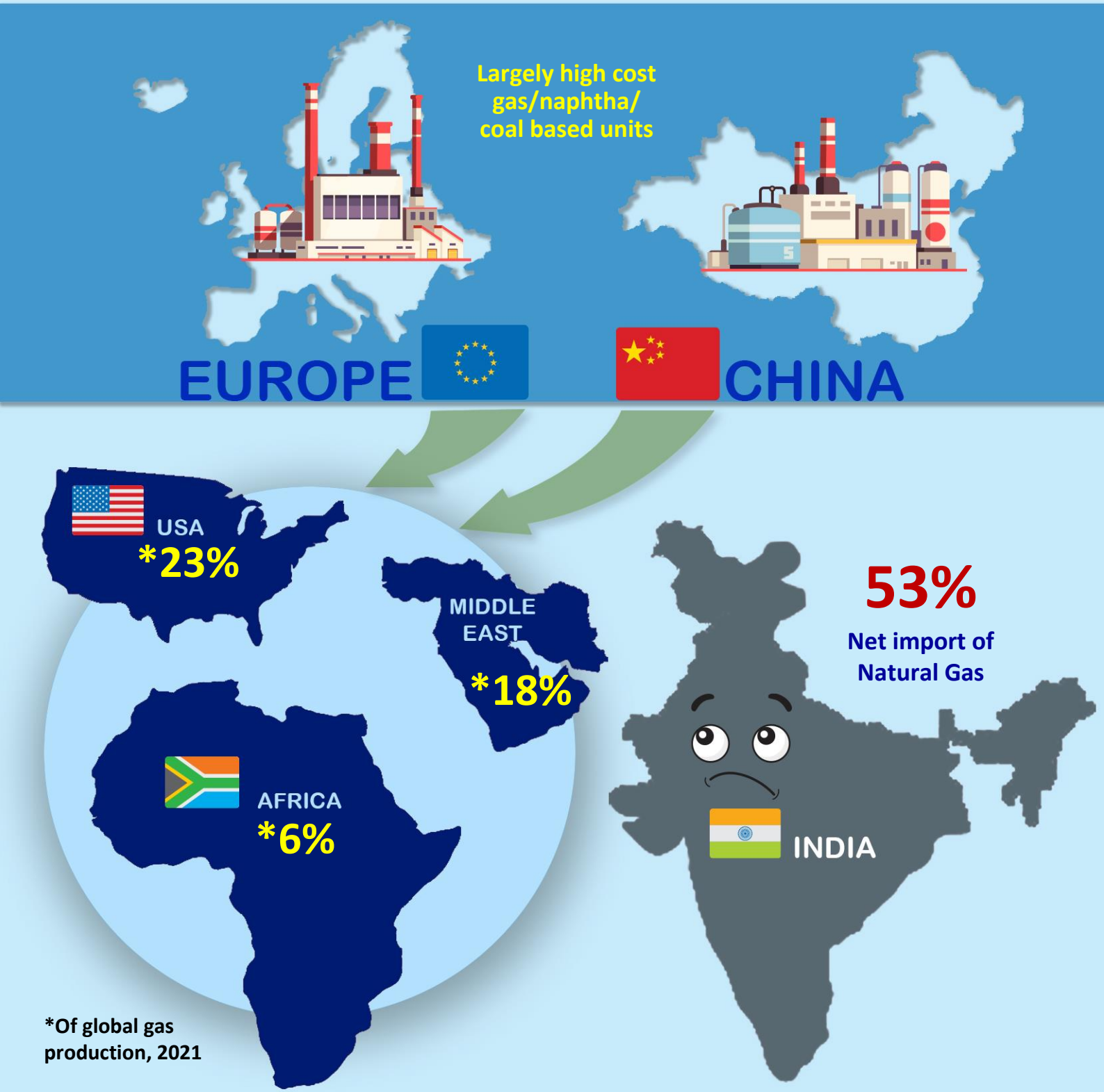
Specialty Chemicals



The Great Migration

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Content

THE GREAT MIGRATION

Specialty Chemicals

The Great Migration

Since ages, creatures have resorted to migration in order to benefit from the comparative advantages offered. The same has been mathematically proved by the seminal economist David Ricardo. Our research shows how production in refining & petrochemicals has migrated globally in the past few decades. We then forecast why we believe that a similar trend awaits the chemicals industry.

- **Led by major oil discoveries, refining capacity in the Middle East grew to 4x over 1970-2020. On the other hand, a rising consumer market led to China raising its refining capacity 28x during the same period. In the meanwhile, the global capacity rose a meager 2x.**
- **Similarly, abundant gas in the US resulted in a wave of petrochemical projects over 2015-19, accounting for 13% of the total capacity added globally. As a fast growing consumer center, China added another 28%.**
- **Chemicals can be broadly divided into two groups - organic and inorganic. Organic chemistry owes its roots to oil/gas or coal (primarily in China). Our research suggests multiple reasons for manufacturing of chemicals to migrate to areas with cheaper availability of feedstock, especially to the US, Middle East, and Africa over the long term.**

Value Chain: Revisiting the basics - upstream to refining to petrochemicals / chemicals

- Chemicals can be broadly divided into organic and inorganic chemicals. An organic chemical necessarily contains C-H or C-C bond-like methane (CH4), ethane (C2H6), and their derivatives, while the rest, which are basically metal or mineral derivatives (lacking C-H or C-C bonds) are termed as inorganic chemicals. Organic chemicals owe their genesis primarily to fossil fuels such as oil, gas or coal or biomass. Even ammonia, a precursor to inorganic chemicals such as nitric acid, and ammonium phosphate and a precursor to organic chemicals such as urea is derived mostly from natural gas or coal.
- The primal raw materials, oil and gas, generate significant benefits across the whole value chain, right from upstream to refining to petrochemicals and chemicals. Our research highlights how various regions have been moving downstream (from exploration and production of oil/gas to refining to further downstream petrochemicals/chemicals).
- Coal is also moving downstream. However, coal synthesis to chemicals is a costly and polluting affair. For example, Chinese production cost for methanol (all from coal) is almost 60% higher than that in the US (based on cheaper natural gas). Similarly, carbon emissions for production of one ton of methanol from coal stands at 1,600kg of CO2 vs. 900kg if natural gas is used as a feedstock. Our research highlights how regions have been moving down the value chain in order to capture larger and larger part of the profitability pie.

The Twin Towers of Refining: Rise of the Middle East & China

- Over 1970-2020, the Middle East raised its oil production to 2x- 28mnbopd. Led by this abundant production of oil, the Middle East raised its refining capacity to 4x during the period.
- On the other hand, China on the back of a fiercely rising economy raised its refining capacity 8x. However, this sharp rise in refining capacity was driven by 26x rise in consumption of oil and not because of increased availability of oil.

- Both the Middle East and China look phenomenal compared with the world refining capacity growing to 2x or North America growing to 1.5x or Europe remaining flat during this period.

The Petchem Trio: ME, US & China

- The 4x refining capacity growth in the Middle East over 1970-2020 led to similar amount in availability of naphtha, one of the key feedstock for petrochemicals. Similarly, production of natural gas tripled over 1980-90 and has doubled in each of the next two decades 1990-2000 and 2000-2010. As a result, during 2005-2019, one-third of the incremental ethylene capacity growth happened in Middle East alone.
- Chinese refining capacity, which grew 8x over 1970-2020 and coal gasification projects; both accounted for another 28% of the global ethylene capacity addition.
- Similarly, North America witnessed doubling its natural gas production during the same period, primarily led by the US. This is broadly the same as the global production during the period. However, the global production in 1970 was marginally less than what the Middle East alone achieved in 2020. The sharp reduction in gas prices in the US to 5.3% since 2008 from 13.3% of WTI prior to 2008, meant a much cheaper petrochemical feedstock, resulting in 13% of total ethylene capacity addition over 2005-19.

The Great Migration: Chemicals to follow suit?

- Ethylene cost curves suggest that natural gas remains the most economical feedstock, especially in the Middle East and the US. Since natural gas (or coal) is the key genesis for most chemicals, it appears likely that manufacturing of chemicals would also drift to those regions, especially the US and the Middle East, over the next few years. Over a longer period, Africa is also likely to emerge as a key manufacturing hub for petrochemicals and chemicals.
- The only exception could be large consumption centers such as China and India. However, our research believes that Indian chemical companies face severe challenges and need to evolve in order to battle the great migration expected globally.

