Indian CHEMICAL News

3rd Edition

CHEMICAL INDUSTRY OUTLOOK 2023

India@75
Looking Back, Looking Ahead

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Indian CHEMICAL News

April 2023

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CIO 2023 India@75: Looking Back, Looking Ahead

Indian Chemical News (ICN), the most credible online media platform for the Chemicals, Petrochemicals, and Energy sector, is happy to present the Third Annual Edition of Industry Compendium titled “Chemical Industry Outlook 2023,” (CIO 2023), an exclusive collection of premium content for stakeholders and thought leaders in the industry. The theme of this year’s edition is ‘India@75: Looking Back, Looking Ahead’.

As the nation celebrates ‘Azadi Ka Amrit Mahotsav’ commemorating 75 years of India’s independence, ICN has embarked on its ambitious endeavor: CHEMICALS@75. The initiative aims to highlight the critical role that the Chemicals sector plays in the country’s economic growth and how it can catalyze the government's dream of a self-reliant, prosperous, advanced, and modern India by 2047, as envisioned by the Prime Minister Narendra Modi.

In the spirit of the Amrit Mahotsav, CHEMICALS@75 is dedicated to companies, brands, and personalities who have and will play revolutionary roles in activating the vision ‘India 2.0’ fuelled by the spirit of Atma Nirbhar Bharat. At the same time, the Compendium also dwells on matters that concern the sector in unleashing its potential, for the country, for businesses, and for the people.

The 2023 edition focuses on past achievements and also on future roadmap. ICN has compiled more than 75 interviews, columns, and overviews covering Chemicals, Petrochemicals, Energy, Digitalization, Supply Chain & Logistics, and Sustainability giving a complete 360 degree view. The interviews/columns and forewords are from industry stalwarts in chemical manufacturing, industry associations, academia, R&D organizations, supply chain & logistics, and digitalization & automation sectors and provide a holistic view.

The interviews/columns focus on global and Indian trends, policy, green chemistry, circular economy, sustainability, Net Zero, etc.

The Indian Chemicals and Petrochemicals industry is forecast to grow from US $220 billion in 2022 to US $304 billion by 2025 and US $1,000 billion by 2040. The chemical companies based in India are looking to become Aatmanirbhar and so are focusing on both forward and backward integration. Not only this, companies are expanding their existing brownfield capacities and building greenfield capacities in a big way by leveraging on China+1 and Europe+1 opportunities. All this is good for India and we need to work with an integrated approach so that all segments benefits in this process.

For India to achieve US $1 trillion by 2040 from the Chemicals and Petrochemicals sector, players need to focus on digitalization in a big way. The government needs to rationalise Supply Chain & Logistics costs by reducing the overall cost from present 14 percent to 8-9 percent and for which the work is underway and the situation will improve with the construction of road, highways, ports, and airports. Indian companies need to focus on global regulations minutely and also improve on their sustainability scores to come at par with global peers. All these steps will make India a Chemicals and Petrochemicals manufacturing hub for the world.

It is encouraging to see Chemicals and Petrochemicals companies based in India increasing their investments in Research & Development by setting up large innovation centres to bring new, innovative, and sustainable products which are in great demand not only in India but also outside India. Focus should also be on new innovations to cut down on the processes and pass on cost advantages to the end consumer. Biobased products are in great demand and the industry needs to harness it by bringing it at par both on price and quality with non-biobased products.

We thank you for all your support in bringing this edition of Chemical Industry Outlook and look forward to your valuable feedback/comments so that we can improve on it going forward.

Happy Reading!

Pravin Prashant
Editor
Indian Chemical News
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Secretary
Government of India
Ministry of Chemicals & Fertilizers
Department of Chemicals & Petrochemicals

27th March 2023

MESSAGE

I am happy to know that Indian Chemical News (www.indianchemicalnews.com) is publishing 3nd edition of its compendium titled 'Chemical Industry Outlook 2023' in April 2023. The theme of the Compendium 'Indian Chemical@75: Looking Back, Looking Ahead, is in sync with the vision of the Department of Chemicals and Petrochemicals, Ministry of Chemicals and Fertilizers, Government of India.

2. The global chemicals and petrochemicals market size is presently estimated at US $5 trillion. The size of Indian Chemicals and Petrochemicals Industry was US $178 billion in 2019 and expected to grow US $ 304 billion by 2025 and US $1 trillion by 2040. The Ministry of Chemicals & Fertilizers, Government of India is ready for reforms to help industry to move forward. We need to create a thriving environment to make India a destination for manufacturing Chemicals and Petrochemicals.

3. Multiple initiatives like PLI scheme, reforms in corporate tax regime, support to MSME sector etc. are helping the domestic industries in ramping up their production and also attracting the global brands; thus making the manufacturing more attractive in the country. Government is taking continuous feedback from stakeholders and improving its policies to realise the growth potential of these sectors.

4. Indian Chemical News (ICN) is a credible information platform for Chemicals, Petrochemicals, and Energy sectors and trying to contribute to the growth of these sectors by creating awareness about Government of India's initiatives of making these industry sectors 'AatmaNirbhar'.

5. The Compendium is a collection of interviews and opinions dedicated to help specialist markets and industry communities exchange ideas and innovations in the field.

6. I wish 'Chemical Industry Outlook 2023' all success.

(Arun Baroka)

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CCFI

31st March, 2023

MESSAGE

I am pleased to know that Indian Chemical News is shortly publishing the 3rd edition of its compendium titled 'Chemical Industry Outlook 2023' in April 2023.

The Agrochemical Industry has grown to reach a business turnover of Rs. 65,000Cr. with Rs. 36,000 Cr. as exports and another Rs. 29,000 Cr. in the domestic market.

This augurs well especially for those members who are focusing on exports, where our quality is well accepted in over 130 countries. Likewise in domestic market companies with PAN India presences, focusing on niche crops have done well.

To make India into manufacturing hub it is critical that fresh investment is made by the corporates which are partially dependent on inclusion of agrochemicals under the Production Linked Incentive (PLI) scheme which is presently under active consideration by the government.

However, it is a matter of concern that imports have been on the increase in the last few years as depicted below

Year	Agrochemical Exports from India (Rs. cr.)	Agrochemical Imports (Rs. cr.)
2019-20	23,757	9,096
2020-21	26,513	12,418
2021-22	36,521	13,365
Est: 2022-23	40,000	15,000

Indian Chemical News as a responsible platform needs to create awareness about the usefulness and the positives of using agrochemicals which have been instrumental in reducing crop losses both in the farmer's fields and during storage.

Crop Care Federation of India (CCFI) extends its warm wishes for this compendium.

Regards,

Harish Mehta
Senior Advisor

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MESSAGE

Indian Chemical News (www.indianchemicalnews.com) is publishing the 3rd edition of its compendium titled "Chemical Industry Outlook 2023" in April 2023. The theme of the Compendium 'India@75: Looking Back, Looking Ahead' is so apt considering that the Nation is celebrating Aazadi ka Amrit Mahotsav.

Alkali industry includes bulk chemicals which acts as the basic crucial component for various industries. Caustic Soda is one of the major contributors in Alkali chemicals. There are various market drivers that exist for the alkali industry to grow substantially.

In 2022, the global market for chlor-alkali chemicals was estimated to be worth US$ 90 billion. It is anticipated to increase at a CAGR of 6.8% to reach US$ 152 billion by 2030.

India produced approximately 7.7 million metric tons of alkali chemicals in fiscal year 2022. Among the three major chemicals under this category, soda ash was the second most widely manufactured alkali chemical in the country with a production of 3.6 million MTPA. Caustic Soda was the highest produced alkali chemical during 2021-22 with a production of 4.1 million MTPA. These chemicals contribute to manufacturing important chemicals including Alumina, Textiles, Glass, Soaps & Detergents, Pulp & Paper, Water Treatment, organic and inorganic chemicals, specialty chemicals, pharmaceuticals, dyes & chemicals etc.

We welcome any new capacity addition in the country as it will be a step towards making India self-reliant. We can foresee a sustainable growth of alkali sector in India.

It is indeed a good initiative of Indian Chemical News (ICN) to come out with this comprehensive issue on chemicals and petrochemicals sector.

I am sure that the Compendium will highlight the challenges and opportunities that Indian chemical sectors have been facing.

I extend my best wishes and success to the 'Chemical Industry Outlook 2023'.

Kapil Malhotra
President
Alkali Manufacturers Association of India

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In India, MFL is the 1st to set up an Epichlorohydrin plant and largest capacity plant of CPVC Resin. MFL is India's 4th largest manufacturer of Caustic Soda, Chlorine and Hydrogen and a leading manufacturer of Caustic Potash, Chloromethanes and Hydrogen Peroxide.

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- o Hydrogen Peroxide

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- o CPVC Resin - Additional Capacity 45,000 TPA
- o Chlorotoluene & its Value Chain
- o Research & Development Centre
- o Wind-Solar Hybrid Power Plant

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MESSAGE

It is heartening to know that Indian Chemical News (www.indianchemicalnews.com) is publishing the 3rd edition of its compendium titled 'Chemical Industry Outlook 2023' in April2022. The theme of the Compendium 'India@75: Looking Back, Looking Ahead' will definitely takes the reader in past, present and future of the Indian chemical industry.

India's agrochemicals sector is estimated to grow at 15-17% in FY23, primarily driven by strong exports and stable domestic demand. The sector registered a 23% rise in the fiscal year ended 2022. In FY24 too, the industry revenue will see an expansion of 10%-12% as India continues to benefit from the "China plus one" strategy of global players and as patents on key molecules expire.

Meanwhile, export revenue is seen rising 18-20% this fiscal, with the US dollar appreciating ~9% so far and volume growing as global players continue to de-risk their China dependency. Next fiscal, exports will likely grow 12-14% as players keep up capex with an eye on molecules worth $4 billion going off-patent over the next two years.

India is the 4th largest global producer of Agrochemicals after US, Japan and China and second largest producer in Generics. Currently Indian pesticide industry market size is estimated to be over US$ 6 billion with exports accounting to the tune of US$ 3 billion.

The industry is expected to grow at an average of 8% to 10%. India can become global pesticide manufacturing hub if the Government provide timely assistance in technology development. The significance of pesticides has been rising over the last few decades catalyzed by the requirement to enhance the overall agricultural production and the need to safeguard adequate food availability for the continuously growing population in the country.

Every year in India pests eat away one fourth of food produced by the Farmers and annual Crop Losses due to Pests and Diseases amounts to 15% to 25% of the total output of the country.

Consumption of pesticides in India is one of the lowest in the world and stands at 0.65 kg/ha against the global average consumption of 3 kg/ha. The role of Pesticides is not limited to protection from pests and diseases that threaten our food supply but they help in yield enhancement as well. This suggests that the market for pesticides is still largely unpenetrated with a huge room for future growth.

Indian Chemical News (ICN) is a credible information platform for Chemicals, Petrochemicals and Energy sectors and trying to contribute to the growth of these sectors by creating awareness about the latest development of these sectors.

I am sure that the Compendium will discuss and highlight all contemporary issues and offer a roadmap for the growth of the Indian chemicals and petrochemicals sectors.

I extend my best wishes and success to the 'Chemical Industry Outlook 2023'.

PRADIP DAVE
President, PMFAI

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MESSAGE

I am happy to know that Indian Chemical News (www.indianchemicalnews.com) is publishing the 3rd edition of its compendium titled 'Chemical Industry Outlook 2023' in April 2023. The theme of the Compendium 'India@75: Looking Back, Looking Ahead' will definitely takes the reader in past, present and future of the Indian chemicals and petrochemicals industry.

Indian Paints & Coatings sector will become a Rs. 1 lakh crore Industry in the next five years from the current Rs. 62,000 crore. This is in line with the consistent double digit Compound Annual Growth Rate (CAGR), the sector has been achieving over the last few years. In order to achieve a figure of Rs. 1 lakh crore, the paint industry needs to invest Rs. 35,000 - 40,000 in Capex. In order to achieve the target, the industry needs to focus on adopting or adapting innovation and focus should be towards the finishing or materials side.

Indian Chemical News (ICN) is a credible information platform for Chemicals, Petrochemicals and Energy sectors and trying to contribute to the growth of these sectors by creating awareness about the latest development of these sectors.

I am sure that the Compendium will offer a deep insight into the Indian chemicals and petrochemicals sectors.

I extend my wishes and success to the 'Chemical Industry Outlook 2023'.

President

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MESSAGE

It is my pleasure to witness the publishing of the 3rd edition of the compendium titled 'Chemical Industry Outlook 2023' in April 2023 by Indian Chemical News (www.indianchemicalnews.com). The theme of the Compendium 'India@75: Looking Back, Looking Ahead' will definitely takes the reader in past, present and future of the Indian chemicals and petrochemicals industry.

Currently, India is the 4th largest producer of crop protection products in the world and according to research reports the Indian Crop Protection Market is approx. INR 250 billion by sales and the sector has a propensity to grow to INR 316 billion by the year 2024.

In order to be Atmanirbhar; the industry is geared up to make India a hub for the crop protection products; not only for India but for the international market as well. The Government of India has identified this sector as one of the ***Champion Sectors*** where India can play an important role in the global supply chain.

India has vast agro-climatic diversity and limited farmland and needs a wide range of crop protection products to protect the crops from various pests and diseases. According to some research reports 15-25% of Indian agriculture production is lost annually due to the pests. These losses can be reduced by efficient, effective and judicious use of crop protection products. Currently, India is amongst the lowest usage of crop protection products per hectare (0.3 kg/ ha) as compared to up to 13 kg / ha in USA, China or other countries.

Crop protection therefore is a key enabler of Government's objectives of food security, doubling farmer incomes and safer food through introduction of newer and better products.

Indian Chemical News (ICN) is an information platform for Chemicals, Petrochemicals and Energy sectors and trying to contribute to the growth of these sectors by creating awareness about the latest development of these sectors.

I am sure that the Compendium will offer a deep insight into the Indian chemicals and petrochemicals sectors.

I extend my best wishes and success to the 'Chemical Industry Outlook 2023'.

Durgesh

Durgesh Chandra
Secretary General
CropLife India

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MESSAGE

I am happy to learn that Indian Chemical News (www.indianchemicalnews.com) is publishing the 3rd edition of its compendium titled 'Chemical Industry Outlook 2023' in April 2023.

The theme of the Compendium 'India@75: Looking Back, Looking Ahead' hopefully will take the readers in past, present and future of the Indian chemicals and petrochemicals industry.

India has already notified the Green Hydrogen Policy aimed at boosting production of green hydrogen and green ammonia to help the nation become a global hub for the environment friendly version. While nearly all hydrogen produced in India today is grey, it is estimated that demand for hydrogen will be 12 MMT by 2030 and around 40% i.e. around 5 MMT will be green.

By 2050, nearly 80% of India's hydrogen is projected to be green, produced by renewable electricity and electrolysis. Green hydrogen should become the competitive route for hydrogen production in future which may be driven by potential cost declines in key production technologies.

With a renewable energy target of 500 GW for 2030 and net zero by 2070, India could become a Hydrogen hub. Hydrogen can play a huge role in sectors like Power, Steel, Fertilizer, Petrochemical and Transport provided the cost of hydrogen becomes affordable. Till such time the green hydrogen cost comes down, we may create hydrogen infrastructure in the country by making use of grey and blue hydrogen as well.

Indian Chemical News (ICN) is a credible information platform for Chemicals, Petrochemicals and Energy sectors and trying to contribute to the growth of these sectors by creating awareness about the latest development of these sectors.

I am sure that the Compendium will offer a deep insight into the Indian chemicals and petrochemicals sectors.

I extend my best wishes and success to the 'Chemical Industry Outlook 2023'.

(Dr. R. K. Malhotra)
President
Hydrogen Association of India
(Regd. Under Society Act)

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MESSAGE

It gives me immense pleasure to know that Indian Chemical News (www.indianchemicalnews.com) is publishing the 3rd edition of its compendium titled 'Chemical Industry Outlook 2023' in April 2023. The theme of the Compendium 'India@75: Looking Back, Looking Ahead' will definitely take the reader into the past, present and future of the Indian chemicals and petrochemicals industry.

India's chemical industry was worth USD 178 billion in 2019. It is expected to grow to USD 304 billion by 2025 at a rate of 9.3 per cent. It is expected to attract investments of Rs 8 lakh crore by 2025.

