gasoline fuel additives market are fairly consolidated with the presence of 7-10 prominent players such as BASF, Afton Chemicals, LANXESS, Lubrizol, Total, Evonik, Clariant, Infineum, Innospec, etc. For Dorf Ketal, diverse know-how, comprehensive product offering, and tailored solutions across entry level, mid and high-end products ensure performance requirements across different requirements.

Dorf Ketal's innovative chemistry has helped them penetrate into an industry with established players with ever changing fuel specifications and requirements. Dorf Ketal has developed customized multifunctional blends of additives that are added to gasoline and diesel at very low dosages. This aids in the cleanliness in all key parts of the engine while reducing engine friction and deliver required improvement instantaneously across fuel economy, power and acceleration.

Exhibit 5.1-3: Competitive Scenario of Diesel and Gasoline Fuel Additives in CY2023 (0.78 USD Bn)



Source: Frost & Sullivan

Top 5 companies comprising of BASF, Innospec, LANXESS, Chevron Oronite, and Evonik Industries occupy 60.00% of the global market share. Others prominent players include Lubrizol, Afton Chemical, Infineum, Baker Hughes, Dorf Ketal, among others.

Exhibit 5.1-4: Benchmarking of key players across Diesel and gasoline fuel additives market

	Dorf Ketal	LANXESS	Chevron	BASF	Evonik	Innospec
Cetane boosters	✓	✓	×	✓	✓	✓
Octane boosters	✓	✓	×	×	✓	×
Deposit control additives	✓	✓	✓	✓	✓	✓
Cold flow improvers	✓	×	×	✓	✓	✓
Lubricity improvers	✓	✓	×	✓	✓	✓
Antioxidants	✓	✓	✓	✓	×	✓
Static current dissipators	✓	✓	✓	✓	×	✓
Combustion improver	✓	×	×	×	×	×

Source: Frost & Sullivan Research and Analysis

Lubricant Additives

Lubricant additives are chosen based on their ability to perform one or more specific functions in combination with other additives. The additives of choice are then blended into packages with other additives that are customized to suit the end application.

The global lubricant additives market is valued at 16.00 USD Bn in CY2023. It is expected to grow to 21.92 USD Bn growing at a CAGR of 4.50% by CY2028. This market accounts for 12-15% of the global lubricant market. Additive groups largely contributing to this revenue are – Dispersants, detergents, corrosion inhibitors, anti-wear agents, viscosity and friction modifiers, cold flow improvers, extreme pressure additives and grease additives among others.

Global Lubricant additives market is highly consolidated with the presence of few players such as Afton Chemical, Lubrizol, Chevron Oronite, Infineum dominating the market and controlling about ~75.00% of the market share globally. Lubrizol accounted for 25.00% market share while Infineum accounted for 20.00% and Chevron Oronite and Afton chemicals both accounted for 15.00% in global lubricant additive market in CY2023.

Other prominent players include Croda, BASF, Evonik, Valvoline, Dorf Ketal, Richful, Tianhe Chemical Group and RT Vanderbilt among few others.

Dorf Ketal has developed specialty chemicals and additive components for independent formulators of automotive and industrial lubricants and metalworking fluids that is effective across a wide range of applications. They are developed on

technology platforms that are suited for modern technologies and compatible with all types of oils, greases and specialty lubricants.

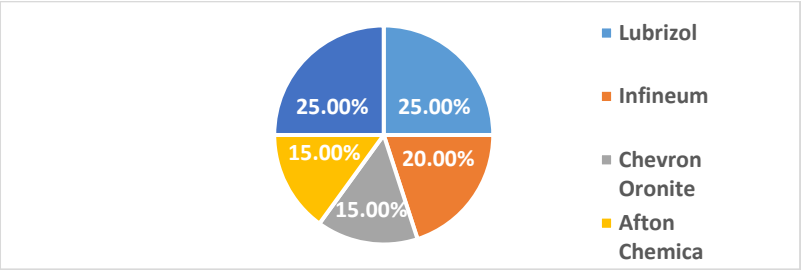
Dorf Ketal's offerings cater to a wide variety of lubricant manufacturers that have customers across construction, mining, agricultural, and manufacturing equipment and automotive lubricants for passenger and commercial vehicles. The additives contribute to improving fuel economy and flow efficiency.

Lubricant additives are broadly divided into 2 categories, additive package manufacturers and component manufacturers. Dorf Ketal has positioned itself as a component manufacturer in order to cater to customers with multiple custom blend formulations. Some of the prominent component suppliers include BASF and LANXESS. These companies supply detergents, dispersants, precursors for antioxidants. Companies providing package solutions include Lubrizol, Infineum, Chevron Oronite, Afton Chemical, Italmach and Richful.

As a component provider, Dorf is positioned better to cater to a wider range of customers for their custom needs.

In India, the Dorf Ketal faces competition from 2 major players BASF and LANXESS.