Exhibit 1: Comparative valuation of companies under coverage

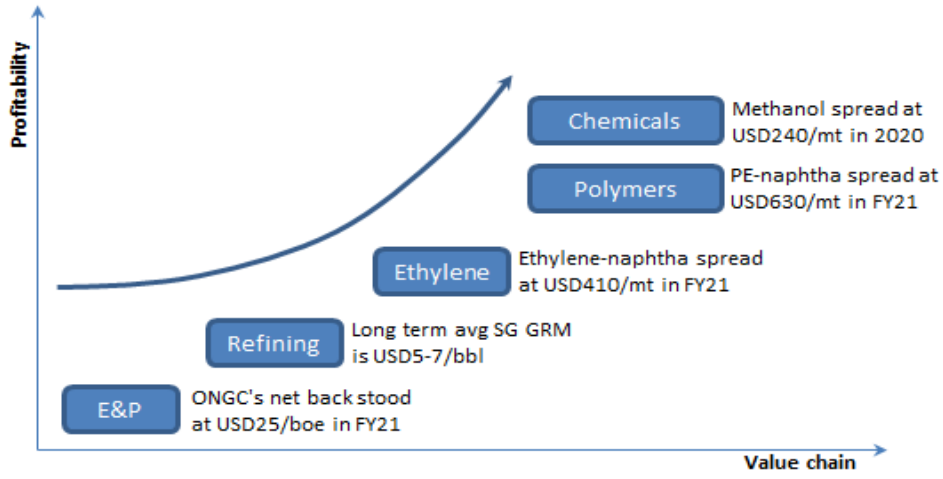
Company	Reco	TP	EPS (INR)			P/E (x)			P/BV (x)			EV/EBITDA (x)			ROE (%)			Div. Yield
		(INR)	FY22	FY23E	FY24E	FY22	FY23E	FY24E	FY22	FY23E	FY24E	FY22	FY23E	FY24E	FY22	FY23E	FY24E	FY23E
Alkyl Amines	Neutral	3,025	44.0	55.9	75.6	63.9	50.3	37.2	14.5	11.9	9.6	44.0	34.7	25.7	25.2	26.0	28.6	0.4
Atul	Neutral	8,627	198.7	194.1	246.5	40.7	41.7	32.8	5.4	4.9	4.3	26.6	27.4	21.3	14.3	12.3	13.9	0.3
Clean Science	Neutral	1,589	21.5	26.9	39.7	69.8	56.0	37.8	20.8	15.8	11.7	52.7	42.0	28.3	34.9	32.1	35.4	0.2
Deepak Nitrite	Neutral	1,890	78.2	73.4	85.9	27.5	29.3	25.0	8.8	7.0	5.7	18.3	19.4	16.2	37.5	26.6	25.0	0.3
Fine Organic	Neutral	6,860	81.8	161.0	152.4	74.8	38.0	40.1	19.6	14.4	11.5	54.2	28.5	29.6	29.5	43.6	31.8	0.1
Galaxy Surfact.	Buy	3,390	74.1	94.7	84.7	38.9	30.4	34.0	6.5	5.6	5.0	26.3	20.2	22.1	18.3	19.7	15.5	0.6
Navin Fluorine	Neutral	4,311	53.8	70.6	107.8	83.2	63.4	41.5	11.9	10.3	8.6	62.6	46.8	30.6	15.2	17.5	22.7	0.2
NOCIL	Buy	283	10.6	11.5	12.8	21.8	20.0	17.9	2.7	2.5	2.3	13.3	12.5	11.0	13.0	12.9	13.3	1.3
Vinati Organics	Buy	2,500	33.7	42.3	62.5	62.2	49.6	33.6	11.8	9.9	8.0	49.9	38.8	26.2	20.6	21.7	26.4	0.3

Source: Companies, MOFSL

Value Chain: From upstream to refining to petrochemicals/chemicals

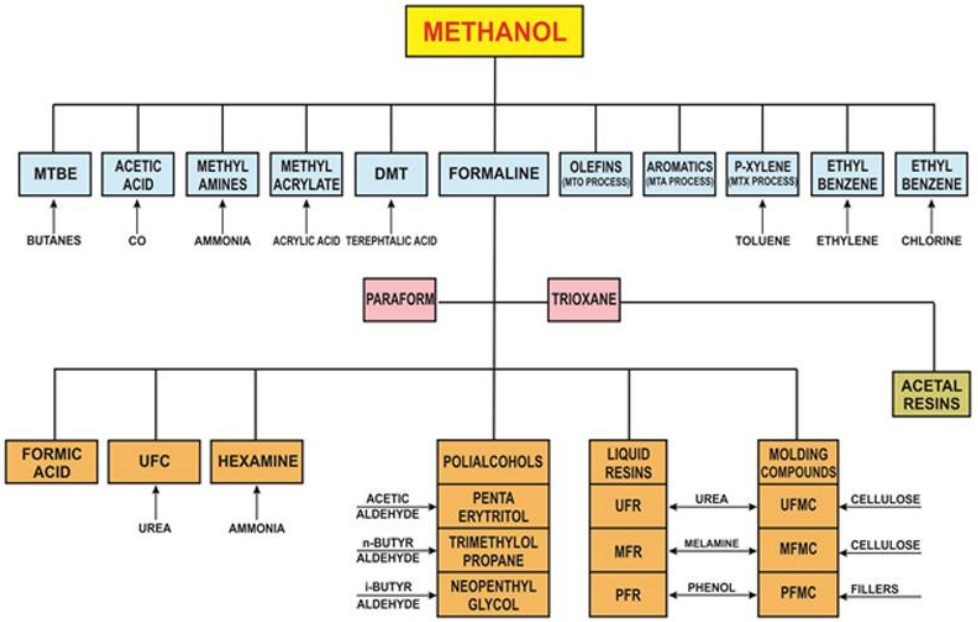
- Chemicals can be broadly divided into two groups - organic and inorganic. Organic chemicals necessarily have C-H or (and) C-C bonds while inorganic chemicals are conspicuous by their absence.
- Three basic chemicals are ammonia, methanol, and ethylene/propylene from which most chemicals are derived. Ammonia is a precursor to all synthetic nitrogen fertilizers.
- Methanol is used to produce acetic acid, formaldehyde, and a host of other chemicals. Methanol is primarily (65%) produced through steam reforming of natural gas. The rest is produced using coal, prevalent mostly in China.
- Ethylene/propylene are used primarily for manufacturing of various plastics. Here again, natural gas is the precursor. Other feedstock includes naphtha (refinery) or coal.
- Although ammonia is inorganic, it is manufactured using steam reforming of natural gas or from coal. Globally, steam reforming accounts for 70% of ammonia production (link). Coal is primarily used in China, which lacks sufficient resources of natural gas.
- In summary, both oil and gas form a key starting point for most chemicals. Although coal has been widely used in China, it causes high pollution. For example, production of one ton of methanol results in 1.6mt of CO2, while reforming of gas results in 0.9mt CO2. Additionally, the usage of coal is a costly affair as seen in (Exhibit 11).
- There is substantial value creation throughout the complete value chain from upstream to refining to petrochemicals/chemicals as shown in Exhibit 2. As we show next, regions have gradually been moving up the value chain in order to grab more and more of the profitability.

Exhibit 2: Value chain: from upstream to refining to petrochemicals / chemicals



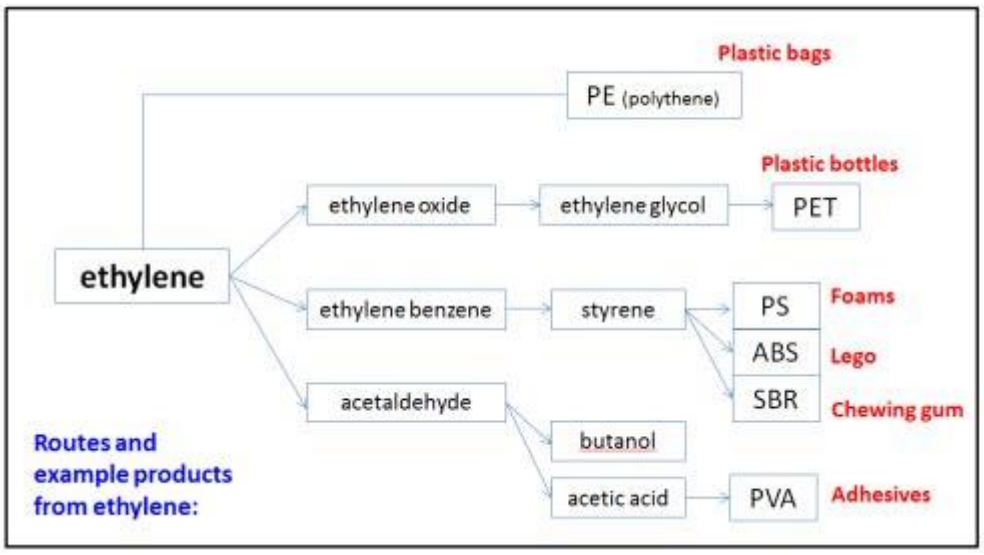
Source: Industry, MOFSL

Exhibit 3: Value chain: from methanol to chemicals



Source: ATEC, MOFSL

Exhibit 4: Value chain: from ethylene to chemicals

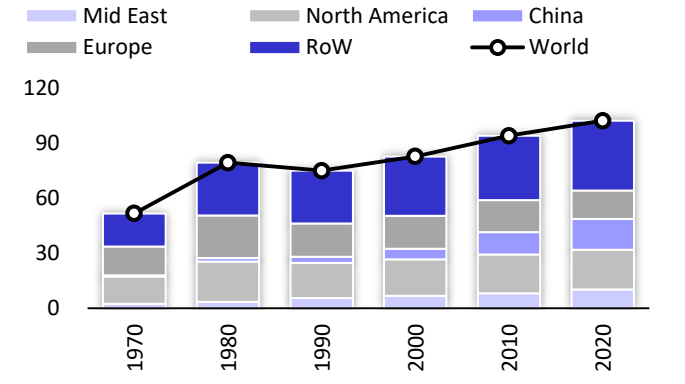


Source: Renewable Carbon, MOFSL

Twin Towers of Refining: Rise of the Middle East and China

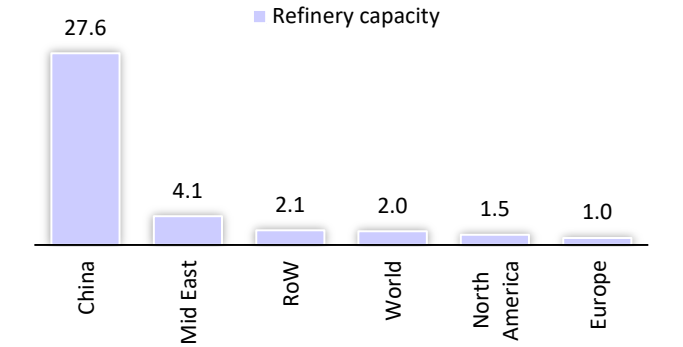
- The Middle East has always been at the forefront of global oil production, accounting for marginally less than one-third of the total global oil production. Although in 1970s, the region accounted for ~1% of the global gas production, it gradually climbed to 18% in 2020.
- In order to grab the benefit of refining margins in addition to the upstream profitability, the Middle East ramped up its refining capacity to 10.2mnbopd in 2020 from 2.5mnbopd in 1970, a 4x rise in the period, when global capacity grew to 2x.
- China witnessed the sharpest growth in refining capacity to 28x over 1970-2020. This, however, was not on the back of a rise in crude oil availability, but was driven by the need to cater to its sharp rise in consumption of refined products (26x).