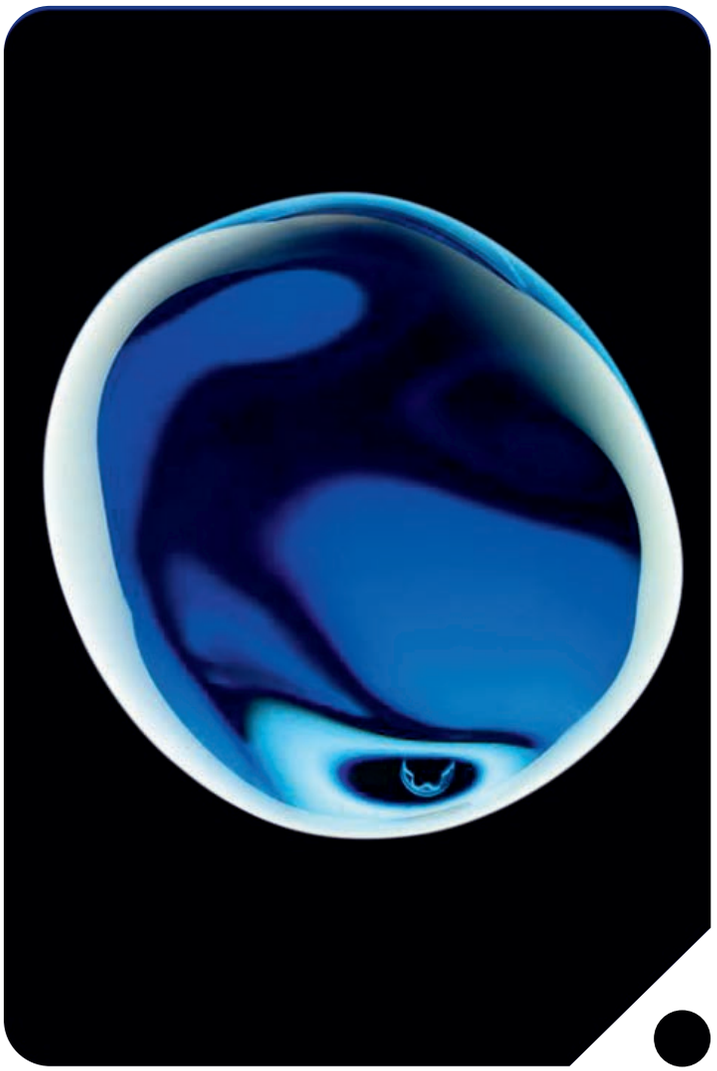
The chemical industry is today the largest and fastest growing component of Gujarat's manufacturing sector. Gujarat, which has over 11,000 chemical units, accounts for more than 50 per cent of the major chemicals produced in India. Gujarat holds a share of 41% out of India's Total Chemical & Petrochemical Exports which accounts for 5% of India's Total & 27% of Gujarat's Total Export respectively. The state has seen its chemical industry emerge as the largest and fastest growing sector of the state's economy.

Indian Chemical News (ICN) is a credible information platform for Chemicals, Petrochemicals and Energy sectors and is trying to contribute to the growth of these sectors by creating awareness about the latest development of these sectors.

I am sure that the Compendium will offer a deep insight into the Indian chemicals and petrochemicals sectors.

I extend my wishes and success to the 'Chemical Industry Outlook 2023'.

Dr. Jaimin Vasa
President
Gujarat Chemical Association



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The theme of the Compendium 'India@75: Looking Back, Looking Ahead' will definitely takes the reader in past, present and future of the Indian chemicals and petrochemicals industry.

Indian agrochemicals Industry was valued at around US $6 billion in 2019-20 and is expected to grow at a CAGR of around 8% - 10% till 2025. There is a huge domestic market for growth and equally promising are the opportunities in the agrochemical export space. If rules and regulations are streamlined and ease of doing business undertaken by the country, it can boost India's export of agrochemicals to US $40 billion in the next five years.

India is using nearly 60,000 MT pesticides and produces US $481 billion worth of agriculture, compared to European Union countries, using 250 lakh MT pesticides and producing less than US $200 billion worth of agriculture, even though the EU has more land than India.

India has one of the lowest per capita consumption of crop protection chemicals per hectare, which suggests, there is a significant scope of growth for the crop protection chemicals in India, increasing agricultural productivity and compensating the shortage of farm labour by extensive use of herbicides.

India crop protection market is highly fragmented with presence of more than 150 active ingredient manufacturers, more than 1,000 formulators and more than two lakh companies engaged in distribution.

So while there are opportunities, the sector has also been associated with a variety of issues, ranging from environment and sustainability, health of humans and animals, soil and water, to some serious disease and contamination afflicting the living and non-livings alike.

Indian Chemical News (ICN) is a credible information platform for Chemicals, Petrochemicals and Energy sectors and trying to contribute to the growth of these sectors by creating awareness about Govt of India's initiatives of making these industry sectors 'Aatm Nirbhar'.

The Compendium is a collection of interviews and opinions dedicated to help specialist markets and industry communities exchange ideas and innovations in the field.

I wish 'Chemical Industry Outlook 2023' all success.

AGRO CHEM FEDERATION OF INDIA ★ DELHI

Dr. Kalyan Goswami
Director General
Agro Chem Federation of India

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Indian Paint & Coating Association

MESSAGE

My heartiest congratulations to the Indian Chemical News (www.indianchemicalnews.com) for publishing the 3rd edition of its eagerly awaited compendium titled 'Chemical Industry Outlook 2023' in April 2023. Indian Chemical News (ICN) is a credible gleaner for Chemicals, Petrochemicals and Energy sectors and trying to bring the world of chemicals together by creating awareness through pertinent and relevant information a must read for all. The theme "Looking back and Looking Ahead" reflects upon the need to learn or unlearn from our past and transforming ourselves for a better future. Looking back is always a ready reckoner helping us to look, move and remain forward in our different walks of life.

The crude oil trajectory which is one of the most popular point of debate wherein the rise and fall of the same is the direct quotient of industry sorrow or happiness depending on who is at the receiving end of what. Going back 15 years FY 2008 when crude peaked at 130$ and if we go as per the inflation adjusted index for crude the current price of crude should be hovering around 300$ whereas the current levels are at 80$ which is incidentally much lower than the 2008 levels. What does this reflect upon? The Indian economy has been **resilient** to say the least in spite of the multiple shocks of demonetization, pandemic, supply chain disruption, geo-political crisis in the form of the Russian Ukraine war and the now more prevalent erratic patterns of prices and demand. **Indian is and will remain the bright spot in the encircling gloom and we need to be prepared with the change for the change.** We are at the threshold of **resurgence** and the next few months will decide how soon we will be breaking barriers to emerge as the next developed economy. The news of OPEC cut on their production targets for FY2023 shows the anxiety or panic button being pressed to keep the prices artificially higher for as long as it can be sustained.

Further, the shift to alternative green fuel could have happened long back but the world needed a trigger like the current war crisis to make shifts to various alternatives be it gas, nuclear, wind or solar energy and ethanol blend in a big way to curtail the consumption of the biggest wealth creator for the Gulf Cooperation Council, Russia and to some extent China. This unshackling and loss of trust of the above economies is bound to bring it a huge boost in trade and vested gains for the Indian economy as one of the most natural alternatives. Business is all about keeping investing be it time, resource or money. We start moving as students only when our exams are around the corner and much hasn't changed on our becoming entrepreneur wherein we invest only after someone knocks at our doorstep. This needs to change we need to be ready with the infrastructure and it's about time we started knocking on the doorstep of opportunities galore.

On behalf of IPCA we once again look forward to this edition of ICN and wishing the entire team all the success.

Rohan Bhasin

President - IPCA

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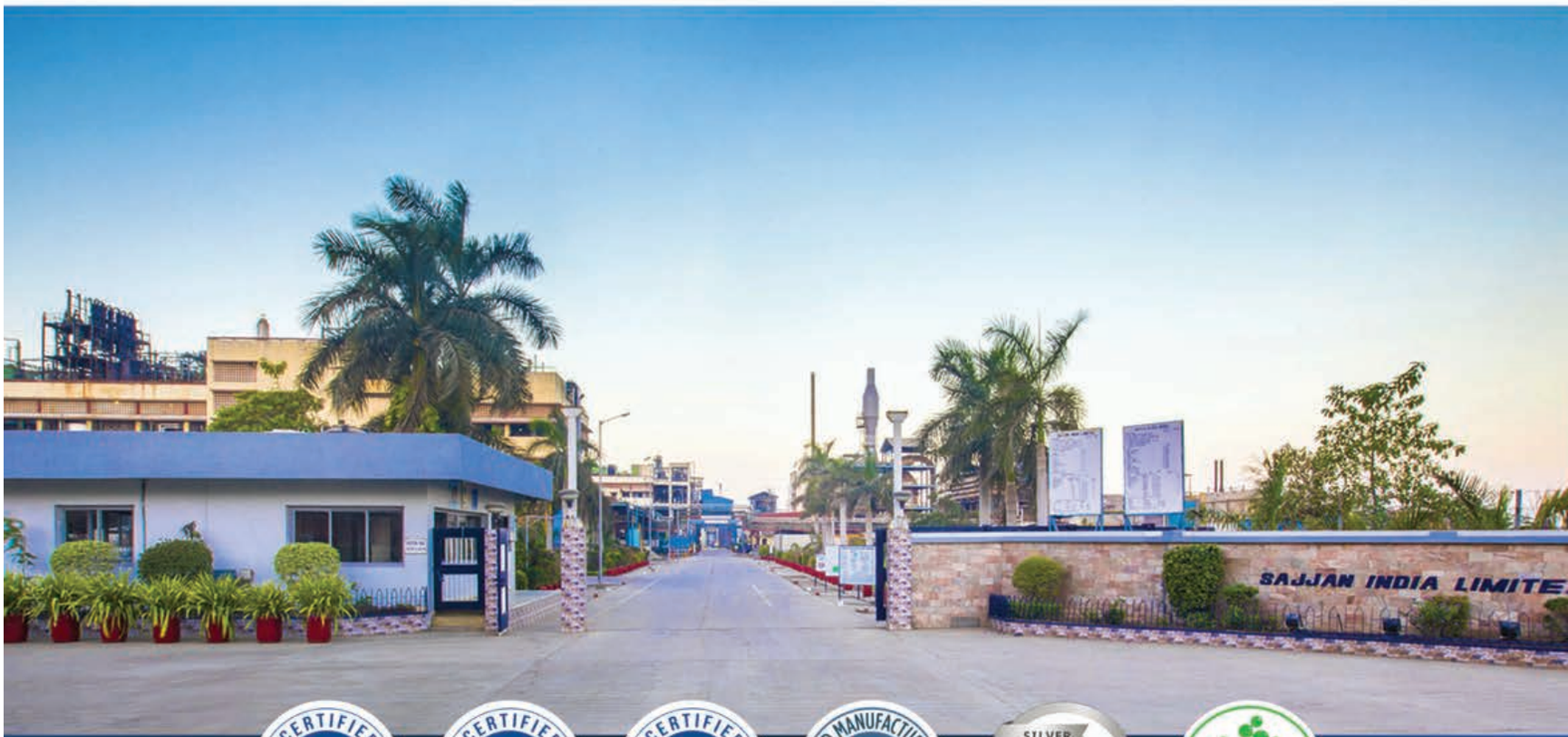

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In 1995, the per capita consumption of paint in India was 0.32 kilos whereas the global average was close to about 11 kilos and Asia Pacific was 9.7 kilos. With lifestyle change over the last few years, we are currently sitting at around 4.1 kg of per capita paint consumption. However, the consumption in the rest of the world is much higher. This is where we have a huge gap which should act as a driving engine for growth.

About 5 years ago, the share of the SMEs in the Indian paint industry was about 35% and now it is down to 26% and in the coming times, the share would tremendously come down further. To survive and make profits, very specific innovations would have to be adopted by the SMEs.

Substitution of raw materials, and replacement of obsolete methods with automation are the keys to survive. Niche paints will be important for them to create 8-9% profits. The anti-virus paints are a big hit. Hygiene paints, hospital paints, anti-dust paints, air purifying paints, energy paints, and roof coating paints pose a huge opportunity that needs to be tapped.

Indian Chemical News (ICN) is a credible information platform for Chemicals, Petrochemicals and Energy sectors and trying to contribute to the growth of these sectors by creating awareness about the latest development of these sectors.

I am sure that the Compendium will offer a deep insight into the Indian chemicals and petrochemicals sectors. I extend my wishes and success to the 'Chemical Industry Outlook 2023'.

Regards

Shilpa Raveshia

S. M. Raveshia

PRESIDENT INDIAN SMALL SCALE PAINT ASSOCIATION

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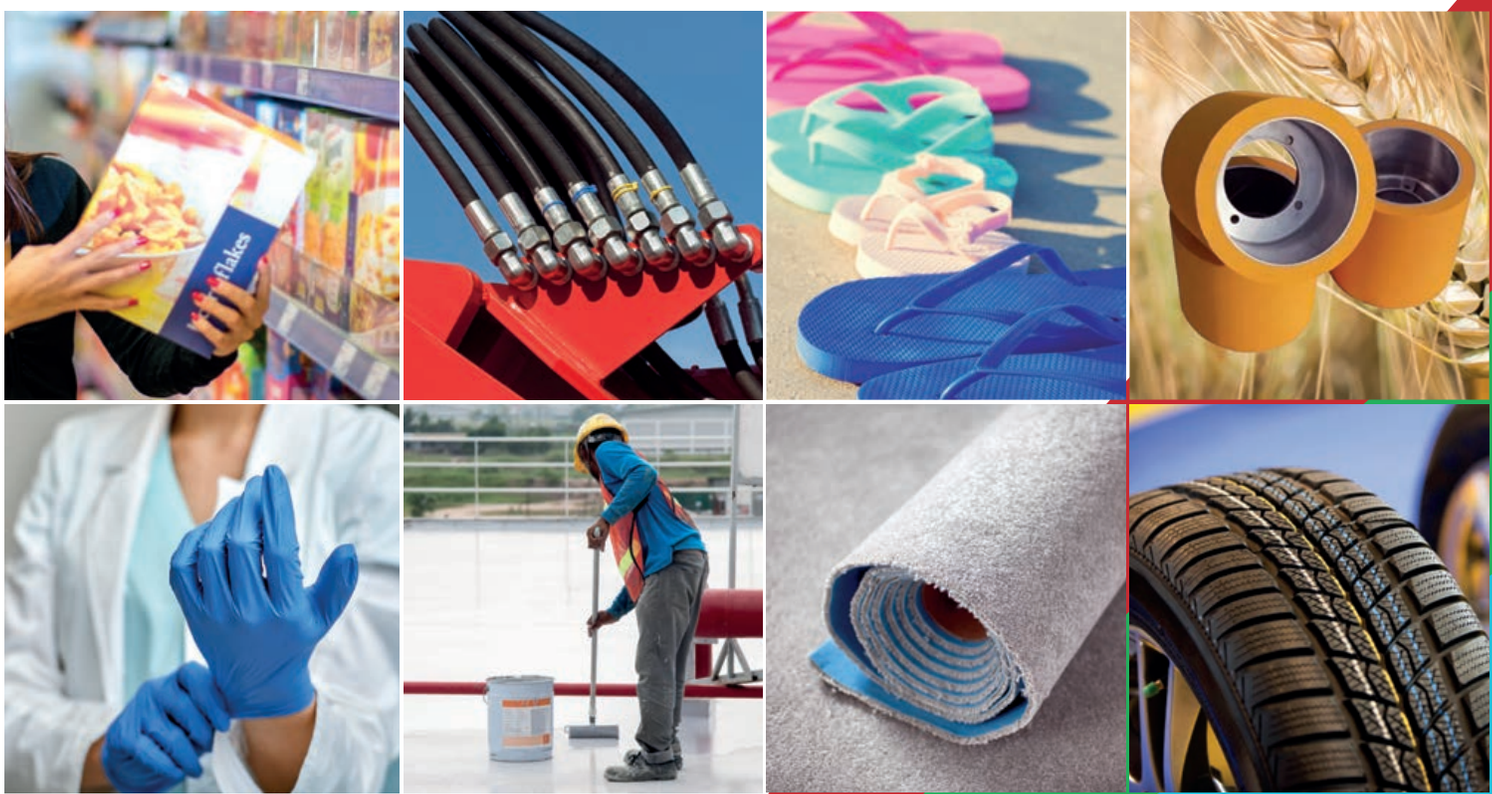