Exhibit 5.1-5: Competitive Scenario of Lubricant Additives in CY2023 (15.0 USD Bn)



Source: Frost & Sullivan

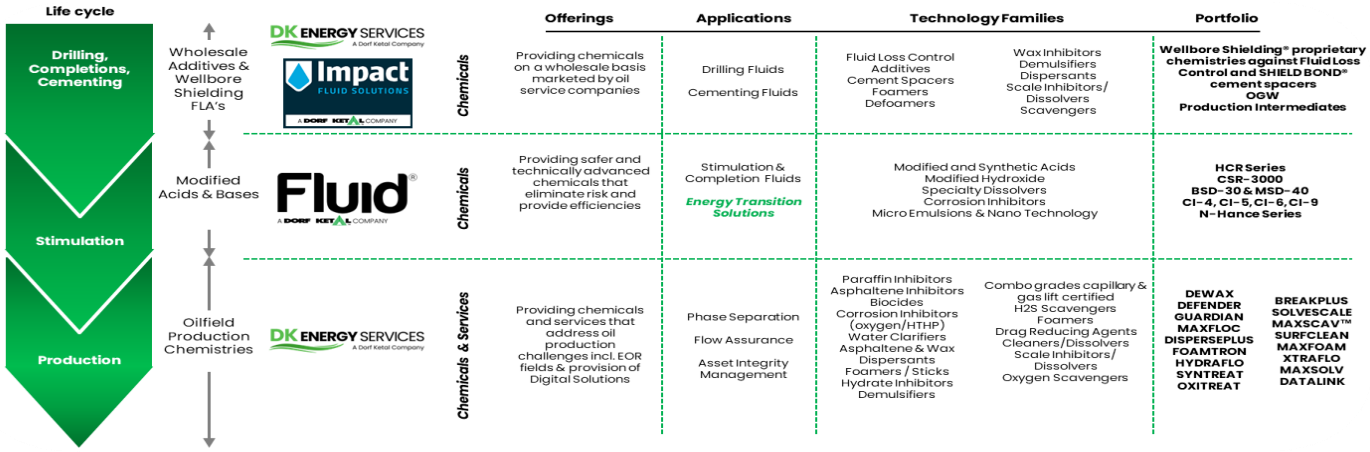
Exhibit 5.1-6: Benchmarking of key players across Lubricant additives market

	Dorf Ketal	Evonik	BASF	Lubrizol	LANXESS	Afton
Antioxidants	✓	✓	✓	✓	✓	✓
Extreme pressure additive	✓	×	✓	✓	✓	✓
Friction modifier	✓	✓	✓	✓	✓	✓
Corrosion inhibitors	✓	✓	✓	✓	✓	✓
High temperature resistance	✓	✓	✓	✓	✓	×
Viscosity modifiers	✓	✓	✓	✓	✓	✓
Grease additives	✓	×	×	✓	✓	✓
Detergents	✓	×	✓	✓	✓	✓
Cold flow improvers	✓	×	✓	✓	✓	✓

Source: Frost & Sullivan Research and Analysis

Dorf Ketal Upstream Offerings:

Dorf Ketal's upstream experiences and presence covers the entire oil & gas life cycle across Drilling, Cementing, Completions, Stimulation and Production chemistries.



The closing of acquisitions across January 2023 (Fluid Energy), April 2023 (Clariant Land Oil NA) and June 2024 (Impact Fluid Solutions) have expanded Dorf Ketal's technology portfolio and market presence both regionally across North America and internationally through the wellbore shielding© proprietary chemistries, SHIELD BOND© cement spacers and energy transition solutions with modified acids and bases.

Dorf Ketal Energy Services and companies across the upstream market is now both a supplier to the likes of SLB, Halliburton and Baker Hughes for enhancing and supporting their activities across drilling, cementing, completions, and stimulation but also competing with these companies in the oil & gas production space.

The latter is characterized by the provision of both the actual products and chemistries but also through extensive services including digital platforms such as Trackabout™ and Dorf Ketal's Energy Services DatalinK.

Part of the Clariant Land Oil NA acquisition in April 2023 included 18 patents applicable to the US and Canada; e.g. Demulsifiers and a method of using demulsifiers for breaking emulsions of water and crude oil, Fracturing and Stimulation Composition and Method of using Microemulsions as Flowback Aids, Micro Dispersions of polymeric oil additives for paraffin inhibition flow assurance, Synergized Acetals composition and method for scavenging sulfides and mercaptans (non-triazine H2S scavengers).

The North American Land Oil business has complemented Dorf's upstream presence in Latin America (LATAM) and Europe, Middle East, Africa and India (EMEAI) and is further supporting Dorf Ketal's Energy Services geographical expansion plans for Asia Pacific (APAC).