Exhibit 5: Region-wise refining capacity (mnbopd)



Source: BP Statistical Review, MOFSL

Exhibit 6: Growth over 1970-2020 (x)

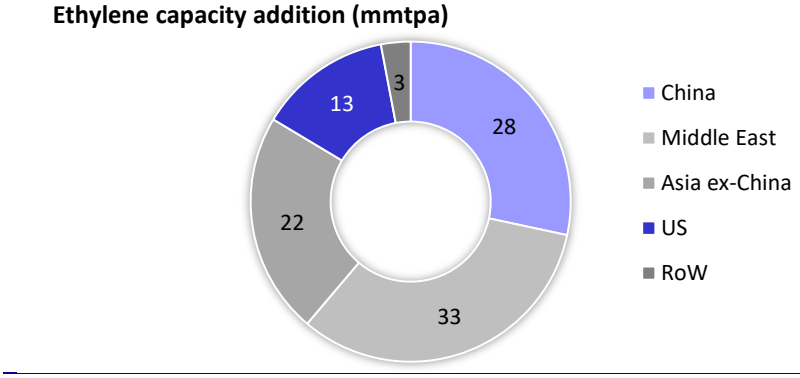


Source: BP Statistical Review, MOFSL

The Petchem Trio: ME, US & China

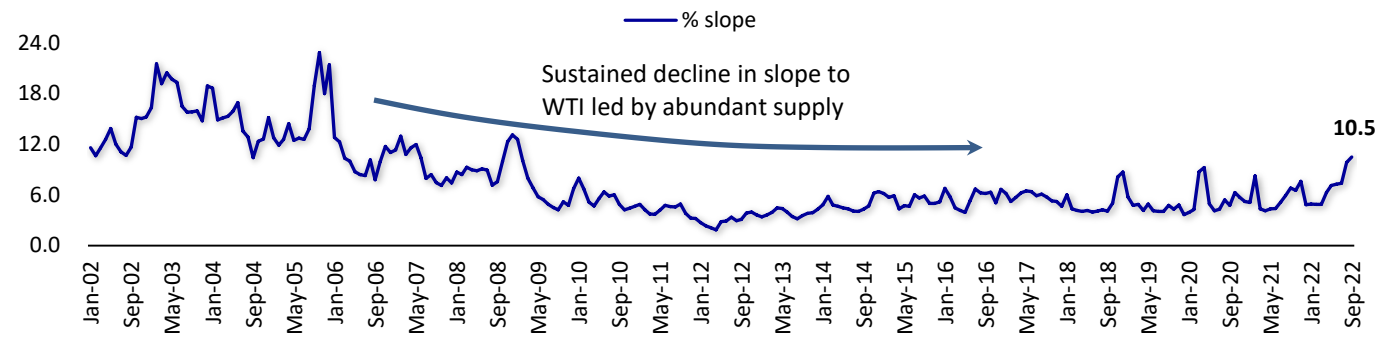
- In addition to the growth in refining capacity, the Middle East witnessed its natural gas production rising to 67x over 1970-2020. Additionally, the sharp rise in refining capacity provided another feedstock for petrochemicals - naphtha.
- As a result, the Middle East accounted for one-third of the ethylene capacity addition over 2005-19.
- The US also witnessed a sharp rise in its natural gas production since the onset of shale gas production in 2008. Prior to 2008, Henry Hub traded at 13.3% slope to WTI. However, abundance of natural gas resulted in the slope crashing to 5.3% since then, except for the anomaly of the past few months.
- This resulted in the US accounting for 13% of the total global ethylene capacity addition over 2005-19.
- China, once again, responding to a sharp rise in its domestic demand, accounted for 28% of the total global ethylene capacity addition over 2005-19.

Exhibit 7: Region-wise share of ethylene capacity addition over 2005-19 (%)



Source: Woodmac, MOFSL

Exhibit 8: Sharp decline in gas prices due to abundant supply in the US



Source: Bloomberg, MOFSL

The Great Migration of Chemicals ahead

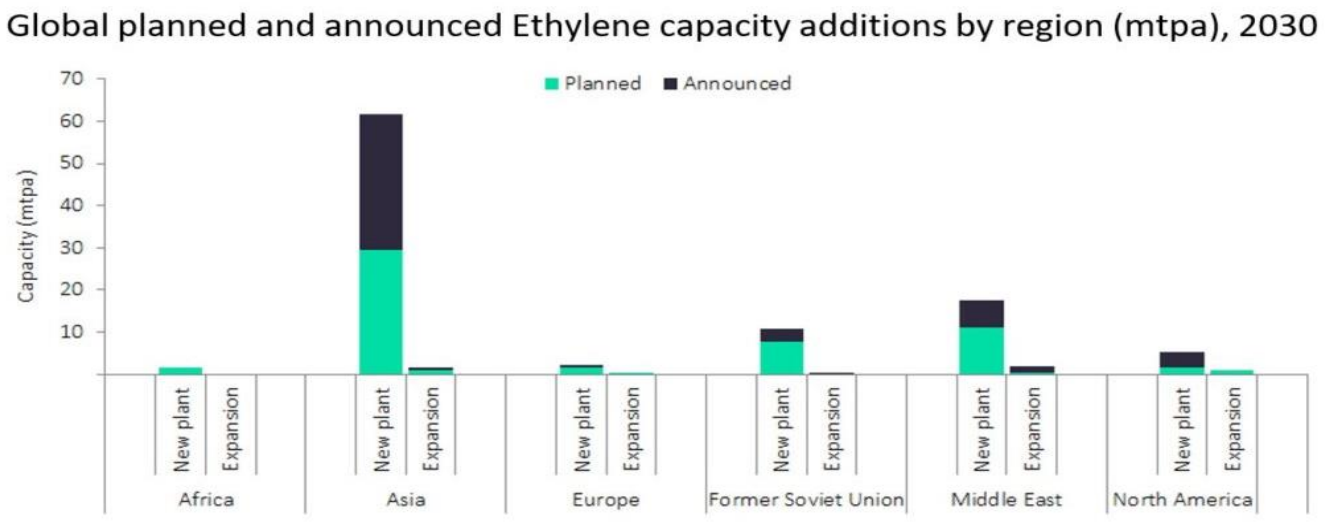
- Since natural gas and naphtha are much cheaper than coal-based chemical producers, it is likely that just like refining and petrochemicals, chemicals' manufacturing would also migrate toward regions, where natural gas or naphtha is available in abundance.
- Reports suggest that with respect to methanol, 35% of the capacity over 2021-25 is expected to come up in the US, all based on natural gas. China, once again as a large consumption center, accounts for 46% of the incremental methanol capacity.
- China remains a large net importer of polyethylene (PE), a key product of ethylene. In CY21, the country imported 14mmt of PE. As a result, due to continued high consumption of PE, China accounts for the largest capacity addition at 38.5mmt through 2030. Iran, a major gas producer stands second with 11.3mmtpa capacity addition through 2030.
- So far, the projections mentioned above suggest that the US and the Middle East would see large capacity additions in terms of basic chemicals, led by availability of cheaper natural gas. On the other hand, being the largest consumption center, China remains strong with high capacity additions.
- However, we note that China also suffers a fate similar to India in terms of natural gas availability. It uses refinery naphtha or coal for manufacturing most of its ethylene/methane and downstream chemicals.
- (*Exhibit 11*) shows how coal-based producers or refinery-naphtha-based producers are disadvantaged compared to natural gas, especially in regions, where gas prices are comparatively low like that in the Middle East or in the US.
- In addition to the high cost, producing chemicals from coal results in emissions eight times more than natural gas. As a result, coal-based chemical manufacturers would become more expensive if related carbon costs are included.
- Hence, irrespective of strategic reasons, coal-based production are likely to remain at the highest end of the cost curve.
- India has also set up a coal gasification target of 100mmt by 2030. However, project execution concerns remain and these will not be able to compete with natural gas-based projects.
- Hence, we believe **chemical manufacturing would gradually move to low cost natural gas regions such as the US and the Middle East over the coming decades**. Further, **Africa** is expected to ramp up its natural gas production in the coming years attracting subsequent investment in downstream chemcials.

Exhibit 9: US and China lead methanol capacity additions over 2021-25

Country	Location	Capacity (mmtpa)	Expected start	Remarks
US	Koch	1.7	2021	Commissioned in 2021
Iran	Sabalan	1.7	2021/22	Commissioned in 2021
US	Various	0.8	Geismar 2 debottleneck (2021) US Methanol (2021-end) Others	
Russia	Shchekinoazot	0.5	2021	Commissioned
China	Various	5.5	Backward integration of 2 MTO plants Standalone capacity additions in 2021/22	
US	Geismar 3	1.8	2023/2024	
Total		**12**		

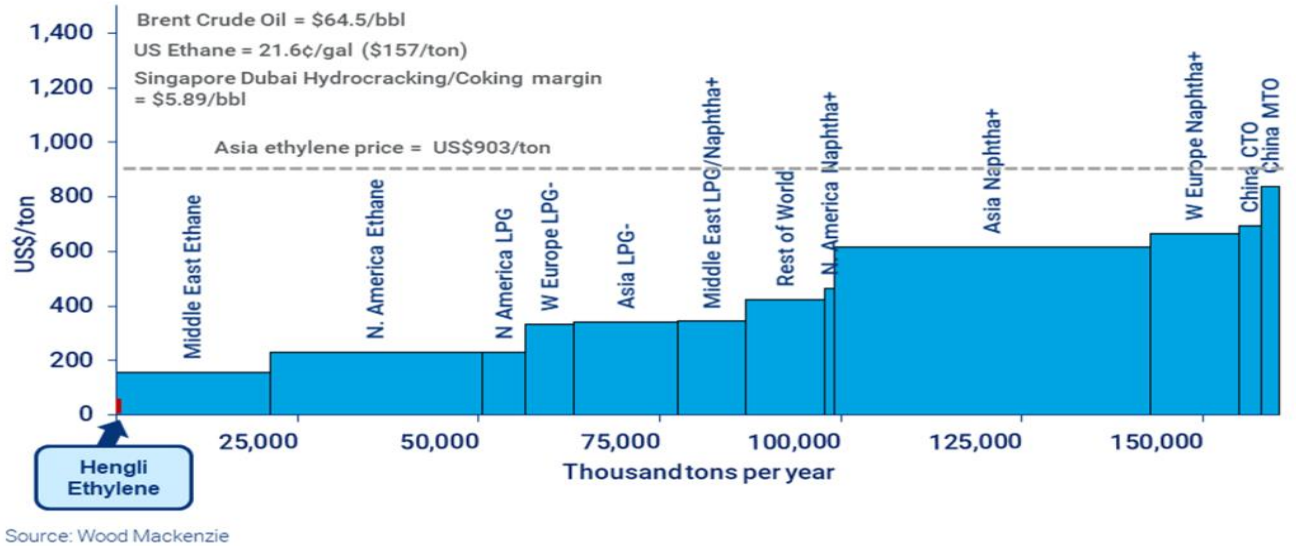
Source: Methanex, MOFSL

Exhibit 10: Ethylene capacity additions through 2030: China & the Middle East to lead