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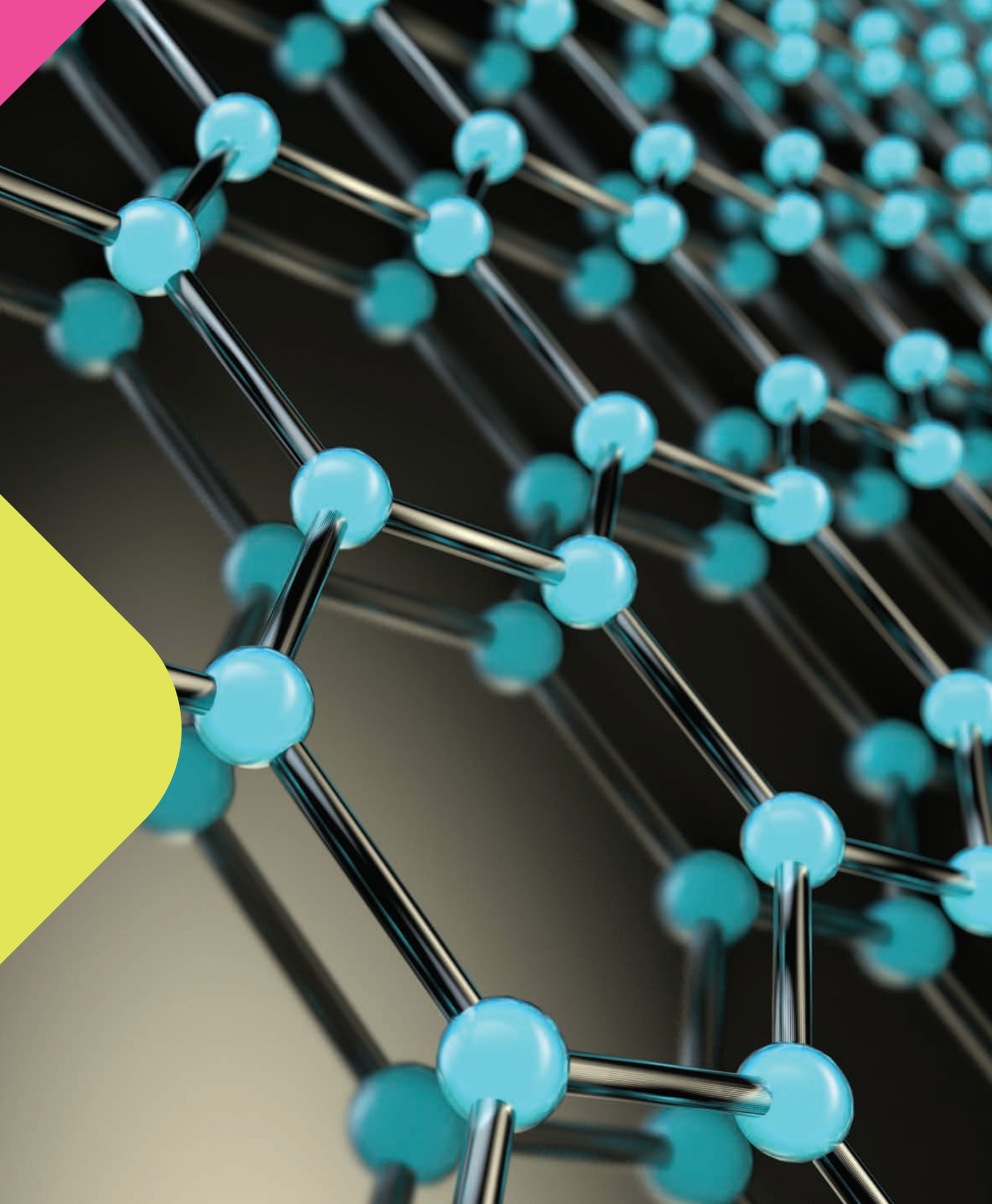

THE NEXT FRONTIER: INDUSTRY READIES FOR GIANT LEAPFROG

Driven by vision 2034 to improve domestic production, chemicals could offer a hub of growth opportunities over the next one decade. India's chemical industry currently valued at around US $220 billion, is expected to touch US $300 billion by 2025 and reach the $1 trillion mark by 2040, fuelled by growth in per capita income and consumption levels TEAM ICN

India holds a strong position in chemicals globally, ranking 14th in exports and 8th in imports. Covering more than 80,000 commercial products, the industry is expected to grow at 9.3% to reach US $304 billion by 2025. The growth is predicted on the back of rising demands in the end-user segments for specialty chemicals and petrochemicals.

The global pandemic and its subsequent disruptive impacts have encouraged many companies to de-risk their supply chains. Increased dependence on a single manufacturing source, rising costs in China, growing US-China tensions, stringent environments, and high compliance costs, etc. have created vulnerabilities that have driven firms to diversify supply chains outside of China. India is uniquely positioned to benefit as MNCs increasingly adopt the 'China+1' strategy owing to its competitive cost advantage, focus on quality and sustainability, conducive business environment led by reforms, and incentivized government policies.

In the post pandemic scenario, the Indian chemical industry has got numerous opportunities considering the supply chain disruption in China and trade conflict among the US, Europe, and China. Anti-pollution measures in China will also create opportunities for the Indian chemical industry in specific segments. Additional support, in terms of fiscal incentives, such as tax breaks and special incentives through Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs) or Special Economic Zones (SEZs) to encourage downstream units will enhance production and development of the industry. To bring about structural changes in the working of the domestic chemical industry, future investments should not only focus on transportation of fuels such as petrol and diesel, but also on crude-to-chemicals complexes or refineries set up to cater to the production of chemicals.

In the face of various global challenges, the Indian chemical industry continued to be resilient in 2022 and has shifted gears in the right direction of becoming a noteworthy global player. However, numerous challenges

The government has started many initiatives such as mandating BIS-like certification for imported chemicals to prevent dumping of cheap and substandard chemicals into India

still persist including limited domestic feedstock availability, delayed regulatory approvals, and scarcity of skilled R&D talent. These enablers and obstacles have influenced the spectrum of chemical sub-segments falling in the consideration pool, in terms of both market attractiveness and cost competitiveness.

Government Initiatives

The Indian government has recognized the chemical industry as a key growth element and forecast to increase the share of the chemical sector to ~25% of the GDP in the manufacturing sector by 2025. Under the Union Budget 2022-23 the government allocated Rs. 209 crores (US $27.43 million) to the Department of Chemicals and Petrochemicals. A production linked incentive (PLI) scheme has been introduced to promote Bulk Drug Parks, with a budget of Rs. 1,629 crores (US $213.81 million). It is considering launching a PLI scheme in the chemical sector to boost domestic manufacturing and exports.

The government has started various initiatives such as mandating BIS-like certification for imported chemicals to prevent dumping of cheap and substandard chemicals into the country. Under the new PCPIR Policy 2020-35, a combined investment of Rs. 10 lakh crore (US $142 billion) is targeted by 2025, Rs. 15 lakh crore (US $213 billion) by 2030 and Rs. 20 lakh crore (US $284 billion) by 2035 in all PCPIRs across the country. The four PCPIRs are expected to generate employment for around 33.83 lakh people.

A 2034 vision for the chemicals and petrochemicals sector has been set up by the government to explore opportunities to improve domestic production, reduce imports and attract investments in

LOOK AT THE STATS

Chemical production reached 907,639 MT in August 2022, while petrochemical production reached 1,727,019 MT. In August 2022, production levels of various chemicals were as follows: Soda Ash: 267,416 MT, Caustic Soda: 283,279 MT, Liquid Chlorine: 203,195 MT, Formaldehyde: 26,842 MT and Pesticides and Insecticides: 18,881 MT.

A revival in domestic demand and robust exports will spur a 50% YoY increase in the Capex of specialty chemicals manufacturers in FY22 to Rs. 6,000-6,200 crore (US $815-842 million). Revenue growth is likely to be 19-20% YoY in FY22, up from 9-10% in FY21, driven by recovery in domestic demand and higher realisations owing to rising crude oil prices and better exports. In FY22, India's dye exports totaled US $3.24 billion.

the sector. The government plans to implement a production-link incentive system with 10-20% output incentives for the agrochemical sector; to create an end-to-end manufacturing ecosystem through the growth of clusters.

Road Ahead

India has significant presence in production of basic organic chemicals, fertilizers, pesticides, paints, dyestuffs and intermediates and fine and specialty chemicals. The chemical sector in India faces key challenges such as inadequate infrastructure facilities, high costs of basic raw materials like natural gas and crude oil, high cost of capital and need for technological modernization of its facilities. The key success factors for the chemicals industry in India are the use of advanced technology, strong research capabilities, backward and forward linkages and development of domestic capacity to reduce dependence on imported raw materials. It has also become imperative for the Indian chemical industry to address safety, health and environmental protection issues in an organized manner.

A consistent value creator, India's chemical sector remains an attractive hub of opportunities. The sector has created enormous wealth for investors in the past with stocks of many specialty companies rising manifold. Robust demand across end-user industries led by rising domestic consumption, strong export growth, and rising import substitutions are expected to be primary growth drivers for the chemical sector. Growing strong domestic demand and increased exports will continue to fuel the growth of the Indian specialty chemicals industry. The robust performance of the sector is prompting specialty chemical manufacturers to ramp up their production capacity to meet the growing demand for its products. Furthermore, anti-pollution measures in China will also create opportunities for the Indian chemical industry in specific segments.

Additional support, in terms of fiscal incentives, such as tax breaks and special incentives through PCPIRs or SEZs is set to encourage downstream units that will enhance the production and development of the industry. The dedicated integrated manufacturing hubs under the PCPIR policy would also attract an estimated investment of Rs. 20 lakh crore (US $276.46 billion) by 2035.

"India's chemical industry currently valued at around US $220 billion, is expected to touch US $300 billion by 2025 and reach the $1 trillion mark by 2040, fuelled by growth in per capita income and consumption levels," predicts Arun Baroka, Secretary, Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers at the Indian Chemical Council's event.

To sum it all up, the fast paced growth of the Indian chemical industry is inevitable and its growth trajectory will witness a transition to specialty materials as user industries constantly evolve. ■

SNAPSHOT

GROWING DEMAND

Rise in demand from end-user industries such as food processing, personal care and home care is driving development of different segments in India's specialty chemicals market. The domestic chemicals sector is expected to showcase 18-23% revenue growth in FY22, owing to an improvement in domestic demand and higher realization.

OPPORTUNITIES

India's specialty chemicals companies are expanding their capacities to cater to rising demand from domestic and overseas. With global companies seeking to de-risk their supply chains, which are dependent on China, the chemical sector in India has the opportunity for a significant growth

POLICY SUPPORT

The government plans to introduce a production-linked incentive (PLI) scheme to promote domestic manufacturing of agrochemicals. Under the Union Budget 2022-23 the government allocated Rs. 209 crores (US $27.43 million) to the Department of Chemicals and Petrochemicals.

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LEVERAGING INDIA'S OPPORTUNITIES IN CHEMICAL SECTOR

Rising demand, increasing end use applications, demand for more value centric products on account of increasing income, geopolitical changes, and supply chain disruptions will further drive chemical manufacturing into India

ADITYA SHRIRAM
EXECUTIVE DIRECTOR
DCM SHRIRAM LTD.

2023 marks the beginning of "Amrit-Kaal" which starts on a rather positive note with India's G-20 presidency.

This presidency comes with several benefits for India. It will provide India with an opportunity to enhance its global profile, influence policy decisions within the strong group of 20 nations, and foster better collaboration with other major economies on issues of mutual interest.

This exposure will not be sector specific but will encompass manufacturing, services and agriculture sectors. These three sectors are the pillars of Indian economy.

Indian Chemical Industry: An overview

One of the key manufacturing industries in India that provides critical inputs to industries across the board is the chemical industry. It is the backbone of virtually all other sectors and has touch points with almost everything we see, feel or consume. Indian chemical industry has witnessed a spectacular growth journey in the recent years, and there is strong evidence for the trend to continue. This sector has not only survived unprecedented disruptions in global economy but has also created huge wealth by giving high returns to the investors in long run.

With roughly 80,000 products, Indian chemical industry, at present, is divided into 5 major categories, viz. Bulk chemicals - 25%; Pharma APIs 20%; Specialty chemicals 21%; Petrochemicals 19% and Agro-chemicals and Fertilizers 15%.

As per a recent paper by McKinsey, the Indian chemical industry's estimated current size is ~US $170-180 bn and is expected to reach ~ US $800 bn by 2040.

Expected to be the driver of this growth, speciality chemicals segment alone has the potential to contribute up to US $20 Bn to Indian exports by 2040 (from current levels of US $2 Bn).

Indian Caustic Soda's annual capacity is around 6.1 million metric tonnes which accounts for around 5-6% of the global capacity and is expected to grow in line with the country's GDP

Factors Driving Growth

The disruptions created by COVID are gradually easing, and the world now has started looking at India as the next manufacturing hub. Rising demand, increasing end use applications, demand for more value centric products on account of increasing income, geo political changes and supply chain disruptions will further drive manufacturing into India.

A huge supply demand gap for petrochemicals and intermediate chemicals

is likely to emerge, and it is up to us to rise to the occasion and ensure that these shortfalls are made-up through indigenous production, rather than relying on imports.

Opportunities

These factors present an excellent opportunity for India, with India ranking number 2 as the most attractive manufacturing destination as per Cushman Wakefield report in 2021. As per American Chamber of commerce, more than 26% of businesses are looking to decrease investment in China and world trade is going through a drastic structural change favouring India. Geo-political issues in the west and global disruptions in supply chains are also positioning India in a better light for manufacturing.

Various government policies like the Production Linked Incentive Scheme (PLI) for several sectors will propel Indian manufacturing towards a growth trajectory. The PLI has seen favourable response from other sectors. We hope that it soon gets notified for chemicals sector given the sector's critical role in the economy. Essentially, this scheme is aimed at boosting domestic manufacturing, creating jobs, reducing burden of imports and encourage investments. Inclusion of chemicals sector in this scheme will have a positive multiplier effect on the whole economy. Initiatives like "Make in India", "Swachh Bharat Abhiyan", "Atam Nirbhar Bharat", will further boost demand for home-grown products. The chemical industry will also play a crucial role in helping India achieve its global climate commitments.

While the growth is encouraging, as a nation, we should aspire for much higher goals. The opportunities are immense considering the following facts.

Vast pools of value continue to lie untapped with roughly 50% of niche intermediates being imported currently.

India's per capita packaging consumption at ~8.5 kg is far lower than many developing and developed economies.

- 700 million Indians will be living in urban India in the next 2 decades, thereby creating the need to almost build "2.5 Americas".
- Huge demand supply gaps are being met by imports.
- There is a strong opportunity to invest in newer and greener technologies.
- The bar on ESG and EHS will be continuously raised both by legislation and societal expectations.
- An increasing need to focus on R&D to develop newer, greener technologies, catering to changing demand patterns.

Government Support

Undoubtedly, there are massive opportunities and the industry itself will have a major role to play in tapping the same. However, government backing with favourable and stable policy framework to enhance manufacturing is essential. It will complement the Indian manufactures' intention and hunger for growth while helping achieve Hon'ble PM's vision of making India a US $5 Trillion economy. In my opinion, several critical areas that require government's support are:

- Incentivizing manufacturing and encouraging exports through schemes like the PLI and RoDTEP respectively. While PLI for chemicals has been under consideration for some time now, it is yet to be notified. RoDTEP, which incentivizes exports, has given a marginal benefit to most chemical products compared to the previous MEIS. The current framework is not an incentive but essentially a remission of Duties or Taxes on Export Products. This is to prevent taxes getting exported with products.
- Incentivizing R&D (viz. tax breaks) since innovation and R&D are the key drivers for investments today.
- Securing feedstock and making the same available at competitive prices will give a huge fillip for domestic chemical manufacturing. Today, downstream players are mostly struggling to secure feed from anchor

tenants.