Dorf Ketal Positioning in Key Product Segments

Dorf Ketal have promising presence in key product segments such as specialty chemicals for hydrocarbons, fuel additives, organometallic titanates and zirconates, etc. Dorf Ketal has one of the world's largest manufacturing facilities for organometallic titanates. It is located in proximity to the Mundra port, in a Special Economic Zone ("**SEZ**"), which provides a strategic advantage to exports and allow duty-free import of chemicals. Dorf ketal is well positioned to capitalize on opportunities in the specialty chemicals segment due to the market position, global manufacturing and distribution network, R&D capabilities and customer centric approach. Further, as customers look for differentiated offerings, many smaller chemical vendors who relied solely on chemical sales will be forced out of the market which will result in market consolidation.

Several factors will drive demand for Dorf Ketal's products, including increasing demand for performance enhancing chemicals, customers looking for green chemistries, carbon efficiency and safer chemistries, the requirement of higher throughput as existing oil wells mature and new oil well drilling slows down. Demand for fuel additive and lubricant segment is expected to be driven by the increase in demand of branded fuel and opportunity to enhance fuel-efficiency stabilization. Demand for specialty catalysts is expected to increase further driven by strong growth in packaging and coating segment, the requirement for modernization in the infrastructure segment, increase in electronic components in automotive segment as a result of electrification of vehicles, etc. Dorf Ketal is well positioned to capitalize on opportunities in the specialty chemicals segment due to market leadership position in certain specialty chemicals, global manufacturing and distribution network, R&D capabilities and customer centric approach. It has grown faster than the industry, demonstrating ability to take market share from competitors. Further, as customers look for differentiated offerings, many smaller chemical vendors who relied solely on chemical sales will be forced out of the market which will result in market consolidation.

Exhibit 5.1-7: Dorf Ketal Positioning in Key Product Segments in CY2023

Product Segments	Launch year	Global Market Size (USD Bn)	Quantity Sold in FY24 (MT/KL)	DK Global Market Share (%)	DK % share in India (%)	DK % share in NA (%)	DK % share in Middle East (%)	DK % share in Brazil
Oilfield specialty chemicals	2012	26.00	84,603	0.81%	10.77% (#1 Rank)	1.04%	0.00%	30.26% (#1 Rank)
Refinery Chemicals and Petrochemicals	1997	1.70	15,847	4.30%	29.89% (#1 Rank)	1.18%	1.08%	72.78% (#1 Rank)
Fuel additives	2003	2.40	58,299	7.78% (#4 Rank)	57.78% (#1 Rank)	0.43%	10.97%	27.65% (#1 Rank)
Modified acids	2023	0.44	1,40,675	15.05% (#1 Rank)	100.0% (#1 Rank)	16.09% (#1 Rank)	26.00% (#1 Rank)	0.00%

Specialty chemicals for hydrocarbons	1997	30.54	2,99,424	1.76%	23.90% (#1 Rank)	1.51%	0.83%	34.14% (#1 Rank)
Organometallic titanates and zirconates	2009	0.08	9,224	64.17% (#1 Rank)	95.11% (#1 Rank)	63.24% (#1 Rank)	12.28% (#1 Rank)	67.03% (#1 Rank)
PVF	2009	0.01	652	80.00% (#1 Rank)	97.99% (#1 Rank)	94.56% (#1 Rank)	0.00%	84.69% (#1 Rank)
Optical brighteners	2021	1.60	5,306	1.14%	16.32% (#2 Rank)	0.06%	0.19%	11.27%
Lubricant additives	2007	16.00	3,786	0.16%	0.23%	0.77%	0.01%	0.79%

Industry Threats and Challenges

Industry Threats:

- Investment in R&D: Global competitors are consistently investing in R&D and product development to cater ever-changing demands of oilfield operations. Baker Hughes spent USD 650 million while Clariant spent USD 180 million for R&D in FY2023. Continuous investment in R&D, as well as sustained effort to keep pace with competitors and industry advancements is a key requirement.
- Large global players are integrated across upstream and downstream, along with expertise in other lateral technologies. Baker Huges offers packaged oilfield services. ChampionX offers complementary artificial lift technologies. These value added services help competitors to attract customers.
- Diversification of business from oil and gas to renewable energy: Companies like Shell and BP have announced net zero targets by CY2050. While this will impact their investments in oil and gas exploration, this will also ensure use of efficient and cost-effective oilfield chemicals.

Challenges:

- Diverse customer needs: Depending on nature of crude, oilfields have unique challenges and require customized chemical solutions. Dorf Ketal must cater to diverse customer needs across regions, oilfield types, and extraction methods. This needs to be constantly supported with new innovations and product development.
- Environmental regulations: Stricter environmental regulations in the oil and gas industry are likely to elevate compliance costs. The newly introduced EU Methane Regulation 2024, which mandates reductions in methane emissions at the source, will drive both compliance and production expenses for oil and gas companies leading to lower margins, thereby driving demand for cost-effective products.
- Oil price volatility: The EU's embargo on Russian crude oil, combined with a slowdown in global oil demand, is expected to keep the oil and gas market volatile in the near term. In recent years OPEC production cuts were announced which were in response to recession concerns, underscore the uncertainty. In this environment, there is a growing preference for formulations that deliver optimized performance.