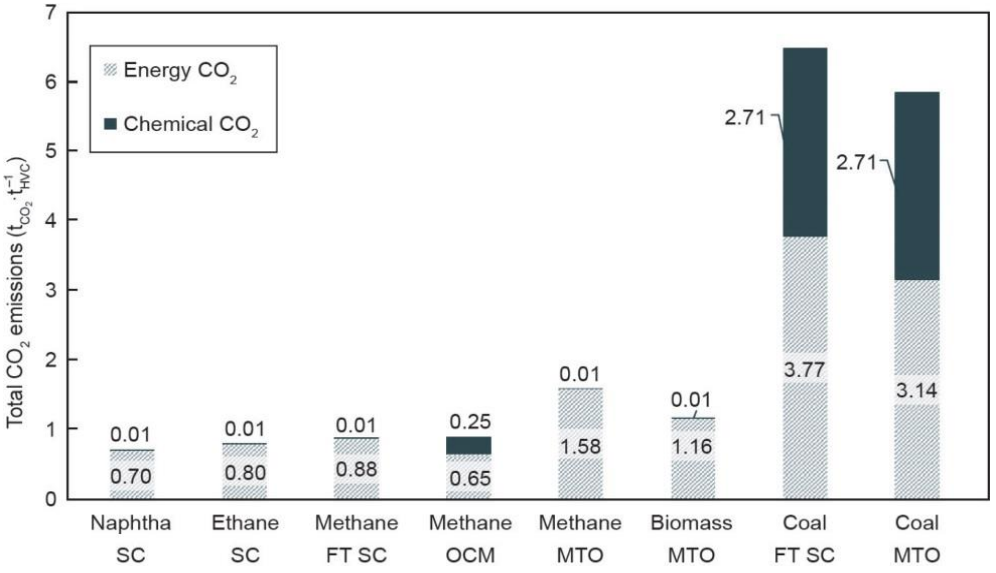
Source: Globaldata, MOFSL

Exhibit 11: Ethylene cost curve (2019)



Source: Woodmac, MOFSL

Exhibit 12: Comparison of emissions from various feedstock



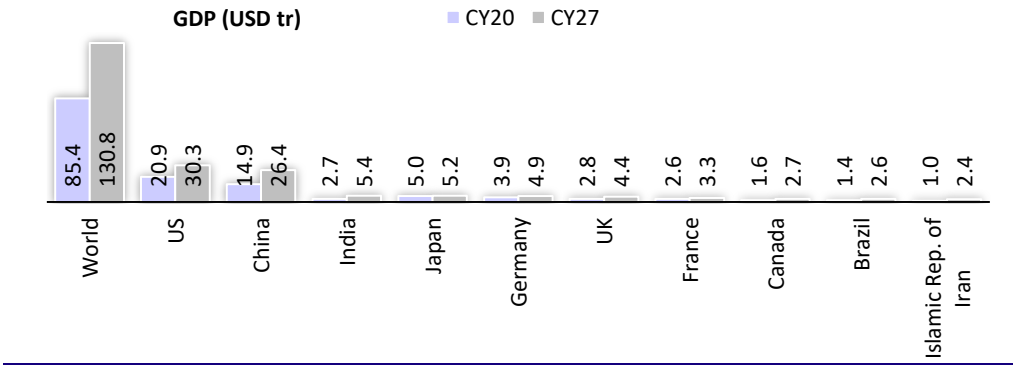
Source: Science Direct, MOFSL

India: Advantages as a large consumption center

Even though India is set to become the third largest economy by CY27, India's GDP would be just 4.1% of the global GDP by the same year.

- **A significantly large consumption center:** India offers a large consumption center with median age of 28 years (v/s ~38 years in China and the US, ~42 years in Western Europe, and ~49 years in Japan). Working population also accounts for 67% of the total population.
- The per capita consumption of chemicals is one-tenth of the global average, leaving a large scope for consumption growth. However, even after a decade, India's GDP may be just 4.1% of the global GDP - still much smaller than countries such as the US and China.
- **Large import substitution opportunity:** In FY21, our net imports of chemicals stood at USD12.7b (USD10.6b for FY22 till Sep'21). Out of this, organic chemicals stood at USD1.6b (USD2.4b), while inorganic chemicals stood at USD5.2b (USD3.7b). This high level of import presents a golden opportunity for domestic manufacturers.
- Whether India would be able to leverage its large consumer base and emerge as a large production center like China despite the feedstock disadvantage depends on the factors deliberated in the next section.

Exhibit 13: India's expected market share in global GDP a decade later



Source: IMF, MOFSL

Exhibit 14: Net imports into India (USDb)

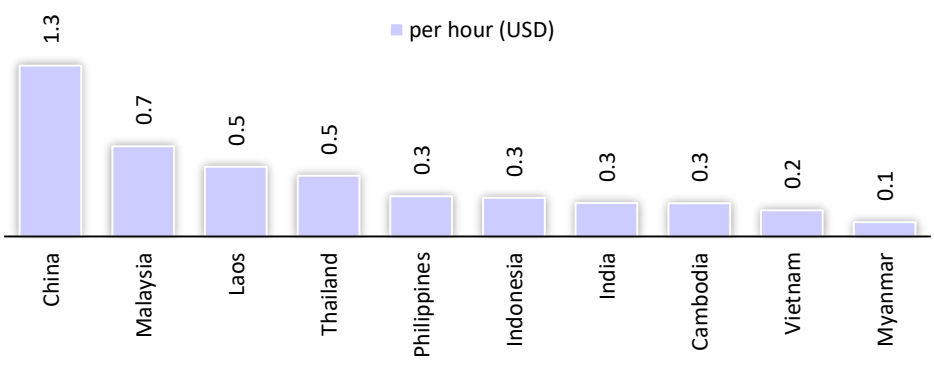
Net Imports (USD b)	FY17	FY18	FY19	FY20	FY21	FY22 (till Sep'21)
Inorganic Chemicals	3.4	4.3	5.6	4.6	5.2	3.7
Organic Chemicals	3.8	4.4	4.1	2.3	1.6	2.4
Miscellaneous Chemicals	4.6	6.6	6.2	5.1	5.9	4.5
Net Imports	**11.8**	**15.3**	**15.9**	**11.9**	**12.7**	**10.6**

Note: This data is excluding Pharmaceutical products and Fertilizers Source: Ministry of Commerce, MOFSL

India: Additional advantages

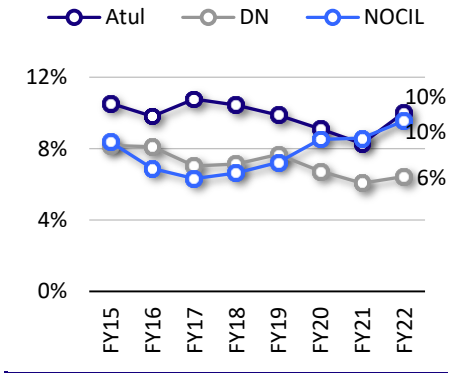
- **Cheaper labor cost:** As mentioned in our Initiating Coverage, India fares better than China in terms of cheaper manpower. Indian labor cost is now as low as one-third of China. It remains competitive to that of other emerging production hubs such as Malaysia, Thailand, and Indonesia.
- **Competitive electricity cost:** Under our coverage universe, process heavy companies such as Atul, NOCIL, Alkyl, Clean, Vinati, and Deepak Nitrite incur as much as 6-11% electricity cost as a percentage of sales.
- In terms of electricity costs for industrial usage, India fares well compared to other major economies. Average electricity cost in India in Mar'22 stood at USD.07/kWh vs. USD0.17-0.44/kWh for most developed countries. China also had a marginally higher electricity cost while the Middle East countries have access to significantly low electricity cost of USD0.005-0.05/kWh.
- **Government initiatives:** Government has taken several initiatives such as Production Linked Incentives (PLI), Atmanirbhar Bharat, Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs), and National Logistics Policy to boost domestic production.
- **PLI Scheme since 2020:** The Central government launched PLI schemes in 2020. Initially, it was targeted at Mobile and allied component manufacturing, electrical component manufacturing, and medical devices. However, since then, it has extended to a total of fourteen sectors, including automobile and auto components, electronics and IT hardware, telecom, pharmaceuticals, solar modules, metals and mining, textiles and apparels, white goods, drones and advanced chemistry cell batteries. The scheme stipulates 1% to as high as 20% incentives on incremental sales. In total, incentives worth INR1.97tr have been identified in addition to INR19.5b provided in FY23 budget.
- **PCPIR scheme:** The government aims to redraft PCPIR guidelines, which may raise investments and provide the basic raw materials for the chemical industry in India.
- **National Logistics Policy:** Logistics cost in India stands at 16% of the GDP. The government aims to reduce it to the global average of 8% by 2030 (link).