- Revisiting the PCPIR model or shifting to an easier, Cluster approach with plug & play model will definitely help in boosting manufacturing with shared infrastructure. It will help in reducing environmental damage owing to CETPs.
- Clarity and parity between Center and the State w.r.t. policies and their implementations will play a critical role in improving EoDB
- Basic issues like availability of land for Greenfield or brownfield expansion, easing out local licenses and processes, lowering cost of energy and increasing availability of water in industrial states like Gujarat. Chemical industry is a continuous and energy intensive industry. Gujarat, having the highest number of chemical facilities in the country, ironically has amongst the highest rates of Electricity duty.
- Hon'ble PM has a vision to achieve net-zero emissions by 2070 and having 500 GW of installed Renewable energy capacity by 2030. However, there are several operational hurdles in setting up captive renewable energy plants in different parts of the country. A long term, enabling and favorable policy regime with clear directions in this regard would further encourage manufacturers to adopt renewable energy, greener technologies, and achieve higher ESG standards.

Indian Chlor Alkali Industry

Chlor-Alkali is one of the major segments in Inorganic chemicals. It acts as a basic building block for chemicals industry as a whole. Indian Caustic Soda's annual capacity is ~ 6.1 million metric tonnes which accounts for ~5-6% of the global capacity and is expected to grow in line with the country's GDP.

Chlor-Alkali has numerous applications in Textiles, Alumina, Organics, Inorganics, Pesticides, Soap & Detergents, Dyes, Paper & Pulp, Water treatment, Chemical & Petrochemical processing and Power & Steel.

In 2015-16, imports of caustic soda stood at ~17% of total domestic consumption however today India has become net exporter of caustic soda in last 4-5 years. This goes on to establish the capability of Indian manufacturers to reduce dependence on imports and strongly positioning India in the global arena.

This segment is also not insulated from challenges like intermittent cheap imports, high Energy cost, high Raw material cost and stricter Environmental regulations.

The Chlor-Alkali Industry in India has been growing a steady rate and its consumption is expected to further drive its demand globally. Further, with upcoming capacities and subsequent expansion in downstream, we expect adequate supply within India and increase in the export footprint.

The above issues are common across the chemical industry. While the government has been working on addressing these, there are several hurdles still facing this industry.

> Securing feedstock and making it available at competitive prices will give a huge fillip for domestic chemical manufacturing

Going Forward

The Indian chemical industry, today, is at the cusp of becoming a dominant global industry. No doubt, its future looks very promising. I am sure that with a stable and favourable policy regime from the Government and with the industry's aggressive focus on EHS and R&D, India will grow to become a safe, sustainable and vibrant global chemical manufacturing hub. ■

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MEGATRENDS: DEFINING INDIA'S CHEMICAL INDUSTRY

Chronicle of how India's megatrends and economic surge shape the growth and transformation of the Indian Chemical industry as we look back & look ahead on India@75

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ADITYA BIRLA GROUP

The Indian Chemical industry is today an industry of rapid growth, high recognition and well rewarded by the capital market. India is the 6th largest producer of chemicals in the world and 3rd in Asia, that has a diversified portfolio of basic and specialty chemicals and has moved way beyond the shadows of merely an input or ancillary industry.

This industry, needless to say, is crucial as it provides inputs to a wide array of applications and downstream industries that emerge as a response to the social and economic fabric of any country. As any nation develops, the need from food security to clothing to construction to defence and higher life-style amenities evolve. Chemicals are required at every stage to fulfil these needs. The Indian chemical industry has evolved from being an importer, to a producer and has now become a significant exporter of chemicals over the years in line with the nation's economic trajectory.

Chemical Industry 75 years ago

History is witness that the Indian Chemical Industry was restricted to a handful just about 100 years back, with the production of a few basic pharmaceuticals and chemicals. In the pre-independence era under the British rule, India was a source of raw material to the industries in Britain, where India exported agricultural produce (jute, raw cotton, raw silk etc.) as well as minerals such as iron and aluminium. In turn, the British government capitalized India as a key market for their finished goods. Year 1901 saw the country's first company emerge to produce transportation fuel. Sulphuric acid and phosphate fertilizers were among other limited products produced. However, at the time of World War II, when the foreign supply of pharmaceuticals was limited, a number of pharmaceutical companies opened up to adorn the canvas of Indian Chemical Industry.

Year 1901 saw the country's first company emerge to produce transportation fuel. Sulphuric acid and phosphate fertilizers were among other limited products produced

India@75

Since 1947, the Chemical Industry has grown along the track of our nation's economic trajectory. We can assess this growth broadly along three phases:

Pre-Liberalization: (1947 to 1990)

In this post-independence era, the Indian Chemical Industry witnessed a rapid growth from very modest beginnings, as shared earlier. Aditya Birla Group (ABG) was among the first few corporates to take a major step towards India's Aatmanirbharta mission. To deal with the cotton shortage after partition, ABG incorporated the Grasim Industries immediately after independence; similarly, the Group ventured into aluminium production in 1958 and subsequently backward integrated into Chlor-alkali.

The industrial development in India took place in accordance with five-year plans, the 1st such five-year plan being launched

in 1951. Several industries were established in the first two decades to manufacture basic chemicals, fertilizers, dyes, textile auxiliaries and pharmaceuticals. With the onset of India's Green Revolution in 1960s, several modern techniques were deployed to increase the nation's agricultural output. This gave impetus to the use and consequent manufacturing of fertilizers and pesticides in India. This era of rapid growth is substantiated by the production of Sulphuric Acid that grew from ~107KTPA in 1951 to ~1,900KTPA in 1977 one of the most versatile chemicals used in fertilizer, fibre, dyestuff, and many other applications - often considered as a benchmark of industrial development of a country. During this phase, the Indian Chemical Industry required to overcome two challenges: Capital & Technology

Capital: In 1957, RBI set up Industrial Credit Department to aid banks in providing financial assistance to industries through financial institutions. This catalysed investments across sectors including chemicals. Year 1970 saw the nationalization of banks leading to funds being available to smaller investors pan India. This found expression in the advent of a large number of small-scale industries. For example, the investment in plastic industry increased by four fold between 1961 and 1970.

Technology: All processes developed by companies were licenced, with no protection to any inventor of new methods. This limited R&D spends as manufacturers focussed on inducting technology and extracting maximum use. R&D remained centralized to institutions such as CSIR and National Chemical Laboratory, which proved to be a game changer as many of the processes developed here were subsequently put to commercial use. For example, by 1973, the industry had adopted 47 out of 75 chemical processes developed.

With the above stated influx of capital avenues and technological developments, India had its first integrated naphtha based

cracker in 1970. In 1980s and 1990s, the petrochemical industry expanded rapidly with integrated naphtha crackers having downstream products such as polymers, synthetic fibres, aromatics, and other chemicals. This fuelled industries like textile, packaging, and other downstream chemical products.

Post Liberalization Early Days: (1990 to 2010)

The last four decades post-independence (1947-1990) witnessed the 'License Raj', that reflected in India following a closed economy policy, limiting production of certain goods and leading to constrained supply. This resulted in importing to meet domestic demand, yet exports and foreign investments were significantly restricted. The Post Liberalization era saw India opening its doors for FII, FDI as well as providing a fair playing field to the domestic private companies, thus shifting gears to becoming a more demand led and consumer centric nation.

With the effect of liberalization, the real per capita income grew from 3.6 percent in 1990s to 5.4 percent in 2000s. This led to an increased demand across sectors such as paints and coatings, household and personal care etc. Investment in basic chemicals and petrochemicals was critical to provide feedstock such as hydrocarbon solvents, LAB, caustic soda etc. to these industries.

It was during the early days of liberalization (1991-2008) that the industry witnessed a heavy influx of capital in basic chemicals (~70% of total investment in chemicals during the period) most of which was in petrochemicals (~85%). The other basic chemicals that received investments were chlor-alkali and fertilizers.

With increased investments in chemicals, this period also witnessed an increase in exports of chemicals (including inorganics, organics, pharma, dyes, soaps and cosmetics) by a staggering 13% CAGR during 1998-2009 (including inorganics, organics, pharma, dyes, soaps and cosmetics)

The Recent Decade: (2010 - till date)

Over the last decade, the Indian Chemical Industry set sail towards tremendous growth at a CAGR of ~9% per annum while the aggregate R&D investment by leading Indian chemical companies grew at 13% CAGR during the same period. There are rapid changes taking place in terms of technology, global production, rapidly evolving consumer needs, leading to an evolution of new set of industries.

Today India possesses technical and process competency to carry out complex, multistep reactions and we see the nation's chemical plants running at par excellence with our global peers. This has helped the industry to become a global manufacturing hub for chemicals. The industry is not only putting accelerated efforts on import substitution but has also increased chemical exports significantly (an increase by ~106% during 2014-2022). It can also be seen in case of agrochemicals and intermediates, where India's share in total global outsourcing in agrochemicals has increased from ~14% in 2015 to ~25% in 2020.

What this speaks of is the onset of confidence and optimism that is ruling the Chemical Industry in India today, a phenomena highly appreciated by the capital market, where this industry performed significantly better than its global peers.

Looking Beyond

The chronicle of how India's megatrends and economic surge shape the growth and transformation of the Indian Chemical Industry continues as we look towards the future. 2030 and beyond envisages that the Indian Chemical Industry will grow at a CAGR of ~9% to reach US $1 trillion by 2040.

What will drive this growth in future? Here we highlight four key megatrends which are likely to influence the Indian Chemical Industry.

Needs of an Urban Diaspora

Clean drinking water, food security and affordable housing are basic for India's urbanization story. The water treatment chemicals and membrane materials would be key beneficiary. Companies focussing on waste management chemicals and circular economy are set to benefit. Food security calls for need to improve crop yield, considering the limited arable land for an increasing population. Hence, fertilizers and crop protection chemicals are expected to grow at a CAGR of 8-10% in the coming years. Over 65 million houses in India are 'kutcha' (made of mud), that are unstable, vulnerable to storms, floods etc. The construction chemicals will surely gain from this. With further forward thinking, India may witness adoption of evolving technologies such as 3D printing to build houses that are faster to build and cost effective. To add to this, 3D printed prosthetics, large-scale production of life saving drugs, where India has already shown its mettle during the recent bygone pandemic, will emerge critical to enable India to reach the highest echelon of global platform.

Growing Conscious Consumption

India's preference for EVs, renewable sources of energy including green hydrogen is defining our country's standing at the global arena. India has recently discovered lithium reserves in J&K as well as 15 other rare earth elements in Andhra Pradesh. These discoveries will help in the industrial development of EVs as well as electronic components for mobile phones, televisions, automotive, computers to name a few applications. Today, India is world's third largest producer of renewable energy with 40% of its electricity coming from non-fossil fuel sources. Emerging trends in this sector are green hydrogen, automotive light weighting, and renewable power that will define the input chemicals portfolio.

Indian Chemical industry continues as we look towards the future. 2030 and beyond envisages that the Indian Chemical industry will grow at a CAGR of ~9% to reach US $1 trillion by 2040

Rise of an Assertive India

India's economic prowess targets the nation to be the 2nd largest economy by 2050. This is coupled with India's defining position in the global arena and fortifying the nation's security against volatile geo-political environment. For example, the defence budget for FY23 is ~ 13% the union budget. In February 2023, the Government announced 75% spend of the total defence capital outlay (~Rs. 1.62 Lakh Crore) towards procurement from domestic manufacturers. This leads to a significant growth opportunity for advanced materials and composites.

Affinity for an Experiential Economy

Ever increasing focus on automation and growing penetration of telecom & seamless communication will give stimulus to electronic chemicals and materials thereof. The rapidly advancing consumer trends is and will drive the demand in electronics and consequent chemicals.

While it is proven that economic growth drives the chemical industry of any nation, the converse also holds true. The growth of chemicals' manufacturing and use play an important part in the economic growth of a country. Yester years' evidence prove that the availability of chemicals is critical for any industry to sustain. While the basic commodity chemicals including sulphuric acid, nitric acid, caustic soda, and petrochemicals will continue to grow, the additional growth will come from new age product groups such as advanced materials, high strength lightweight materials, 3D printing materials, bio based chemicals, new age pharma using advanced enzyme technology and electronic chemicals to name a few.

The success story of the Indian Chemical Industry has just begun. The neo-Indian population and economic trends are fuelling the demand that is creating opportunities for larger specialty and indigenous portfolio, digitalized large-scale processes, reduced dependency on imports, last mile connect for user industries, safe and sustainable practices all that would transform this industry to greater heights. ■

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INDIAN CHEMICALS SECTOR: REGULATORY SCENARIO

The international conventions to which India is a signatory member are: Stockholm Convention; Rotterdam Convention; Chemicals Weapons Convention; and SCOMET

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The Indian chemical industry is one of the most important components of our economy and contributes around 7% to India's GDP. Amidst the global pandemic, the chemical industry has been one of the only few sectors to have not only survived it but also grown by leaps and bounds. India is the 6th largest producer of chemicals in the world and 3rd in Asia has aided the Indian chemical industry which is now set to capitalize on forthcoming opportunities. India is 4th largest producer and exporter of agrochemicals and 2nd largest producer and exporter of dyestuffs globally. The present market size is around US $212 billion and the sector has the potential to reach US $300 billion by 2025.

International Conventions

The international conventions to which India is a signatory member are: Stockholm Convention; Rotterdam Convention; Chemicals Weapons Convention; and SCOMET Items.

Stockholm Convention: The Stockholm Convention is an International Environmental Treaty on Persistent Organic Pollutants (POPs). It was signed on 22nd May, 2001 in Stockholm and was effective from 17th May, 2004. The convention aims to protect human health and the environment from the effects of persistent organic pollutants (POPs). The Government of India had ratified the Stockholm Convention on 13th January, 2006 as per Article 25(4).

Rotterdam Convention: The Rotterdam Convention is a Multilateral Treaty to promote shared responsibilities in relation to importation of hazardous chemicals. It involves open exchange of information and calls on exporters of hazardous chemicals to use proper labelling, including directions on safe handling of chemicals. The objectives of the convention include two key provisions, namely the Prior Informed Consent (PIC) Procedure and Information Exchange.

Chemicals Weapons Convention: Chemical Weapons Convention is a universal non-discriminatory, multilateral, disarmament treaty which bans the development, production, acquisition, transfer, use and stockpile of all chemical weapons. India signed the treaty at Paris on the 14th day of January 1993. India enacted the Chemical Weapons Convention Act, 2000. The Department of Chemicals & Petrochemicals (DCPC) is the administrative Department of CWC Act, 2000. It is in force in the country with effect from 1st July 2005. DCPC also notified the CWC Appeals Rules, 2005 in July, 2005 and CWC Rules, 2016 in August 2016.

SCOMET: In Foreign Trade Policy, dual-use items have been given the nomenclature of Special Chemicals, Organisms, Materials, Equipment and Technologies (SCOMET). Export of dual-use items and technologies under India's

> Developed countries like the USA, Canada, Japan, Australia and developing countries such as Taiwan, South Korea, Philippines, and Thailand, have also established REACH-like regulation

Foreign Trade Policy is regulated. Export of dual-use items and technologies is either prohibited or is permitted under a license export policy relating to SCOMET items is given in Appendix 3 of Schedule 2 of ITC (HS) Classification.

Global Scenario

The European Union (EU) initiated the process of regulating the chemical substances with the legislation for Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) in 2006. Its main aim is to understand the possible human and ecological hazards of chemicals in the market and to ensure that any major threat is anticipated as well as prevented.

Major developed countries like the USA, Canada, Japan, Australia and also many developing countries such as Taiwan, South Korea, Philippines, and Thailand, have followed suit and established REACH-like regulation in their countries.

Indian Scenario

India has notified the "Manufacturer, Storage and Import of Hazardous Chemical Rules, 1989" under the Environment Protection Act, 1986 under which 684 chemicals have been identified as hazardous chemicals and the conditions for their safe handling, audit, reporting, emergency handling by users, have been prescribed.

India has also notified the Central Insecticides Act, 1968 under which pesticides technical and pesticides formulations have been approved and registered, while certain pesticides have been banned for use or imports and certain pesticides have been permitted under restricted use.

India has also notified the Drugs & Cosmetics Act, 1940 under which the import, manufacture and distribution of drugs in India are regulated.

India has also notified the Bureau of Indian Standards (BIS) Act, 2016. The Bureau of Indian Standards (BIS) Act 2016 establishes BIS as the National Standards Body of India. The manufacturers and importers have to comply with BIS (Conformity Assessments) Regulation 2018. The Standards are made mandatory under section 16 and Section 25 (3) of the Bureau of Indian Standard Act, 2016. Under Section 16 of the act, the Standards are made as mandatory in the public interest or for: Protection of human, animal or plant health; Safety of the environment, or; Prevention of unfair trade practices, or; and National Security.