Exhibit 15: Labor costs benefit from manufacturing in India



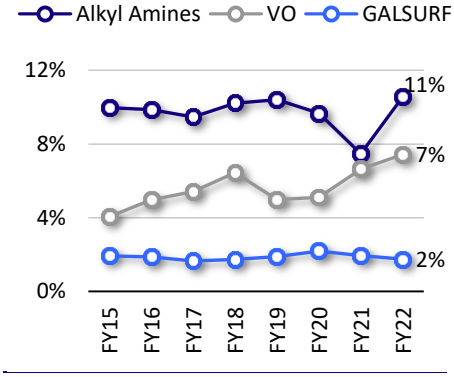
Source: Statista, MOFSL

Exhibit 16: Electricity cost (% sales)



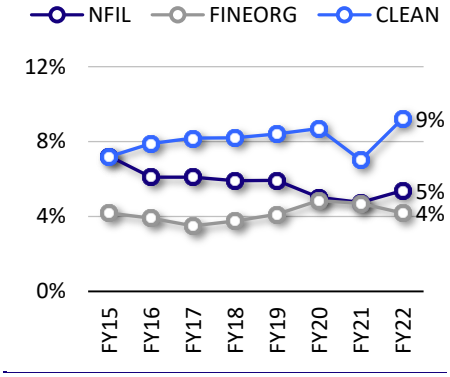
Source: Companies, MOSFL

Exhibit 17: Electricity cost (% sales)



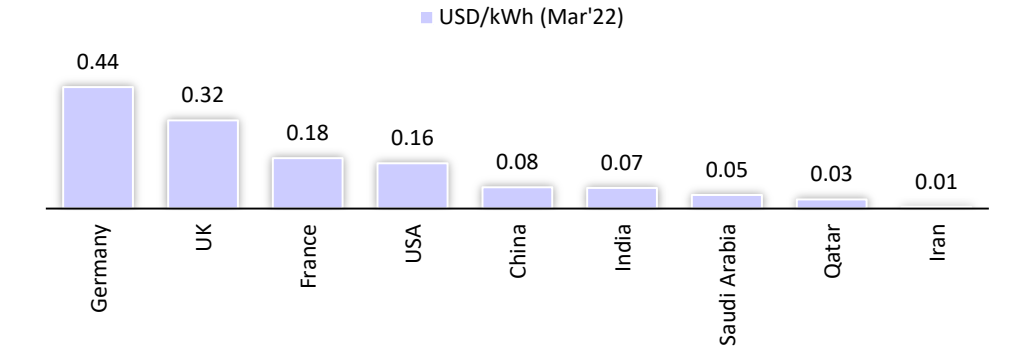
Source: Companies, MOSFL

Exhibit 18: Electricity cost (% sales)



Source: Companies, MOSFL

Exhibit 19: India's electricity cost for industrial users fares well due to high coal usage



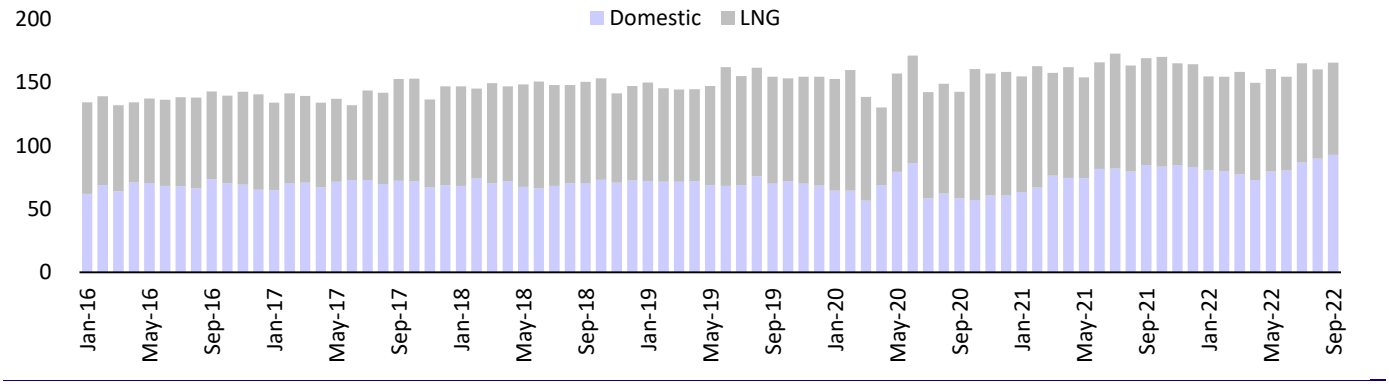
Source: globalpetrolprices, MOFSL

Several challenges remain

- **Lack of key raw materials:** Be it due to lack of resources or due to lack of exploration, our country is highly dependent on imports for both oil (~85%) and gas consumption (50%). Average import price of LNG in India stood at USD9.7/mmBtu in FY22 compared with HH price of USD4.1/mmBtu.
- Gas import would always be expensive due to involved liquefaction cost of USD2-4/mmBtu along with shipping cost of USD0.5-3/mmBtu. Hence, an ethylene plant or a methanol plant in India would never be able to compete with a plant nearer to the source of gas production.
- **Lack of experience in multiple chemistry platforms:** Most of the companies in India have remained in their niche areas. For example, NOCIL has remained in the business of rubber chemicals since its inception. NFIL is focused only on fluorine chemistry. Deepak Nitrite is focused mainly on phenol and downstream. Vinati Organics and Clean Science are focused on phenol downstream. Very few companies such as Atul and Aether Industries (not under coverage) have exhibited willingness to expand into multiple chemistries.
- This is also since they have been finding opportunities to grow in their respective areas. However, once the import substitution opportunity gets smaller, we would see Indian companies diversifying into other chemistries. That is when the strength of the companies to adapt to newer technologies would be tested.

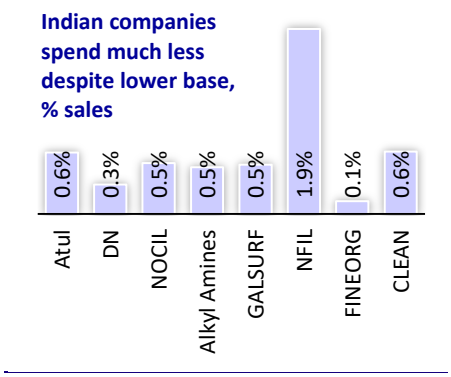
- **Significantly low R&D expenditure:** There appears a great opportunity for Indian chemical manufacturers in light of the increased uncertainty over China and rising production costs in Europe. However, a look at the companies under our coverage suggests that there is hardly any significant expenditure on R&D - a key toward long-term sustainable growth.
- Among the companies under our coverage, Vinati has stopped disclosing R&D expenditure in its Annual Reports over the past few years. Among others too, NFIL is the only one for which R&D expenditure is more than 1% of sales (1.9% average over FY18-22). All the other companies have R&D expenditure below 1% of sales.
- This stands woefully lower than global peers. Even with a much larger base, companies such as Dow and BASF spend 1.8% and 3.3% of their sales, respectively, on R&D. DuPont is higher at 4.6% while companies such as Syngenta and BASF are much higher at 7-9%.
- Even Chinese companies appear to have much a higher R&D expenditure. A few of the companies spend 3-5% of their sales on R&D.
- **Innovation index:** The higher the valuation multiple, the higher the expectation in terms of sustainability of earnings growth and margin stability. Our reverse DCF suggests that even after considering a fair amount of growth in a three-stage DCF, stock prices of most companies suggest 5-6% terminal growth. While this may not be impossible to achieve, lack of sufficient data makes it hard to believe. Innovation indices such as R&D-to-product conversion and new products-to-margin conversion could have helped evaluate the long-term performance of the companies. However, most Indian companies do not have sufficient data on this front.
- American Chemistry Council suggests that the share of revenues from new products stands at 15-18% for American companies. R&D-to-new product conversion stands at 6-9, while new product-to-margin conversion is 1-2%.

Exhibit 20: India's dependence on LNG remains at >50%



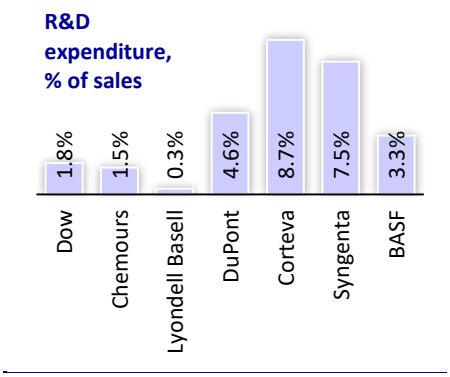
Source: Bloomberg, MOFSL

Exhibit 21: R&D in India (FY18-22)



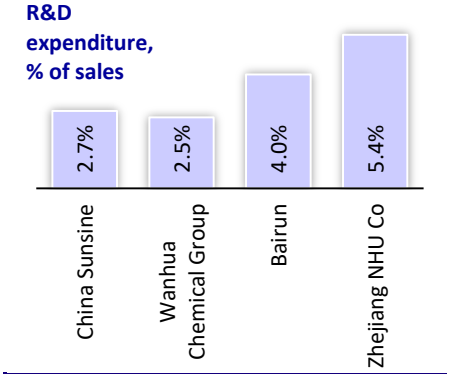
Source: Companies, MOSFL

Exhibit 22: Global majors (CY18-21)



Source: Companies, MOSFL

Exhibit 23: Chinese peers (CY18-21)



Source: Companies, MOSFL

Indian companies do not have sufficient disclosure in this respect, making it difficult to gauge long-term sustainability of growth and margin

Exhibit 24: Innovation index for American chemical companies

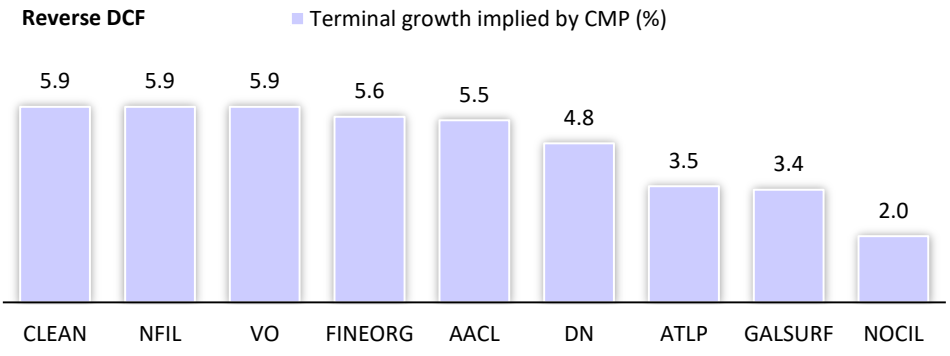
Table 7.1 - Share of Revenues from New Products, 2012-2021

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Share of Revenues from New Products	14.0%	14.0%	16.0%	14.2%	15.4%	12.7%	17.8%	14.2%	14.1%	14.7%
R&D-to-Product Conversion Ratio	7.9	7.7	7.9	6.1	7.2	6.1	8.7	6.9	6.5	6.7
New Products-to-Margin Conversion Ratio	1.4	1.4	1.5	1.3	1.4	1.3	1.8	1.5	1.6	1.2

Sources: American Chemistry Council.

Source: American Chemistry Council, MOFSL

Exhibit 25: Terminal growth rates implied by current stock prices (%)



Source: Companies, MOFSL

India largely absent in new technologies

- **Top 10 technological advances globally:** In 2019, International Union of Pure and Applied Chemistry (IUPAC) launched an initiative to identify "Top Ten Emerging Technologies in Chemistry Initiative". The initiative identified the following: 1) sodium-ion batteries, 2) nanozymes, 3) aerogels, 4) film-based fluorescent sensors, 5) nanoparticles mega libraries, 6) fibre batteries, 7) liquid solar fuels, 8) textile displays, 9) rational vaccines with SNA, and 10)VR-enabled interactive modeling. In none of these emerging technologies, there are any serious India-based players. In the longer run, a lack of cutting edge development would be disadvantageous in the chemical industry.

- **New age refrigerants:** Only 8% Indian households use ACs in India. This is likely to rise to 40% by 2037, reflecting a large surge in demand for refrigerants. Our import from China alone stood at ~13,000mt, which resulted in ADD being applied on the import of HFCs.
- India ratified the Kigali Agreement in 2021. India, along with Group III countries, has agreed to cut down HFCs (hydro fluoro carbons) by 85% of 2024-26 levels over 2028-47. We are still far away from the deadline and the country would continue to use R22 (Hydro Chloro Fluoro Carbon, HCFC), R32 (HFC).
- Rising demand and large dependence on import along with the requirement of low Global Warming Potential (GWP) refrigerants make it necessary to develop domestic technology for new-age refrigerants. Projects such as INDEE (usage of CO2, which later transformed into INDEE+), Global Cooling Prize, Platform for Innovative Cooling Strategies and Godrej-GIZ (propane) have been launched but without much success. Under India Cooling Action Plan, Department of Science and Technology is funding the development of low GWP refrigerants at CSIR-IICT-Hyderabad.
- India, once again does not have much to show except that Navin Fluorine has bagged a contract to manufacture HFO for Honeywell.
- **Electronics materials:** These could be broadly classified into energy storage solutions, semiconductors, and solar panels. Fuel cells are somewhat similar to batteries.
- Energy storage solutions consist of anode/cathode, membrane, and electrolytes. Some Indian companies have announced their plans to venture into PVDF membranes. PTFE is used as superior insulating material, also being produced by few Indian companies. Electrolytes could be LiPF6, LiBF4, or LiClO4. Additives such as Fluoro ethylene carbonate and vinylene carbonate are used in electrolytes for better performance.
- However, India does not have a large manufacturing base as of now for energy storage solutions or for semiconductors. 80-85% of solar panels are also imported. As a result, Indian chemical companies currently do not have much to offer.

Exhibit 26: Top 10 emerging technologies in the chemical industry - India largely not on the scene

Sl. No	Technology name	Attributes	Applications	Companies/Groups active	Indian connection?
1	Sodium Ion Batteries	Although lower shelf life and energy density vs Li, they offer much better sustainability and circular economy and are not constrained in availability like Li; also 30-40% cheaper	Energy storage devices	CATL, China HiNa Battery, China Faradion, UK Natron Energy, USA Altris, Sweden	RIL has acquired Faradion
2	Nanozymes	Humans made nanomaterials with properties such as natural enzymes but much more durable, secure, and stable	Therapeutics, sensing, water treatment, pollution removal	Novozyme, USA Profacgen, USA	Bionics Enviro Tech?
3	Aerogels	Lightest solids known; outstanding thermal insulation with half the thickness of conventional insulators	space technology, catalysts, super capacitors, drug delivery systems, water purification, pollution removal, energy generation & storage, energy harvesting	Aerogel Technologies, USA Aspen Aerogels, USA Svenska Aerogel, Sweden Cabot Corporation, Germany Green Earth Aerogel, Spain	Virtela India? Ciena India? Active Aerogel?
4	Film based Fluorescent sensors	High sensitivity and selectivity	2D/3D films that react to external stimuli	Still in lab stage	
5	Nanoparticle megalibraries	Various combinations of nanoparticles containing different nanomaterials and segments	semiconductors, electrical, magnetic, optical applications	Tera-print, USA Stoicheia, USA	-
6	Fibre batteries	Almost 1D design, with intertwined wires as electrodes, protected by a polymeric coating; flexible, robust & safe; very high energy density	wearable / printed electronics, supercapacitors	Samsung, Huawei appear to have been investigating the applications; MIT, USA made the longest 140m fibre battery so far	-
7	Liquid solar fuels	using artificial photosynthesis to produce solar fuels	renewable fuels, photocatalysis	NREL, USA Several University research Groups in USA/Europe Liquid Sunshine Project, China	-
8	Textile displays	similar to fibre batteries; fibres capable of emitting light; increases breathability, makes wearables softer	wearable electronics	Samsung, South Korea LG, South Korea AU Optronics, Taiwan Japan Display, Japan BOE Technology, China Tianma Microelectronics, China Kopin Corporation, USA Truly Semiconductors, China eMagin Corporation, USA Hannstar Display, Taiwan Varitronix International, China TCL Display, China Yunnan OLiGHTEK, China Lumus Vision, Israel	-
9	Rational Vaccines with SNA	3D nanostructures with spherical nucleic acids enable better cell penetration and are more stable at room temperatures	healthcare, material science	Exicure, research groups in USA	-
10	VR enabled interactive modelling	immersive experience accelerates modelling ten times quicker	healthcare	Nanome, USA	-

Source: IUPAC, MOFSL

Exhibit 27: India again doesn't have much to show in the development of new age refrigerants

Commitment under Kigali Amendment	Requirement	Global initiatives	Inventors	India's presence
To cut down HFCs by 85% of 2024-26 levels during 2028-47	no ODP, low GWP refrigerants	CO2, NH3, HFOs	Honeywell/Chemour (erstwhile DuPont)	NFIL has been contracted by Honeywell for production of HFOs

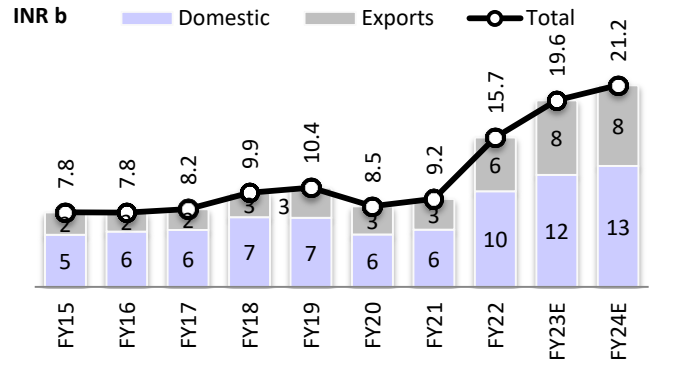
Source: MOFSL

Conclusions, valuations, and recommendations

- **Terminal growth rates of 5-6%:** We build in a reverse 3-stage DCF to understand the terminal growth rates the stock prices are building in.
- Our research suggests that the companies need to show 5-6% terminal growth rate even after this 15-year period, considered in the three-stage DCF. This high growth requires a sizeable R&D pipeline, which the disclosures do not suggest.
- Additionally, in the recent past, the companies have benefited by the global supply chain disruptions as well as emission restrictions in the Chinese chemical manufacturing.
- The natural gas crisis in Europe has also made certain manufacturers cut their production in Europe, both due to inflationary demand pressures as well as high cost of manufacturing.
- However, over the longer term, we expect migration of chemical industries towards the US, the Middle East, and Africa due to availability of cheaper natural gas.
- In light of the above concerns, high valuation multiples do raise concerns. We have a neutral rating on Atul, Alkyl Amines, Clean Science, Deepak Nitrite, Fine Organics, and Navin Fluorine. We reiterate our Buy on NOCIL, Vinati Organics as well as Galaxy Surfactants.
- **NOCIL**: In volume terms, the Indian Tyre industry is likely to grow 7-9% in FY23. Domestic Tyre companies are planning to ramp up production, with a planned capex of INR200b over the next three years. Valuing NOCIL at 22x FY24E EPS, we reiterate our Buy rating.
- **Vinati Organics**: The demand outlook for the ATBS segment remains positive going forward, after a temporary blip in FY22. Veeral Organics Pvt. (a wholly-owned subsidiary of VO) is set to commence production of MEHQ, Guaiacol, and Iso Amylene in 1HFY24E, which should propel the next-level of the growth story for VO. We value the stock at 45x FY24E EPS and reiterate our Buy rating.
- **Galaxy Surfactants**: The continued focus on R&D (with an annual expenditure of INR400- 500m) and increased wallet share from existing customers is likely to drive volume growth and expand EBITDA margin. Volumes registered a ~6% CAGR over the last five years. We build a similar growth over FY22-24 as well and reiterate our Buy rating on the stock.