Growth Enablers

The Government's focus is on strengthening the sector by supporting Industry with the development/adoption of new technologies and techniques. Government has approved four Petroleum Chemicals & Petrochemicals Investment Regions (PCPIRs) to give a boost to the production of chemicals and petrochemicals.

An Advisory Forum for Chemicals & Petrochemicals Sector has been constituted and its role is to provide a platform to the industry associations for raising their issues and concerns. This will help to boost the 'Make in India' initiative by promotion of investments in the chemicals & petrochemicals sector to meet growing domestic demand and promote exports.

The government is also exploring the possibilities to set-up chemical parks which will be segment specific and on a cluster based approach. The said parks will be designed in plug-n-play mode of operations. ■

(Disclaimer: The views of the author in the article are personal.)

EMERGING INVESTMENT SCENARIO IN INDIAN CHEMICAL INDUSTRY

Indian chemical sector is expected to contribute 25% of India's manufacturing GDP by 2025

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INVESTMENT SPECIALIST
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India is showing remarkable resilience and robust growth even though the world is looking ahead to a slowdown. According to the World Bank, India's estimated overall growth this year stands at 6.9% and is expected to deliver a real GDP (Gross Domestic Product) growth of 7.7% year on year, whereas worldwide economic output at just 1.7% in 2023, making India a beacon of hope. Amidst the global trend of economic downturn, India becomes a market that offers a favourable investment ground. A look at the trends and policies shaping India's future, such as the Make in India Initiative, reveals that we are aiming to become a powerhouse for manufacturing and exports.

Digitisation, demographic growth, infrastructure development, and government focus on manufacturing capacity growth are some of the factors that will prove favourable in the growth of India's manufacturing sector. India is now adopting a system of leveraging exports to boost saving and using that for infrastructure development which further increases the manufacturing and export capacity.

It is estimated that the share of manufacturing sector GDP will rise from 15.6% currently to 21% by 2031, which implies manufacturing value rises from US $447 billion to US $1,490 billion. This increase in manufacturing capacity can be expected to spill over to export capacity with an estimated rise to 4.5% by 2031 from the current 2.2%, bringing the size of the export pie to US $1,880 billion. As mentioned earlier, the growth in manufacturing will push infrastructure growth, the expected increase in infrastructure spending will be 7-7.5% of GDP in 2031 increasing from 4.5% of GDP in 2020.

> The reduced corporate taxes and labour reforms have created the space for companies to tap into the abundant opportunity that India provides

Indian Chemicals Sector

India's chemical industry is highly diversified and caters a substantial chunk of global markets in many product segments.

India is the sixth largest producer of chemicals in the world and third in Asia and the chemicals exports are directed to more than 175 countries. By 2025, the Indian chemical sector is expected to contribute 25% of India's manufacturing GDP. India's per capita chemical consumption is far behind the average value in developed nations. In the coming years, GDP growth will lead to a growing middle class and increased urbanisation, and thus raise the domestic consumption of chemicals, according to the Mckinsey Report on "India: The next chemicals manufacturing hub". This will triple India's share in the global chemicals sector to 10-12% by 2040 and create an additional US $700 billion market value.

In the past, India started out with a pharmaceutical and bulk chemicals capacity and over time petrochemical production capacity and foreign investment in the chemicals sector have steadily grown. As chemicals extensively support almost all manufacturing processes, growth in end-user industries such as food processing, plastics, personal care, and home care drives the market for the chemicals industry. Based on the availability of a robust growth runway, India is expected to become a US $850-$1,000 billion chemicals market by 2040. Considering cost competitiveness and market attractiveness, the upcoming sub-segments that will be valuable in the next few years will be flavours & fragrances, nutraceuticals, plastic additives, textile chemicals, speciality polymers, and adhesives & sealants.

Specialty Chemicals: Offering an Attractive Investment Opportunity

The specialty chemicals segment is one of the most promising segments that could aid India's manufacturing capacity. The segment has the capacity to contribute US $20 billion to India's exports by 2040. The primary reason that appears to be contributing to the growth of the specialty chemicals segment is cost competitiveness and market-ready

products. Cost competitiveness is aided by domestic feedstock availability, capacity utilisation, the scope of tech innovation, and the presence of efficient and skilled labour.

There are various attractive investment sub-segments within this sector. One such sub-segment is the agrochemicals market, which is witnessing high demand due to the growing need for crop protection and yield improvement. Currently, agrochemicals in India is a US $5.5 billion market, showing sturdy growth at 8.3%. It is expected that by 2040, agrochemicals will drive 40% of India's overall chemicals exports.

Another promising area is the construction chemicals market, which is expected to grow due to the increasing demand for infrastructure development and urbanization. Additionally, personal care and pharmaceuticals sub-segments are also expected to grow, fuelled by the rising middle class's growing awareness of health and personal hygiene and increasing per capita income which is expected to rise from US $1,360 in 2010 to US $5,242 in 2031.

Overall, the specialty chemicals industry in India presents numerous opportunities for investment, and investors can benefit from the sector's growth potential by strategically identifying and investing in the right sub-segments.

Government Reforms: Boosting Chemical Industry

With the government's focus now being on Atma Nirbhar Bharat, there have been proactive and well thought out policy changes to ensure that manufacturing capacity in India does not only satisfy domestic needs, but also builds capacity to become a global export hub.

The reduced corporate taxes and labour reforms have created the space for companies to tap into the abundant opportunity that India provides. The Production Linked Incentives (PLI) scheme with a mammoth financial outlay of Rs. 1.97 lakh crore assisting 14 sectors creates the scope for fresh investment in the chemicals sector to address related sector expansions.

The PCPIR (Petroleum, Chemicals, and Petrochemicals Investment Region) Policy creates specific administrative zones where the chemical and petrochemical

industry can flourish utilising a network of businesses all integrated into the same value chain. The PCPIR zones are set up around one anchor tenant, usually a refinery that provides the raw materials and feedstock to other companies in the zone that further process and specialise the product to add value.

A progressive focus on the integrated value chain and cluster based chemical industry set-up increases profit margins while reducing logistical costs, making the industry globally competitive. To boost trade, the government has introduced the Remission of Duties or Taxes on Export Products (RoDTEP). The scheme has been introduced with the objective to neutralize the taxes and duties suffered on exported goods and intends to compensate the duties/taxes/levies at the central, state, and local level borne on the exported product including prior stage cumulative indirect taxes on goods and services used in the production and distribution of the exported product.

Additionally, the Union Budget 2023-24 has indicated that a reduction in basic customs duty for certain inputs for the chemicals industry will enhance India's competitiveness and would lead to export promotion. Duty reduction for glycerine and acid-grade fluorspar which was announced in the Budget will help in the production of specialty chemicals and fluoropolymers.

From an infrastructure standpoint, the National Logistics Policy that focuses on digitisation and multi-modal transport for infrastructure development will reduce the logistics cost from the current 14-18% to 8% of GDP by 2030 which will have a positive downstream impact on the manufacturing sector in general, thereby helping the chemicals sector.

Chemical Sector and Net Zero Goals

The chemicals sector is a hard to abate sector with energy intensive and polluting processes leading to negative environmental impact. In order to reach the defined "Net Zero by 2070" goals India has set; the chemical sector needs to prioritise a long-term goal of emission reduction. This needs the industry to tap into solutions encompassing use of renewable energy, improving energy efficiency, increased spending on Research & Development, using bio-based feedstocks, and improving efficient recycling capacity. Capex heavy technologies such as Carbon Capture Utilisation and Sequestration (CCUS) and Green Hydrogen should find greater industrial adoption, more so in the chemicals sector.

Technological development and a robust financial framework can help India become a global leader in environmental protection and sustainability. Given that a lot of India's industrial assets are relatively new when compared to developed nations, and that India is still on a path to development, it is important for us to not take a route that penalizes growth, but one that incentivises innovation for lower and cleaner emissions.

The global markets and demands will soon move to products that are made through sustainable means, so the next few years are crucial for India to develop the capabilities and technologies to meet said demands. The time to invest in and focus on new technologies is ripe right now and leveraging these opportunities will differentiate long-term players from those that will suffer the consequences of the rapid change expected of the industry.

The opinions expressed are those of the authors and do not reflect the views of the organisation. ■

Currently, agrochemicals in India is US $5.5 bn market, showing sturdy growth at 8.3%. It is expected that by 2040, agrochemicals will drive 40% of India's chemicals exports

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DRONE TECH: PROPELLING INDIAN AGRICULTURE TO NEWER HEIGHTS

Agricultural drones are widely being used across the world for yield optimisation and monitoring crop production and growth

SANJIV LAL
MANAGING DIRECTOR & CEO
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Technology has emerged as an enabler by touching every aspect of our lives and propelling businesses and industries to newer heights. Agriculture, the backbone of our existence, too has greatly benefited with the adoption of technology.

India, which has the potential of becoming a global food bowl, too, has recognised that in addition to high-yielding seeds and other traditional inputs such as fertilizers and crop protection products, agri tech can enable farmers to enhance their income by improving efficiency and enhancing farm productivity.

The latest technology to disrupt this sector is drone technology. Agricultural drones are widely being used across the world for yield optimisation and monitoring crop production and growth. Countries such as Australia, Malaysia, and Singapore, among others, have used them to great benefits. Israel even uses AI-backed drones for apple plucking. These advanced machines with robotic arms are engineered to identify and pluck only the ripe fruits. Such is the power of this technology!

According to Frost and Sullivan, drone adoption in India's agriculture sector would rise at a CAGR of 38.5% and reach US $121.43 million by 2030, accounting for 2% of all expenditures on agricultural machinery

The Story, So Far

Prime Minister Narendra Modi flagged off 100 kisan drones to spray pesticides across various crops in 2022 to usher in a new era in Indian agriculture. Soon after, the Department of Agriculture and Farmers Welfare (DA&FW) released a Standard Operating Procedure (SOP) to provide concise instructions for effective and safe operations of drones for pesticide and nutrient application. To make usage of drone financially viable for farmers, the Government of India proposed a financial assistance of up to 40%, and a maximum of Rs. 4 lakh, for purchase of drones by Custom Hiring Centres under Cooperative Society of Farmers, FPOs, and rural entrepreneurs. Agriculture graduates establishing Custom Hiring Centres (CHCs) are eligible to receive financial assistance of 50% of cost of drone up to a maximum of Rs. 5 lakh per drone.

Recent Policy Changes

The DA&FW SOP provides guidelines for effective and safe operations of drones for pesticide and nutrient application. The Central Insecticides Board & Registration Committee (CIB&RC) has prescribed the protocols for registration requirements of pesticides for drone application. It has also finalised the test protocols for phyto-toxicity evaluation and for bio-efficacy evaluation of pesticide formulation.

A contingency expenditure of Rs. 6,000 per hectare is provided to implementing agencies that do not want to purchase drones but will hire drones for demonstrations from CHCs, hi-tech hubs,

drone manufacturers, and start-ups. The contingent expenditure to implement agencies that purchase drones for drone demonstrations is limited to Rs. 3,000 per hectare. For individuals, small and marginal, scheduled caste/scheduled tribe, women and North Eastern state farmers are provided financial assistance at 50% of the cost up to a maximum of Rs. 5 lakh and other farmers at 40% up to a maximum of Rs. 4 lakh.

Funds amounting to Rs. 52.5 crore have been released to the Indian Council of Agricultural Research (ICAR) for taking up large-scale demonstration of drone technology through 100 Krishi Vigyan Kendras, 75 institutions under ICAR, and 25 State Agricultural Universities. Funds amounting to Rs. 70.88 crore have also been released to various state governments for demonstration, providing subsidy to the farmers and establishment of CHCs.

Benefits and Challenges

The use of drones provides large benefits by improving the environmental sustainability of agricultural operations by minimising environmental damage, for example, optimizing crop protection application, improving water use efficiency, and increasing fuel efficiency. Drone application of agrochemicals is significantly safer than manual knapsack spraying. In addition, agriculture applications drones offer a wide range of promising ways to enhance the management of assets, more broadly: they can improve the monitoring of livestock, fences, trees, and wildlife and help farmers document their farms to improve their credit worthiness thus helping farmers with issues of increasing labour shortage in rural areas.

A key factor in enabling an increase of, and efficiency in, food production is providing farmers with relevant information. Drones allow farmers to gain a birds-eye view of their crops, permitting them to detect subtle changes that cannot be identified at ground level. Moreover, multispectral imaging enables drones to pick up on crop conditions that are not always clear to the human eye, such as water stress, fertiliser needs, pest infestations, and diseases. With data procured from drones, farmers can address crop-related concerns through targeted and effective interventions.

However, there are several restrictions on the use of drones, especially along sensitive areas. Also, access to technology and knowledge around it is also a concern. There may be concerns around disposal of used batteries as batteries need to be replaced frequently.

Scepticism aside, technology indeed has the power to completely transform sectors, and drone technology holds the key to ensuring the Indian agri sector goes to the next level. According to Frost and Sullivan, drone adoption in India's agriculture sector would rise at a CAGR of 38.5% and reach US $121.43 million by 2030, accounting for 2% of all expenditures on agricultural machinery. The government has already recognised its promise and made provisions to enable farmers purchase or hire drones, which will go a long way in introducing a digital-first approach to farming in our country. It is now time to build tailor-made strategies to suit our farmers' needs so that technology becomes a means for prosperity. ■

COAL TO CHEMICALS

The implementation of coal to chemical projects in India shall not only contribute to the growth of the country in terms of domestic product development and import substitution but also employment generation

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DIRECTOR (BUSINESS DEVELOPMENT)
COAL INDIA LTD.

Coal is the most abundant fossil fuel in India with about 307 billion MT reserves. India produced around 777 MT in FY 2021-22 with around 80% of the coal being consumed by the power sector. In FY 2022-23, the coal production was around 785 MT up to February 2023 which has already surpassed last year's mark. On the other end of the spectrum, India imports a plethora of chemical products. Import share of total natural gas consumption grew from around 28% in FY 2011-12 to around 48% in FY 2021-22 in India. India imported around US $113.1 billion net worth of oil and gas for the period of FY 2021-22 and for FY 2022-23. This figure has further increased to US $125.6 billion for the period April 2022 to January 2023.

India also has a huge dependency on imports of crude and natural gas-based products mainly ammonia, DME, methanol, olefins, etc. which can be easily substituted by syngas based on coal gasification. Thus, syngas production from coal gasification can be an alternative to replace the natural gas demand in many downstream applications and thus can help reduce the import bill for the nation.

Another end of the spectrum is the transition to cleaner methods of utilizing coal. Thermal power generation is a major source of carbon dioxide emission in India. Coal gasification is therefore considered a cleaner alternative as compared to burning coal and utilizes the chemical properties of coal. In line with this principle, our Prime Minister Narendra Modi has laid down the vision of 100 MT coal gasification by 2030.

The implementation of coal to chemical projects in India shall not only contribute to the growth of the country in terms of domestic product development and import substitution but also employment generation and growth of local communities. Further, ancillary downstream industry and services will arise which will generate additional indirect employment as well. The projects would bring forward an overall social development with an emphasis in the areas of education, training, health, and infrastructure.

Contribution of Coal India

Coal India Limited (CIL) is accountable for more than 80% of domestic coal supply. With the projected growth of the coal demand in the nation, CIL has put together strategies for growth which shall ensure meeting the energy aspirations of the nation.

Recognizing the considerable opportunity in the sector, Coal India Limited has identified the coal to chemical business as a natural transition from its existing portfolio. CIL plans to leverage its strengths in areas of raw material security and self-consumption potential (as in the case of ammonium nitrate) among others.

CIL has identified five projects spread across its subsidiaries producing diverse products such as ammonia, synthetic natural gas (SNG), ammonium nitrate, and

CIL has also executed several MoUs with PSUs BHEL, IOCL, and GAIL in October 2022 to leverage partnerships to implement identified projects

Coal India Limited has identified the coal to chemical business as a natural transition from its existing portfolio

urea. CIL has also executed several MoUs with PSUs – BHEL, IOCL, and GAIL, in October 2022 to leverage partnerships to implement these identified projects.

CIL is a promoter in another project taken up by the Talcher Fertilizer Limited (TFL) along with GAIL (India) Ltd. (GAIL), Rashtriya Chemicals & Fertilizers Ltd. (RCF), and Fertilizers Corporation of India Ltd. (FCIL). The plant, envisioned to be India's largest and first coal gasification urea plant is expected to significantly reduce the dependence on imported urea. Thus, the realization of all the five identified projects shall provide a boost to the coal-to-chemical sector and thus aid in achieving the vision of Atmanirbhar Bharat.

Key Challenges & Way Forward

The coal gasification sector in India faces a range of challenges covering technical as well as commercial aspects. With regards to technical challenges, the inherent property of Indian coal being high in ash content coupled with limited technology licensors for the same is one of the key challenges. Other challenges include issues in technology transfers, pithead land availability, etc.

Another major challenge for coal gasification projects in India is the high Capex requirement. Therefore, it is imperative to introduce incentives and policy enablers which shall aid domestic players to remain competitive with the international players in terms of prices.

The Government of India has also come out with a number of recent interventions which indicate strong push towards the coal to chemicals sector including the release of the National Coal Gasification Mission document, a preferential auction policy and proposals for surface coal gasification (SCG) projects in the Union Budget among others.

While a number of steps has been already taken to promote coal gasification in India, other potential enablers are essential for swift implementation of SCG projects in the nation. One such enabler could be in the form of allocation of earmarked land for development of pit-head surface coal gasification projects. This shall significantly reduce logistics cost, improve the overall profitability, and viability of the project.

Other key enablers may include introduction of economical financing options for SCG projects, robust and timebound fiscal incentive policies such as tax holidays, exemption of duties or introduction of capital subsidies. ■

INDIA'S JOURNEY IN BATTERY MATERIAL INDUSTRY

India’s battery material industry, which was valued at US $1.66 billion in 2020, is projected to reach US $4.85 billion by 2027

VIKRAM HANDA
MANAGING DIRECTOR
EPSILON CARBON PVT. LTD.

As the world moves toward a future powered by renewable energy and electric vehicles, the role of batteries in our lives has become more important than ever before. The battery material industry, which forms the backbone of this transformation, has seen significant growth in India. Every year, the adoption of batteries increases remarkably across the globe and this transition will require consistent, innovative, and high quality supply of battery materials.

Battery Materials in India

India relies heavily on imported battery materials. In 2018, we imported around US $1.23 billion worth of lithium-ion batteries, which accounted for more than half of the country's demand. To address this, the Indian government launched the Production Linked Incentive (PLI) scheme for the Advanced Chemistry Cell (ACC) battery to boost domestic manufacturing. This scheme reduced dependencies on imported battery materials and accelerated the rate of innovation within the country. This had a significant impact on the country's battery material industry, which was valued at US $1.66 billion in 2020 and is projected to reach US $4.85 billion by 2027, registering an impressive CAGR of 17.23% during the forecast period of 2022-2027.

This unprecedented growth was amplified due to India’s strong manufacturing ecosystem, prowess in innovation, and a large pool of technical and engineering talent. The industry has gained significant momentum in recent years and has put us in a position of strategic importance in the global battery materials market.

Scope of Growth

The magnitude of demand for batteries is high, with the number of GWh (Gigawatt Hours) required increasing from about 700 GWh in 2022 to around 4.7 TWh (Terawatt Hours) by 2030. Additionally, there are looming concerns about supplies of key battery materials like cobalt and lithium that are pushing the search for alternatives to the standard lithium-ion chemistry. This is where India has a major advantage as a leader in the chemical industry to address this challenge. The chemical industry is a crucial contributor to the battery material supply chain, providing essential raw materials to produce batteries.

In 2019, the Indian chemicals industry stood at US $178 billion and is anticipated to reach US $304 billion by 2025, registering a CAGR of 9.3%. It is one of the fastest growing sectors in India and is currently the 10th largest chemical trade partner for the US which is estimated to scale up to 7th by 2030. Herein lies an opportunity for India’s booming chemical industry to take lead and convert minerals into battery materials and reduce the dependence on China.

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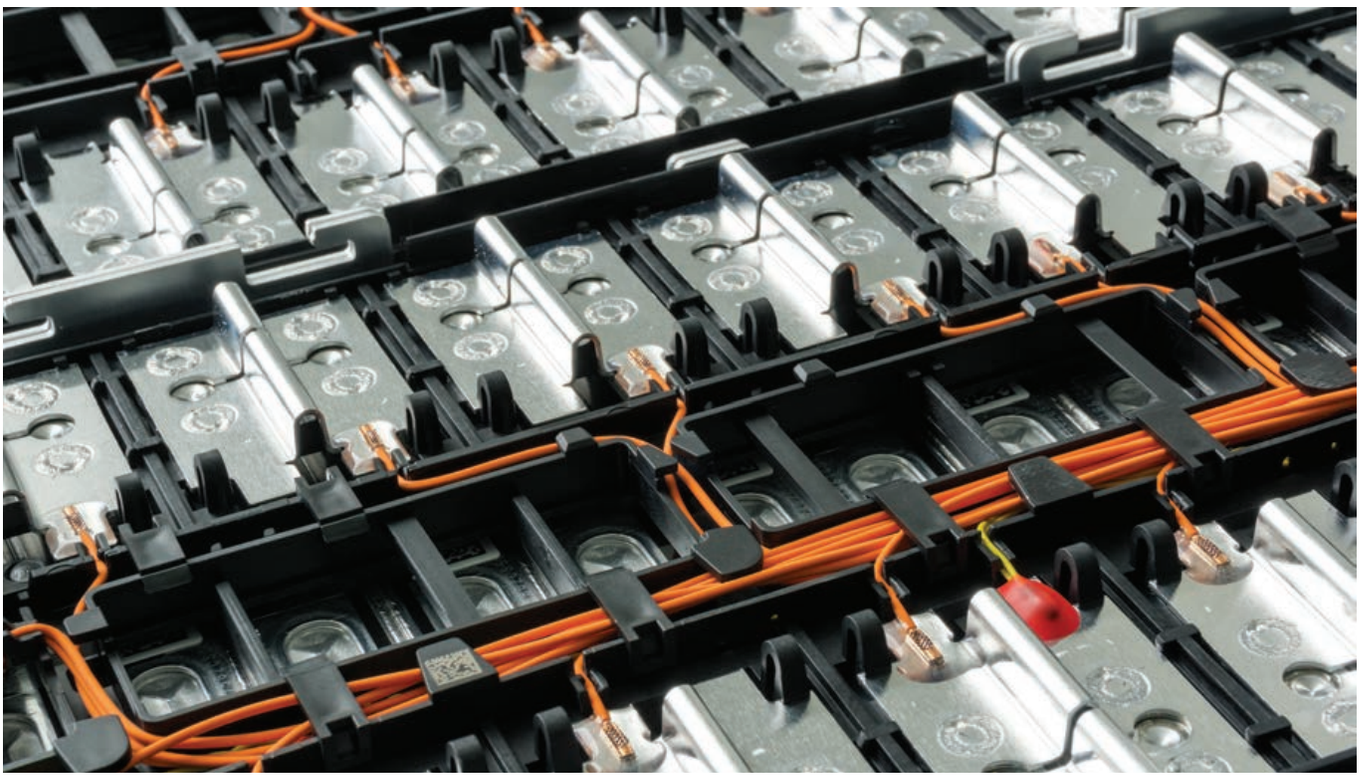

India's Emergence as a Leader in Next-generation Battery Technologies

India's advancement in innovation in the chemical landscape will contribute significantly to the global battery materials industry, making it a preferred destination for battery materials due to its efforts in developing innovative and advanced battery technologies.

The demand for higher energy densities was initially driven by the portable gadget industry, which led to the development of batteries with extended cycle life, smaller sizes, and higher capacities. However, the introduction of electric vehicles brought in new challenges and opportunities where batteries must be reliable, lightweight, and affordable.

As our prowess lies in innovation, the next generation of batteries with different chemistries will be built in India. The innovation to keep an eye on is the solid-state lithium batteries, a promising breakthrough in the field of electric vehicles and energy storage, offering improved safety, and energy density, and packing more energy into a smaller space. Solid-state lithium batteries could potentially address the issues of range anxiety and long charging duration, making electric vehicles a more viable option for consumers. It has captured the manufacturer's attention with a promise of improving safety, and energy density, and catering to a wide range of electric vehicles. Instead of the flammable, liquid electrolytes used in conventional lithium-ion batteries, battery cell manufacturers install solid-state batteries with electrolytes in a solid form.

India will also see growth in battery innovation, manufacturing Lithium-sulphur (Li-S) batteries and silicon-based anodes. The Li-S battery technology is based on the principles of green chemistry, which involves utilizing by-products from the petroleum industry such as sulphur, as well as agro-waste elements and copolymers like cardanol (a by-product of cashew nut processing) and eugenol (derived from clove oil), as cathodic materials. This innovation can benefit the energy storage and electric vehicle industry in India and the world. Among the new chemistries & materials being studied, silicon has a good potential as an anode material to be added alongside the commonly used graphite.

The anode material determines how fast the vehicle battery can be charged and, with an increase in the energy density, helps to extend the driving range per charge. Even though graphite-based materials have been widely used so far for anode manufacturing, more and more battery manufacturers are trying to raise the silicon contribution, which will increase the energy density and reduce charging time.

While there are still challenges to overcome in the development of Li-S and silicon-based batteries, the potential benefits are too significant to ignore. India can drive progress in this potential area by investing in research and development and fostering partnerships between academia, industry, and global governments.

The battery material industry in India has undergone a remarkable transformation in recent years. It has moved from a heavy dependence on imports to investments in the manufacturing and innovation process. This transformation is a testament to the country's commitment to sustainable development and its ability to create an enabling environment for the growth of new industries. With continued investment and support, India's battery material industry is well-positioned to become a global power. ■

INDIA @75: A GROWTH ENGINE FOR FUTURE WORLD

The government has implemented various policies to encourage growth in the sector, including the introduction of tax incentives and the liberalization of the industry

MANISH KUMAR RATHOD
MANAGER-PROJECTS & BUSINESS DEVELOPMENT IPCO PROCESS & BELT TECHNOLOGY INDIA PVT. LTD.

India at 75 marks a significant milestone in the country's history as it celebrates 75 years of independence from British colonial rule. Over the years, India has made significant progress in various areas such as economic growth, social development, and technological advancements.

Looking Back: India's Journey So Far

One of the most notable achievements of India in the last 75 years is its economic growth. India has emerged as one of the fastest-growing economies in the world. The GDP in India is seen expanding 7% in the 2022/2023 fiscal year, unrevised from initial estimates. However, the growth rate for 2021/2022 was revised higher to 9.1% from 8.7%. For the 2023/2024 year, the government is expecting 6-6.8% economic growth. India has also made significant progress in social development, with the government launching various schemes and programs to improve the living standards of its citizens. The country has made significant strides in reducing poverty, improving health and education, and promoting gender equality.

Technological advancements have also been a significant area of progress for India in the last 75 years. The country has emerged as a global leader in the IT sector, with its skilled workforce and innovative start-ups. India has also made significant progress in space technology, with the successful launch of the Chandrayaan and Mangalyaan missions.

As India celebrates 75 years of independence, it is an opportunity to reflect on its achievements and

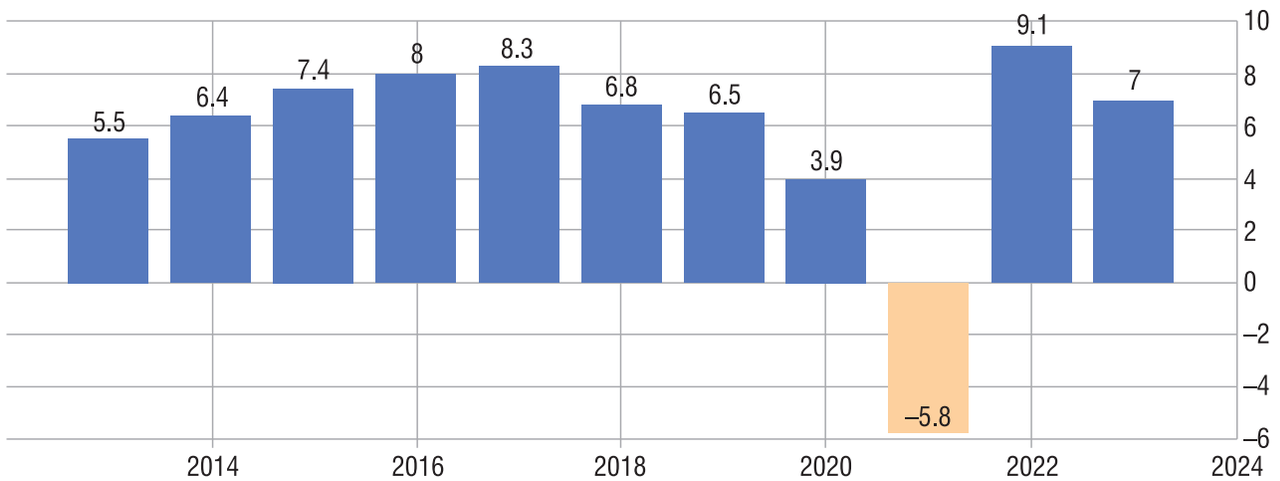

Figure 1: India's GDP growth rate (Image courtesy: www. tradingeconomics.com)

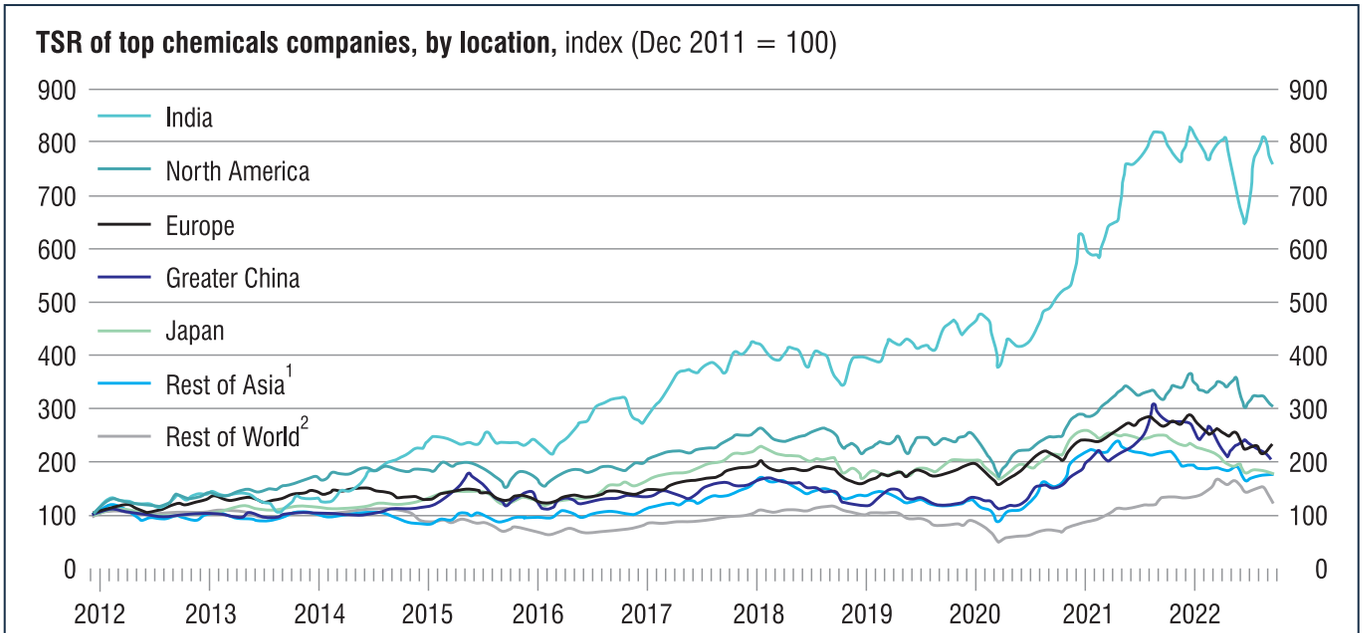

Figure 2 : The chemical industry in India has surpassed shareholders expectations (TSR) in all region (Image courtesy : www.mckinsey.com)

challenges and work towards a brighter future. India has the potential to emerge as a global leader in various areas and make a significant contribution to the world. With the right policies and initiatives, India can continue to grow and prosper in the years to come. Over the years, the industry has undergone significant changes. The government has implemented various policies to encourage growth in the sector, including the introduction of tax incentives and the liberalization of the industry. These policies have helped to attract foreign investment and stimulate the growth of the sector.