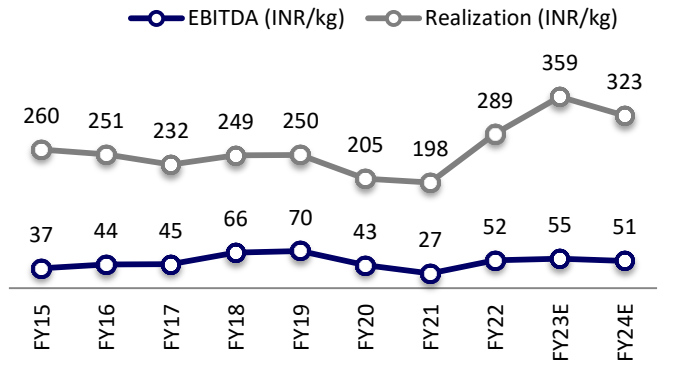
NOCIL– financial summary and assumptions (TP: INR283) – BUY

Exhibit 28: Exports to constitute ~40% of total revenue



Source: Company, MOFSL

Exhibit 29: Realization/mt and EBITDA/mt snapshot



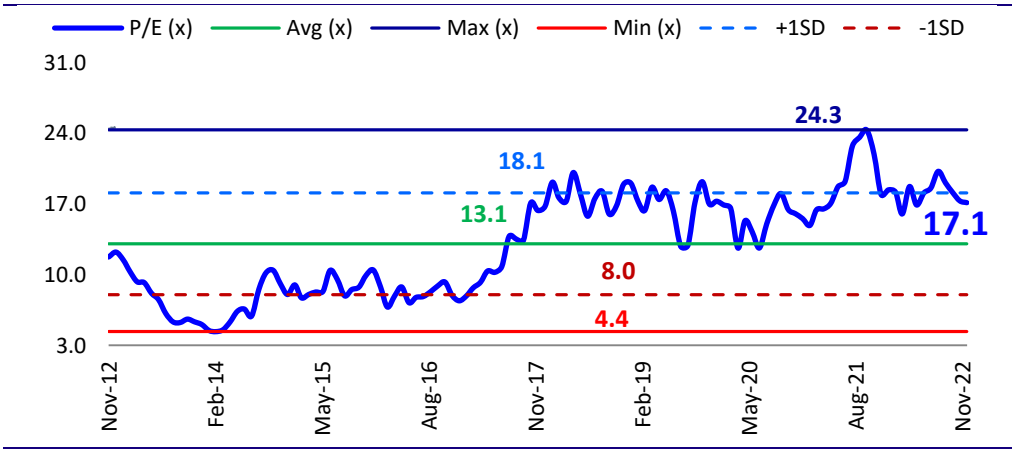
Source: Company, MOFSL

Exhibit 30: Financial summary (INR b)

Y/E March	FY17	FY18	FY19	FY20	FY21	FY22	FY23E	FY24E
Sales	8.2	9.9	10.4	8.5	9.2	15.7	19.6	21.2
EBITDA	1.6	2.6	2.9	1.8	1.3	2.8	3.0	3.3
PAT	1.0	1.7	1.8	1.3	0.9	1.8	1.9	2.1
EPS (INR)	5.8	10.1	11.1	7.9	5.2	10.6	11.5	12.8
EPS Gr. (%)	24.6	74.1	9.2	(28.9)	(34)	103	9	11
BV/Sh.(INR)	54.4	62.4	69.4	70.8	77	86	93	101
Ratios								
Net D:E	(0.1)	(0.0)	(0.0)	(0.0)	(0.1)	(0.0)	(0.0)	(0.1)
RoE (%)	14.1	17.4	16.8	11.2	7.1	13.0	12.9	13.3
RoCE (%)	12.6	15.6	15.4	10.5	6.6	12.2	12.1	12.5
Payout (%)	24.0	21.0	27.0	76.0	38.5	28.4	40.0	40.0
Valuations								
P/E (x)	39.3	22.6	20.7	29.1	44.0	21.7	19.9	17.8
P/BV (x)	4.2	3.7	3.3	3.2	3.0	2.7	2.5	2.3
EV/EBITDA (x)	23.5	14.4	13.0	21.5	29.4	13.4	12.6	11.0
Div. Yield (%)	0.5	0.8	1.1	2.0	0.9	1.3	2.0	2.2
FCF Yield (%)	3.4	1.3	(1.9)	(0.0)	1.7	(1.7)	2.1	5.0

Source: Company, MOFSL

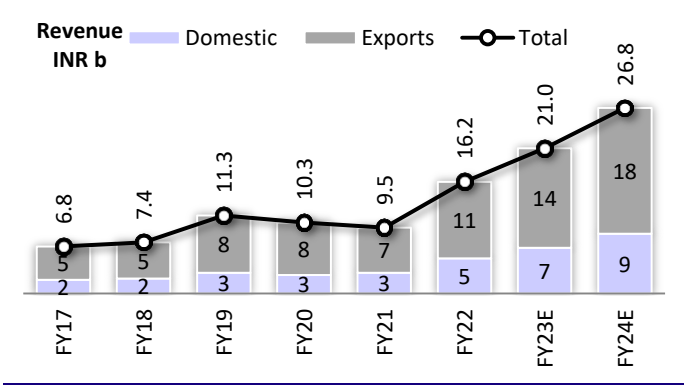
Exhibit 31: One-year forward P/E trades at 17x for NOCIL



Source: Company, MOFSL

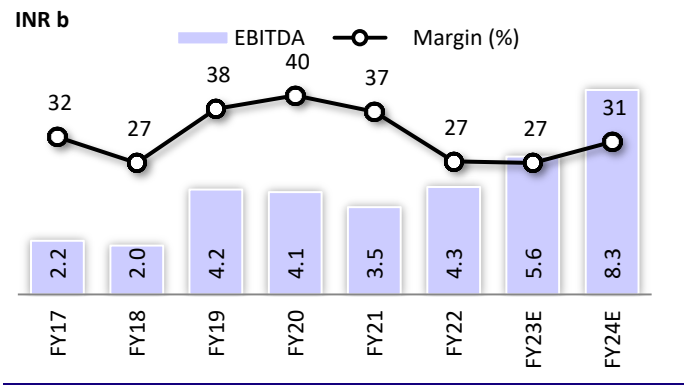
VO– financial summary and assumptions (TP: INR2,500) – BUY

Exhibit 32: Exports likely to remain high



Source: Company, MOFSL

Exhibit 33: EBITDAM to improve as new projects start



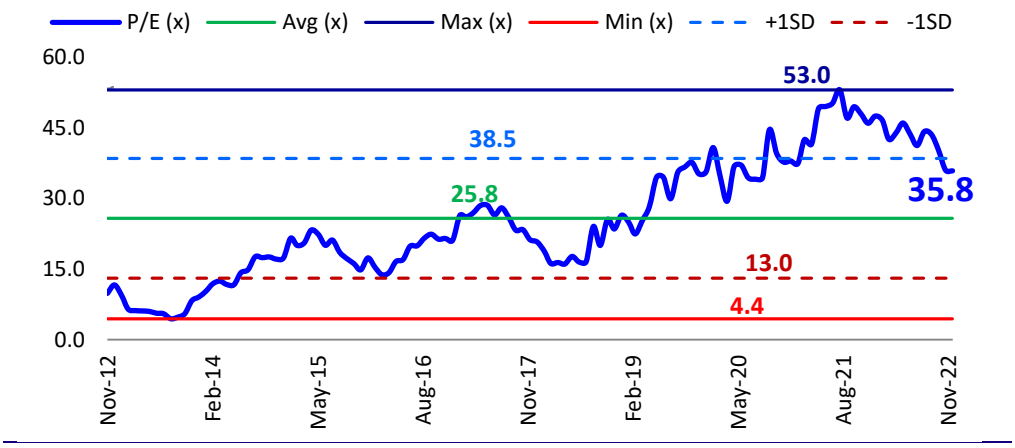
Source: Company, MOFSL

Exhibit 34: Financial summary (INR b)

Y/E March	FY17	FY18	FY19	FY20	FY21	FY22	FY23E	FY24E
Sales	6.8	7.4	11.3	10.3	9.5	16.2	21.0	26.8
EBITDA	2.2	2.0	4.2	4.1	3.5	4.3	5.6	8.3
PAT	1.4	1.4	2.8	3.3	2.7	3.5	4.3	6.4
EPS (INR)	13.6	14.0	27.5	32.5	26.2	33.7	42.3	62.5
EPS Gr. (%)	6.6	2.6	96.3	18.2	(19.3)	28.7	25.3	47.9
BV/Sh.(INR)	66.2	77.5	102.3	124.5	150.2	177.9	212.0	262.5
Ratios								
Net D:E	(0.0)	0.0	(0.0)	(0.0)	(0.0)	0.0	0.1	0.1
RoE (%)	23.0	19.5	30.6	28.6	19.1	20.6	21.7	26.4
RoCE (%)	20.5	17.6	27.9	26.9	18.1	19.5	20.1	24.0
Payout (%)	2.2	2.2	9.9	31.6	22.9	19.3	19.3	19.3
Valuations								
P/E (x)	153.9	150.0	76.4	64.7	80.1	62.3	49.7	33.6
P/BV (x)	31.7	27.1	20.5	16.9	14.0	11.8	9.9	8.0
EV/EBITDA (x)	99.5	109.5	51.0	52.0	61.2	49.8	38.9	26.3
Div. Yield (%)	0.0	0.0	0.1	0.3	0.3	0.3	0.4	0.6
FCF Yield (%)	0.1	0.4	0.7	0.5	0.8	(0.2)	0.4	1.1

Source: Company, MOFSL

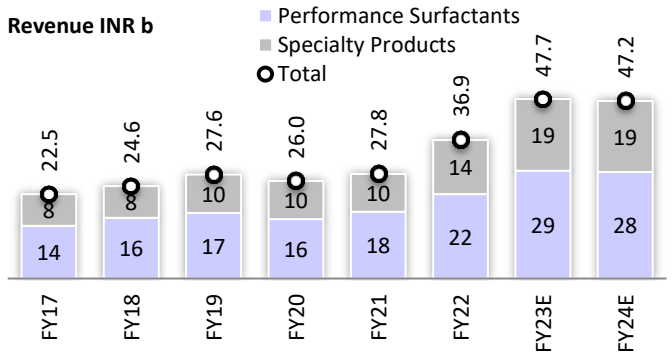
Exhibit 35: One-year forward P/E trades at 36x for VO



Source: Company, MOFSL

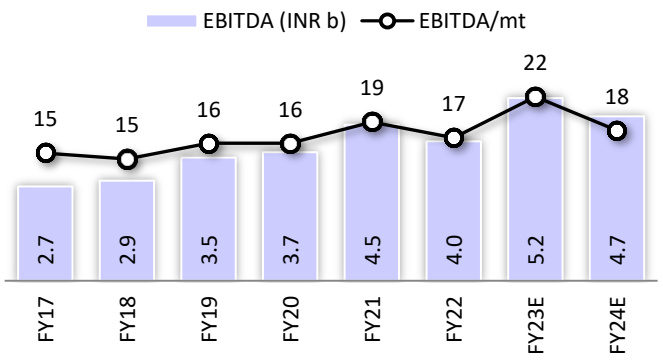
GALSURF – financial summary and assumptions (TP: INR3,390) – BUY

Exhibit 36: Specialty products to have consistent share



Source: Company, MOFSL

Exhibit 37: EBITDA/mt is set to rise to INR21-22 in FY23E



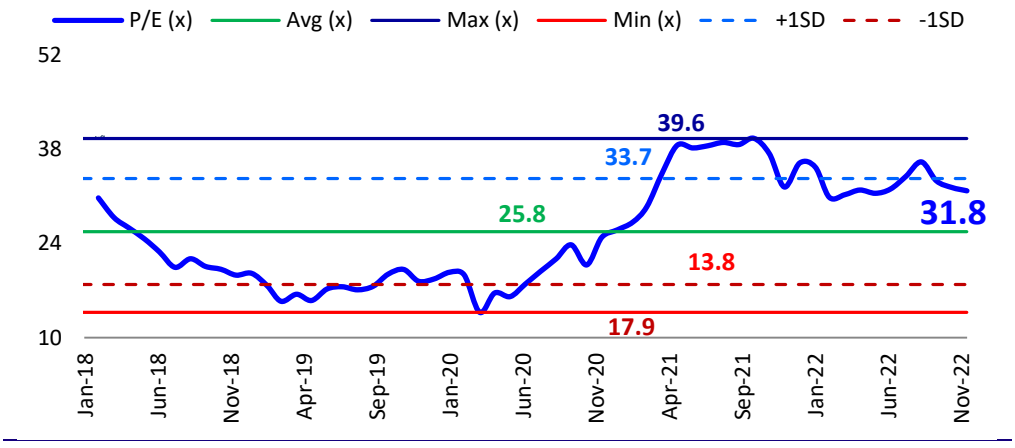
Source: Company, MOFSL

Exhibit 38: Financial summary (INR b)

Y/E March	FY17	FY18	FY19	FY20	FY21	FY22	FY23E	FY24E
Sales	22.5	24.6	27.6	26.0	27.8	36.9	47.7	47.2
EBITDA	2.7	2.9	3.5	3.7	4.5	4.0	5.2	4.7
PAT	1.5	1.6	1.9	2.3	3.0	2.6	3.4	3.0
EPS (INR)	42	45	54	65	85	74	95	85
EPS Gr. (%)	44	7	21	21	31	(13)	28	(10)
BV/Sh.(INR)	162	203	247	301	367	444	516	580
Ratios								
Net D:E	0.6	0.4	0.3	0.2	0.1	0.2	0.2	0.1
RoE (%)	28.9	24.4	23.9	23.7	25.5	18.3	19.7	15.5
RoCE (%)	17.8	17.3	18.4	19.1	21.1	15.5	16.5	13.6
Payout (%)	11.6	8.1	26.9	31.5	21.1	24.3	24.3	24.3
Valuations								
P/E (x)	69.2	64.6	53.5	44.3	33.8	38.9	30.4	34.0
P/BV (x)	17.8	14.2	11.6	9.6	7.8	6.5	5.6	5.0
EV/EBITDA (x)	39.0	36.6	29.7	28.4	23.0	26.2	20.2	22.1
Div. Yield (%)	0.1	0.1	0.4	0.6	0.6	0.6	0.8	0.7
FCF Yield (%)	0.7	0.9	1.1	1.7	2.5	(1.5)	0.1	2.5

Source: Company, MOFSL

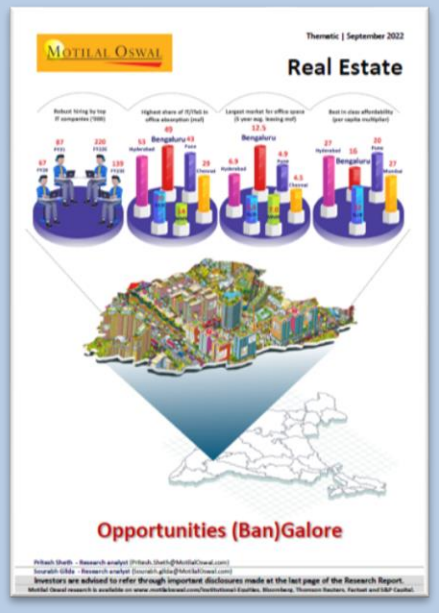
Exhibit 39: One-year forward P/E trades at 32x for GALSURF

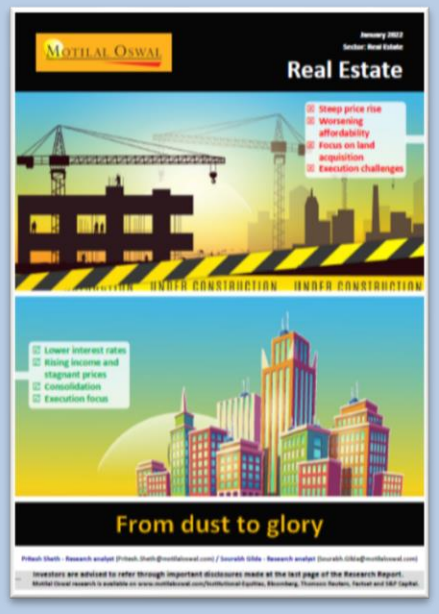


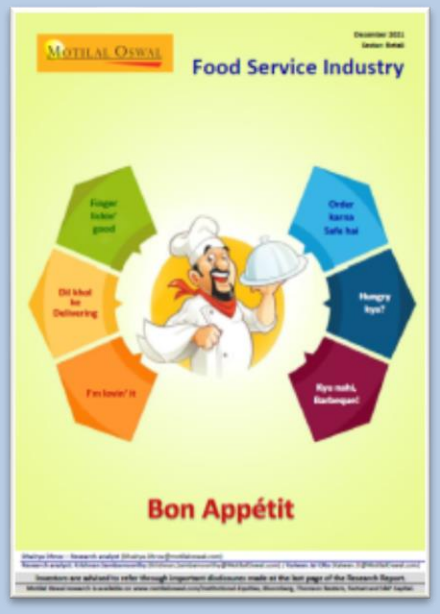
Source: Company, MOFSL

REPORT GALLERY

RECENT STRATEGY/THEMATIC REPORTS







REPORT GALLERY

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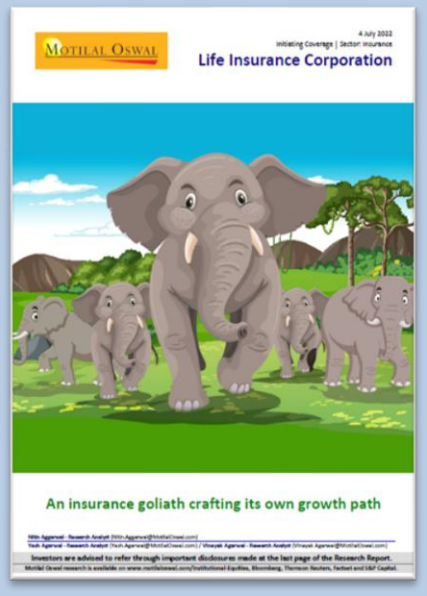

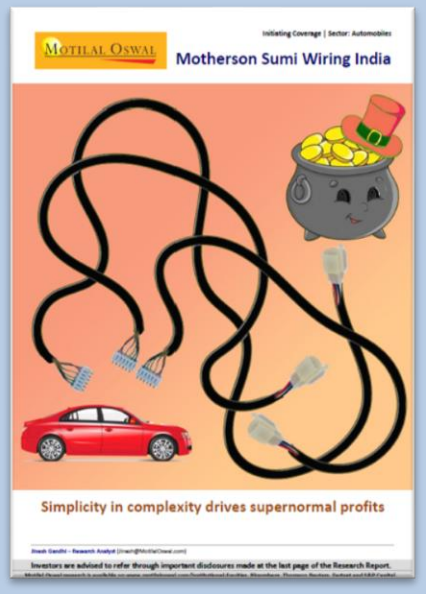

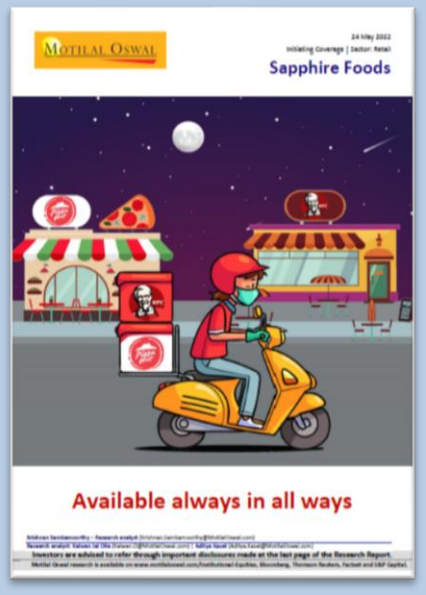

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Investment Rating	**Expected return (over 12-month)**
BUY	>=15%
SELL	< - 10%
NEUTRAL	< - 10 % to 15%
UNDER REVIEW	Rating may undergo a change
NOT RATED	We have forward looking estimates for the stock but we refrain from assigning recommendation

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