As a result of these policies, the chemical and refining sector in India has grown significantly. Today, India is one of the world's largest producers of chemicals and petrochemicals. The sector has diversified into a wide range of products, including specialty chemicals, plastics, and pharmaceuticals. India is also home to several world-class refineries, which produce a range of petroleum products.

The chemical and refinery sector is expected to witness significant technological advancements in the future which will improve production processes and enhance product quality

Current Scenario of Chemical and Refinery Sector in India

The Chemical and Refinery sector is one of the crucial sectors for any economy. It is responsible for providing a wide range of chemicals and fuels, which are used in various industries such as agriculture, healthcare, transportation, and many more. The sector has a significant impact on the overall growth and development of an economy, and India is no exception. The chemical and refinery sector of India has been growing rapidly over the years and is expected to continue its growth trajectory in the future.

According to the Indian Brand Equity Foundation (IBEF), the chemical industry in India is expected to reach USD 300 billion by 2025, growing at a CAGR of 15-20%. Similarly, the refinery sector in India has been growing at a steady pace, and the country has emerged as a significant player in the global oil refining industry. An investment of Rs. 8 lakh crore is anticipated in the sector by 2025. In July 2021, production volumes of key chemicals stood at 909,310 MT and petrochemicals at 1,867,351 MT.

The growth of the chemical and refinery sector in India can be attributed to various factors such as the increasing

demand for chemicals and fuels, favourable government policies, and the availability of low-cost labour. India's geographical location, which makes it a natural gateway to the Middle East and South Asian markets, has also been an advantage for the sector.

Future Prospects of Chemical and Refinery Sector in India

The chemical and refinery sector of India is expected to continue its growth trajectory in the future. The sector's future prospects are bright, and it is expected to play a significant role in India's economic growth and development. Some of the factors that are expected to drive the sector's growth in the future are:

Rising demand for chemicals and fuels: The demand for chemicals and fuels is expected to rise in India, driven by the growing population, increasing urbanization, and rising disposable incomes. The sector is expected to cater to this growing demand and expand its production capabilities.

Favourable government policies: The Indian government has been taking various measures to promote the chemical and refinery sector, such as providing incentives and subsidies, easing regulations, and attracting foreign investment. These policies are expected to continue in the future and create a conducive environment for the sector's growth.

Technological advancements: The chemical and refinery sector is expected to witness significant technological advancements in the future, which will improve production processes and enhance product quality. The sector is expected to adopt advanced technologies such as artificial intelligence, internet of things, and big data analytics, among others.

Increasing exports: India's geographical location and favourable government policies are expected to help the sector increase its exports. The sector is expected to tap into the growing demand for chemicals and fuels in the global market and increase its share in the global trade.

Challenges: As India approaches its 75th year of independence, the chemical and refining sector faces several challenges. One of the biggest challenges is the need to balance growth with sustainability. The sector is a significant contributor to greenhouse gas emissions and other environmental issues. As such, the industry needs to adopt sustainable practices to reduce its impact on the environment.

Another challenge facing the industry is the need to invest in research and development. While India has made significant progress in the chemical and refining sector, it still lags behind many other countries in terms of innovation. To remain competitive in the global market, Indian companies need to invest in research and development to develop new products and processes.

In addition to these challenges, the sector also faces significant opportunities. One of the biggest opportunities is the increasing demand for chemicals and petrochemicals in India and around the world. As the global population grows and becomes more affluent, the demand for chemicals and petrochemicals is expected to increase significantly. Indian companies can capitalize on this trend by expanding their production capacity and developing new products to meet the growing demand.

Conclusion

The Indian chemical and refining sector have come a long way since independence. The sector has grown significantly, providing employment to millions of people, and supporting many other industries. However, the sector faces several challenges, including the need to adopt sustainable practices and invest in research and development.

As India approaches its 75th year of independence, the chemical and refining sector has significant opportunities for growth. The increasing demand for chemicals and petrochemicals, as well as the focus on renewable energy, presents significant opportunities for Indian companies. With the right policies and investments, the Indian chemical and refining sector can continue to grow and contribute to the country's economic development. ■

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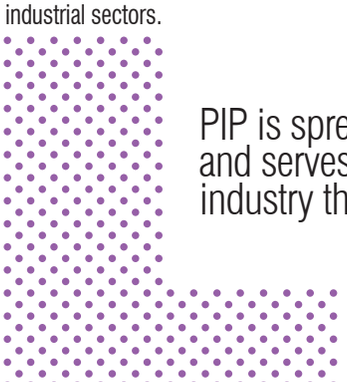
WHAT MAKES PIP A PERFECT PLACE FOR CHEMICAL FACILITIES?

With its state-of-the-art infrastructure, adequate water availability, waste management, and multi-modal connectivity - PIP is an ideal location for nascent industrial sectors

The burgeoning economic growth of India in recent years can be largely attributed to the crucial role played by industries, which in turn, owe their growth to the supporting infrastructure and services provided by industrial parks. These specialized zones have been instrumental in fostering industrial growth across diverse sectors, including manufacturing, production, and logistics. Industrial parks are strategically located in areas that offer a range of favorable conditions to industries, including but not limited to, access to robust transportation networks, a skilled and educated workforce, and a regulatory environment that is conducive to their operations.

Taking inspiration from this thought, and with the aim of contributing to India's GDP, Arete Group, one of the largest industrial park developers in India, took a step and came up with an innovative and ground-breaking venture - PIP (Payal Industrial Park). PIP is spread across 3,500 acres in Dahej PCPIR and serves as a golden opportunity for any industry that is looking to flourish in the long run. With its state-of-the-art infrastructure, adequate water availability, waste management, and multi-modal connectivity - PIP is an ideal location for nascent industrial sectors.



PIP is spread across 3,500 acres in Dahej PCPIR and serves as a golden opportunity for any industry that is looking to flourish in the long run

Dahej PCPIR is India's first operational Petroleum Chemicals Petrochemical Investment Region (PCPIR), which is a Special Investment Region defined for chemical industries. It is a gateway to industrial prosperity and business development in India. Its advantageous location near the industrial hubs of Gujarat results in reduced transportation costs and shorter delivery times for crucial cargo.

Challenges in Finding Right Industrial Park

Finding the right industrial park that suits all your needs is a complex and challenging process. It may seem a daunting task at first. Key challenges in finding right industrial park:

- Finding the right location is important as it impacts transportation costs, proximity to suppliers and skilled labor are critical to the success of your business.
- A reliable and adequate infrastructure is crucial for any industrial park, a lack of which can lead to delays and higher costs.
- Cost of industrial parks may vary depending upon the infrastructure, facilities, location, and other factors. Finding a park that meets the budget and offers good value for money is a challenging task.
- Depending upon business needs, one may require specific amenities like office space, logistics, effluent discharge plant, and warehousing. An industrial park that offers all of these is difficult to find.
- One of the main challenges in locating suitable industrial land is dealing with numerous approval processes involved, such as obtaining environmental clearance, securing water and electricity connections, managing construction, and finding sufficient manpower. Even after the industry has been established, ongoing support and guidance is often needed to ensure the business runs smoothly. PIP handholds their partners throughout the journey.

Are you acquainted with the myriad of factors that render PIP a highly conducive environment for your industrial endeavours?

PIP occupies a conspicuous and noteworthy position

As PIP is located in Dahej, it takes the advantage of its central location, and multi-modal connectivity, with easy access to ports, railways, airports, and highways. It is conveniently located on the Delhi-Mumbai Industrial Corridor via National Highway 48. PIP has close proximity to three main ports - Dahej Port, Kandla Port, and Mundra Port. These ports are situated on the western coast and are the largest ports in India. Air - PIP benefits from its proximity to two major international airports - Surat and Ahmedabad. Rail - PIP benefits from its proximity to the western railway network.

Infrastructure is most conducive and advantageous

PIP is very carefully planned in a resource-rich state and is equipped with the most

essential infrastructure, and master planning overseen by CH2M. The Payal Industrial Park has also been approved for a total 92 MLD of treated water and 50 MLD in Phase 1, and 66 kVA substation approved within the park. Also for further demand the surrounding area is home to 33 planned and operational sub-stations, ensuring a steady supply of power. PIP is developing 2.5 MLD CETP in Phase 1 while having approval of a total 50 MLD CETP from the Ministry of Environment, Forestry & Climate Change Department and has approval for 40 MLD deep sea discharge line in GIDC pipe line. Shovel-ready plots are available, allowing for immediate construction.

Location that is marked by a high degree of versatility

PIP, owing to its location in Gujarat, a state known for its vibrant economy and dynamic industrial landscape, serves as an ideal destination for both established enterprises seeking to expand their operations, and emerging industries striving to make their mark in the competitive global marketplace. The strategic position of PIP further enhances its appeal, with its proximity to key markets in Southeast Asia, the Middle East, Europe, and Central Asia, allowing industries to leverage the vast potential offered by these regions. Moreover, PIP forms an integral part of the Indian government's PCPIR program aimed at catalyzing chemical industry investment in Asia. The West India PCPIR, which spans 453 square km has obtained the necessary environmental clearances, significantly reducing the time and effort required for setting up industries in the region.

Most advanced effluent treatment plant

The PIP has developed a CETP (Common Effluent Treatment Plant) that is unparalleled in its comprehensive inlet norms for chemical industries. With an inlet COD (Chemical Oxygen Demand) level of 5,000 ppm, this first-of-its-kind project in India aims to treat the parameters to meet the marine discharge norms of 250 COD. As a result, most chemical industries will only need to establish their initial chemical treatment process such as MEE (Multiple Effect Evaporation) and primary treatment, without needing to install biological treatment processes on their premises. This approach helps industries to utilize their space for manufacturing purposes.

What's new

The Experience Center - The one of its kind technologically advanced experience center set up in PCPIR works great for industries to take a tour and get the look and feel of the place. The Experience Centre at PIP is a unique selling point that sets it apart from other industrial parks. This three-dimensional virtual tour has been created to simplify and enhance the experience for industry professionals. Visitor companies are taken on an insightful demonstration tour of the Park, showcasing its exceptional facilities that are ideal for businesses seeking more space or fresh ideas. Since its inception, this cutting-edge facility has engaged and educated industry players through its ground-breaking virtual experience. Visitors from around the globe can gain insight into how to plan and envision their future expansion, providing a glimpse into what their new manufacturing plants will look like when operational.

Apart from this, there are physical office spaces where the companies get an opportunity to work, if they want to set up their industry in PIP, they can work with their employees in the office initially. Without any hassles, the work will not be interrupted. A resort-like stay is also under construction so as to provide comfort and convenience for every industry that is planning to set up in PIP.

Connection to the Indian market

PIP offers convenient access to the Indian market, manpower is readily available nearby, and other ancillary products as a part of the industrial cluster. It's an ideal location for water-intensive and pollution-creating industries such as chemical, agrochemical, fertilizer, dye intermediates, pigments, polymer, rubber, metals etc. As a result, any industry associated with it is certain to enjoy a significant advantage in the Indian market. With its prime location and exceptional facilities, the PIP is set to gain increasing traction with each progressive day.

Support in non-core activities

PIP focuses on supporting all the non-core activities and creating a valuable product around them. The focus of PIP is to enable or empower the industries to focus on their core activity which is to manufacture products and create markets. PIP creates solutions around - all regulatory approvals and following on compliances such as GPCB, procurement of water, waste treatment and disposal, and livability solutions. Apart from Infrastructure, creating a value-added product around these non-core activities is a prime focus area of PIP.

The Ministry of Environment, Forestry and Climate Change (MoEFCC) has granted PIP Environment Clearance under 7(C) A Category, enabling industries in the chemical sector such as Chlor-Alkali, Fertilizer, Agro Chemicals, Petrochemicals, Textiles, Dyes & Dye Intermediates, Pigment & Pigment Intermediates, Synthetic Organic Chemicals, Specialty Chemicals, Polymers, and Inorganic Chemicals to begin construction of their green field project quickly.

Following the perks of having your industry in Dahej Gujarat, PIP has become the talk of India for driving business and commerce for greater economic stability. The aim and vision of Arete group: "To be a strong growth engine for businesses, and create value for stakeholders" justify completely as soon as you enter the success drive of your industry. ■

IMPORTANCE OF SPECIALTY THERMOPLASTICS FOR CHEMICAL INDUSTRY

STP are processed more or less like Engineering Thermoplastics (ETP) except that temperature of processing is 50°C to 100°C above those for ETP

DR. PRAKASH D. TRIVEDI
CONSULTANT
GHARDA CHEMICALS LTD.

Specialty Thermoplastics (STP) are those which are a notch above engineering thermoplastics (ETP) in nearly all their properties. Their major improvement over the EP is due to their superior thermal resistance and hence their thermal and thermo-mechanical properties. Besides, their resistance to oxidation, flame, wear and tear and their ease of recyclability are far superior to those of ETP.

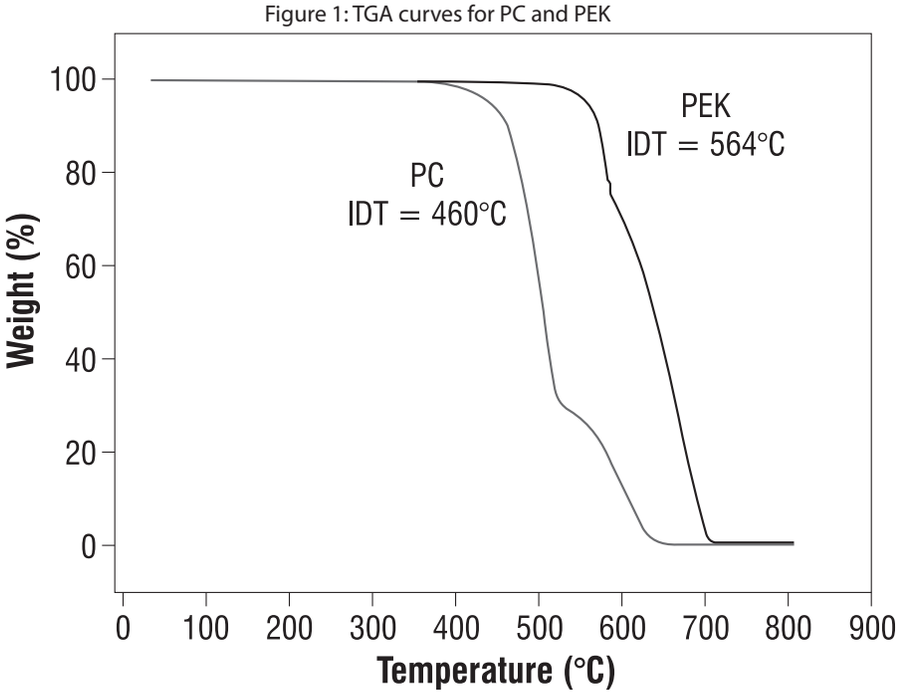
STP come as amorphous or crystalline polymers. The amorphous STP are polyaryl ether sulfones (PAES) and polyaryl ether imides (PEI). Crystalline STP are polyphenylene sulfide (PPS), liquid crystalline polymers (LCP), polyaryl amides (PPA) and polyaryl ether ketones (PAEK).

Those thermoplastics which have Tg of 180 °C or above or have Tm of 280 °C or both are generally considered as STP. If not, then they usually are termed ETP.

Apart from Tg and/or Tm, another significant improvement of STP over ETP is thermal stability. Figure 1 gives Thermo-Gravimetric Analysis (TGA) of PEK Vs. PC, under nitrogen atmosphere. As it shows, while PC starts degrading at about 460 °C, PEK is stable up to 564 °C! A clear gain of 100 °C in stability for STP over ETP.

This higher thermal stability of STP over ETP and commodity plastics is what makes them successful in critical applications over not just ETP but also thermosets and metals.

Figure 1: TGA curves for PC and PEK



Production of STP

STP are mainly produced using step growth mechanism of polymerizations, where a single or two monomers with two functionalities react to build molecular weights.

A-M-B → A-[M-]n- + A-B.
Where A & B are functional groups.
A-M-A + B-N-B → A-[-M-N-]n-B + A-B.

(Where n denotes degree of polymerization. These reactions can be either nucleaophilic or electrophilic chemistry.)

Many of these reactions are carried out in an aprotic solvent, with alkali or Lewis acids as catalysts and by-products like salts or water are generated. In some systems, polymer after attaining certain molecular weight may come out of solution and slurry is formed. It becomes therefore important to purify these STP of any unreacted monomer, solvent, salt and other impurities, which otherwise tend to create issues while processing at high temperatures. LCP and PPA are produced using melt polymerization, without solvent and like PEKK, they generally use three monomers.

The PAES considered as STP are polyether sulfone (PESU), polysulfone (PSU) and polyphenylene sulfone (PPSU); PEI is standard polyether imide; PPS, LCP and PPA also standard grades and PAEK represents polyether Ketone (PEK), polyether ether ketone (PEEK), polyether ketone ketone (PEKK).

Processing of STP

STP are processed more or less like ETP except that temperature of processing is 50 °C to 100 °C above those for ETP. This requires superior metal of constructions and heating systems for the extruders and injection molding machines. Besides this, this equipment must be corrosion and wear resistant to process these high viscosity materials, particularly when reinforced with Glass Fibers (GF) or carbon fibers (CF). While most STP may be compounded to improve their specific properties, being polar and hence moisture absorbing, drying of them before extrusion or molding is mandatory.

The presently popular method of Additive Printing (3D printing) using laser or filament system are becoming prevalent for STP also.

Properties of STP

The Tg and Tm of major STP are as given in following Table 1.

Table 1: Tg and Tm of STP

STP	Tg °C	Tm °C
PAES*	180 to 222	None
PEI	217	None
PPS	82	285
LCP*	–	350
PPA*	–	–
PAEK*	137 to 170	305 to 395

• Depending on chain structure.

In general, STP are known for their mechanical properties. These are about 1.5 to 3 times those of commodity plastics and 1.2 to 1.5 times those of ETP. The major importance lies in the tensile strengths of STP at temperatures like 180 °C to 250 °C being nearly same as those for PP or ABS tensile strength at ambient temperatures, making STP usable up to high temperatures. Additionally, their oxidation resistance is also high so some of them have Continuous Use Temperatures (CUT) also as high as 200 °C to 300 °C. That means an article made from a specific STP can be kept for 100,000 hrs (almost 12 years) at its CUT by which time it will lose only 50% of its given property. Thus, for example PEK with CUT 260 °C and with initial tensile strength of 110 MPa will still have about 55 MPa tensile strength after maintaining at 260 degree C for 12 years, still higher than that of PP at room temperature.

Among the other properties of some STP are their very high resistance to hydrolysis, chemicals, flame, radiation including gamma rays. These allow their usage in membranes, food trays and medical devices, nuclear plants, electrical and electronics, Oil and gas industries, transportation including auto and aerospace. Depending on their history of processing, they can be kept transparent to opaque.

Another big advantage of STP is getting superior mechanical properties when reinforced with glass or carbon fibers. Table 2 shows some of these properties of PEKK with 30% GF and CF filled compounds.

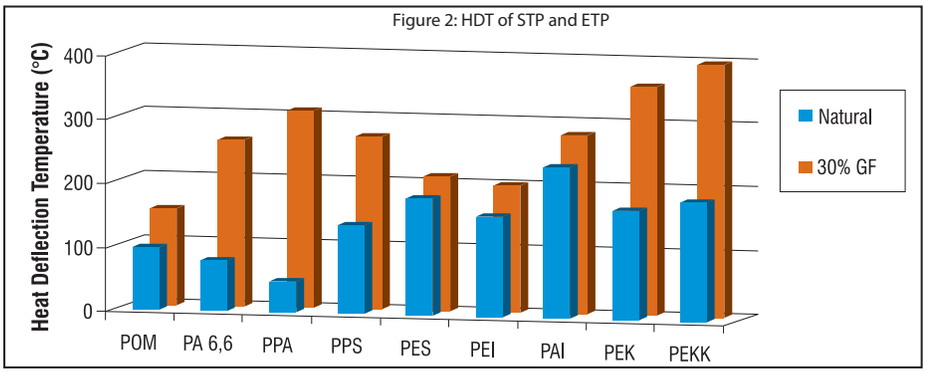
Table 2: Mechanical Properties of 30% GF and CF Filled PEKK* 100:0

Property	Test Method	PEKK	PEKK + 30% GF	PEKK + 30% CF
Filler type	–	0	Chopped glass fiber	Chopped carbon fiber
Filler wt.%	–	0	30	30
Specific gravity	ASTM D792	1.3	1.54	1.43
Tensile strength (at Break), MPa	ASTM D638	110	180	245
Tensile elongation (at break) %	ASTM D638	10	2.9	3.4
Tensile modulus, GPa	ASTM D638	4.2	12.8	26.2
Flexural strength, MPa	ASTM D790	200	258	360
Flexural modulus, GPa	ASTM D790	4.2	12.1	20.8
Impact strength, J/m	ASTM D256	50	66	42

*PEKK has T: I ratio of 100:0 for this grade.

As can be seen, the reinforcement with GF and CF improves the mechanical properties substantially, including for impact strength.

A comparison of some STP with ETP, with or without 30% GF is shown in Figure 2. Two important aspects of this study are that GF improves HDT of



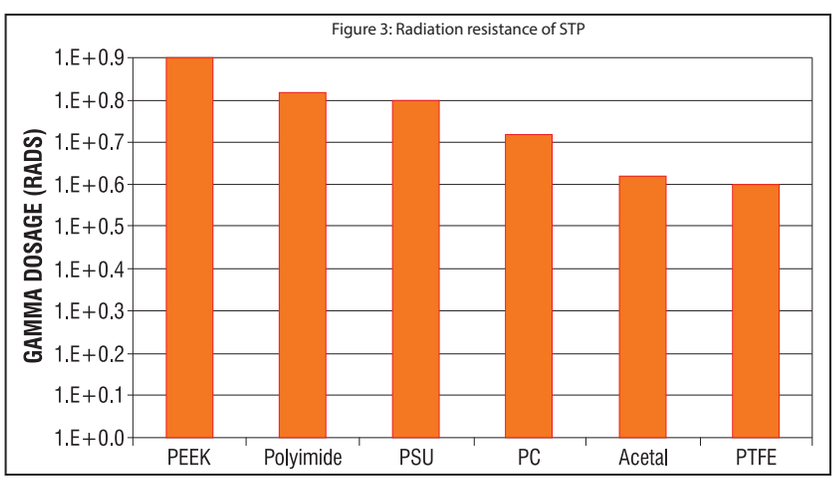
crystalline STP or ETP by a wider margin than for amorphous ones. Also, of course STP overall show higher HDT values than ETP in Figure 2.

Table 3 gives the Limited oxygen Index (LOI) for various ETP and STP. Again, STP shows far less tendency to burn as against ETP.

Table 3: LOI of ETP and STP

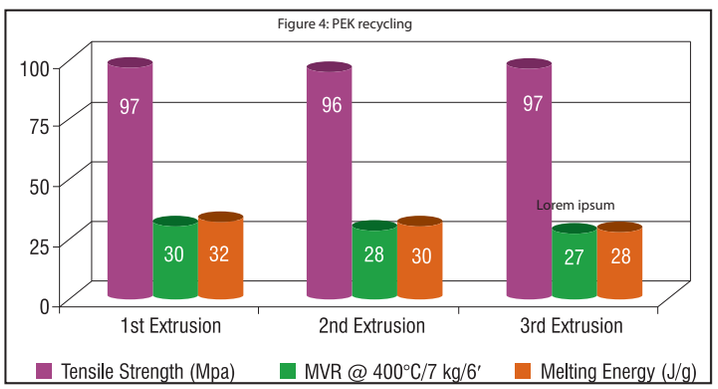
PLASTICS	LOI %
PTFE	90
PEI	47
PPS	44–53
LCP	37–46
PES	38
PC	35
PEEK	35
PSU	30
ABS	19

Similarly, STP show far superior gamma ray radiation resistance than ETP Figure 3.



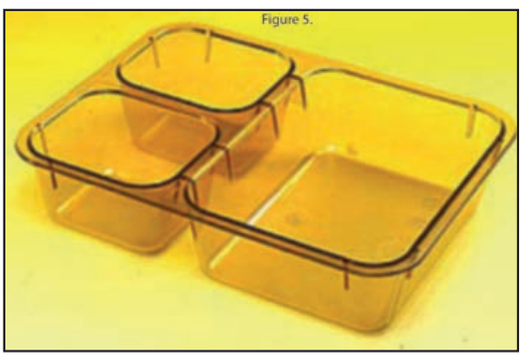
An increasingly becoming important aspect for polymers is sustainability due to recycling. Figure 5 shows properties of recycled PEK on 100% basis. While in general, addition for recycling to virgin polymer is 10-20% only, PEK as shown here on 100% recycling shows virtually no loss in mechanical or flow properties.

These are some of the most important general properties of STP. Like other thermoplastics, some specific property may be outstanding for a given STP. Thus, for example, PPSU has impact resistance rivalling that for PC, and PEKK has Tm of 395 oC, highest of all thermoplastics. A CF 30% reinforced PEK has specific strength higher than that for aluminium and just marginally lower than that of steel!



Applications of STP

STP are getting used whenever conditions are harsher or more critical. Thus, for example in Oil/Gas industries



where chemicals/oil and temperature resistance is important. In food and medical devices where, repeated sterilization, transparency and light weight are important. In aerospace, where resistance to higher temperature fluctuations and radiation are the norm. In electronics and electrical industry, where good electrical properties, non-flammability are important.

Figures below show injection molded PPSU and PEI articles, extruded stock shapes of PEK for machining and 3D Laser printed spinal cord parts of PEKK.

For every individual STP, there is a long list of applications that cannot be covered here. Those interested are requested to look through the bibliography references provided. ■

SPECIALTY CHEMICALS INDUSTRY ON UPWARD TRAJECTORY

The future looks bright for the Indian specialty chemicals industry with large investments, merger & acquisitions, and robust export revenue growth

AJAY JOSHI
FOUNDER
MSTACK INC.

The Indian specialty chemicals industry is expected to double its export share to 7-8% by 2028 from the current share of 4%. In this post-pandemic world, jargon like "Europe+1" and "China+1" have become as infamous as the words "lockdown" and "quarantine". Surprisingly, the growth of the Indian specialty chemicals industry cannot be credited fully to either the European energy crisis or the supply volatilities emanating from China. The main catalyst for this growth is the "mindset shift" of Indian companies in today's post-pandemic world.

Eccentric Nature

Specialty chemicals are known to be high value and low volume in nature. Plus, they add tremendous value to end products (e.g., UVA/UVB filters in sunscreen or advanced intermediate chemicals in active pharma ingredients). However, when it comes to India, the specialty chemicals industry is highly concentrated into two segments - pharmaceuticals and agrochemicals. This has worked out well for Indian companies in the past where they have grown to be not only major export suppliers to countries like the US, Japan, Germany, and Brazil but also strategic partners for global companies like BASF, Syngenta, Corteva, etc. in contract manufacturing.

While companies like Aether Industries, Jubilant Ingrevia, and Ami Organics have leveraged heavily on R&D to develop value added chemistries in India; companies like SRF, PI Industries, and Deccan Fine Chemicals, today stand tall vis-a-vis Chinese and European counterparts in the space of contract manufacturing by ensuring superior product quality, cost optimization, and supply reliability.

Another eccentric nature of the Indian specialty chemicals industry is due to the anomaly in upstream supplies of building blocks - methanol, ethylene, propylene, butadiene, benzene, and toluene. The limited availability of methanol, ethylene, and propylene for the merchant downstream segment has made India a net importer of key intermediates. An extremely basic example is specialty amine portfolio i.e., imidazole, morpholine, xylidine, piperazine, diethylenetriamine, aminoethyl ethanolamine, etc. On the other hand, due to easy availability of butadiene and benzene, companies like Vinati Organics and Aarti Industries have been able to maintain a well-balanced portfolio of both commodities as well as specialty chemicals.

Due to higher dependency on

From value chain integration to diversification, import substitution to export growth, and limited offerings to portfolio optimization are some of the major changes the industry is witnessing

the lifesciences (pharmaceuticals and agrochemicals) segment coupled with non-integrated value chains, the time has come for Indian specialty chemical players to adopt a new approach for the next generation of profitable growth. Fortunately, due to the "mindset-shift" Indian specialty chemicals industry is now ready for the revolution.

Changing Scenario

From value chain integration to diversification, import substitution to export growth, and limited offerings to portfolio optimization are some of the major changes the Indian specialty chemicals industry is witnessing in current times.

Value chain diversification:

Companies like Navin Fluorine and SRF have leveraged fluorination to diversify their sales outlets into multiple end industries - Agrochemicals, pharmaceuticals, fluoropolymers, refrigerants, etc. Simultaneously, these companies along with the new entrant Anupam Rasayan, have also been investing heavily into technical expertise to continuously grow their custom synthesis and contract manufacturing business.

Rising export revenues: The Chinese supply crisis of 2021-22 was immediately followed by the Russia-Ukraine conflict causing a major energy crisis in Europe. This made the previously known stalwart European monopolistic suppliers (i.e., BASF, Clariant, Evonik, etc.) unreliable and costlier, leading to search of new supply source by customers in Southeast Asia, Latin America, Middle East, North Africa, and North America. Particularly, in non-life science segments like personal care, food & feed, and flavour & fragrance, companies like Privi Specialty, Camlin Fine Science, Galaxy Surfactants, and Clean Science and Technology have shown remarkable export revenue growth by both growing business in the existing geographies and entering new geographies.

Product portfolio optimization:

One major challenge that has hindered the growth of many Indian companies is higher focus on selling commodity products. Companies like Jubilant Ingrevia, and Laxmi Organics have powerful products which can fetch them higher margins and values, but the focus has always remained on volume growth drivers in the past. Fortunately, this is now changing. Increasingly Indian specialty chemical companies are now vying to become staunch specialty chemical companies by focusing on complex molecules which have limited supplier base but multiple sales outlets. Jubilant Ingrevia's powerful pyridine chemistries can do wonders like what fluorine has done fantastically to SRF.

Conclusion

Overall, the future looks bright for the Indian specialty chemicals industry with large investments, merger & acquisitions, and robust export revenue growth. With Indian specialty chemical companies focusing on higher R&D spent, collaboration with global companies (joint ventures/technology transfers, etc.) has catalysed the innovation wave for the Indian specialty chemicals industry. The spill-over impact of China's declining competitiveness has set the stage for India to intensify its effort to capture a larger market share. The powering trend of de-risking of input procurement from China by global demand centres offers significant export sales opportunities for the Indian specialty chemical industry.

To summarize, let me share some more personalized views which I have collated post my visits to multiple Asian, Latin American, and Middle Eastern demand centres in the past six months. The make-in-India is happening on a real time basis for the specialty chemicals industry. The intent to buy from India is higher than it ever was among customers in South Korea, Indonesia, Japan, Turkey, Saudi Arabia, Thailand, Vietnam, Philippines, and Brazil. For big chemical companies in the aforementioned countries, there is a clear mandate by the senior management to have India as one of the Top 3 supply sources. ■

TARGETING A GROWTH OF 25% IN FY 2023-24

Will inaugurate own GMP certified state-of-the-art laboratory at Navi Mumbai to accelerate product and process development work

PRIYAMVADA BHUMKAR
CHIEF EXECUTIVE OFFICER
SOUJANYA COLOR PVT. LTD.

2023 trends in the colour solutions industry?

Colour continues to be an important aspect for all industries. For the paints and coatings industry - Colour sector is a big trend. Industrial coating manufacturers are seeing value in outsourcing color as a product from specialty color manufacturing companies like Soujanya - as it provides them advantages in terms of offering more color choices to their customers, timely servicing of their order, and cost savings whilst getting precise quality which adheres to demanding standards of industrial coatings. For architectural coatings, the trends are moving towards better color offerings and higher performance colorants

The home and personal care industry where we provide color solutions are seeing exciting trends where the industry is looking to outsource colorants. Traditionally this industry, especially in the color cosmetic space was used to incorporate pigment powder into products such as lipstick. The companies are now realising the value of incorporating liquid color dispersions from companies like us, which gives them enhanced colors, easy to manufacture, and time & cost savings. In short, as a color solutions provider, we see exciting trends to drive color as a key differentiator for our customers' business in each industry. This provides immense opportunities for innovation in the color space.

The new EOU in JNPA-SEZ will see a capacity addition of a further 3 million litres over the next 2-3 years. The Capex will help Soujanya to double its turnover over the next 3 years

Company's financial performance in FY 2022-23 and forecast for FY 2023-24?

FY2022-23 saw uncertainty and volatility for most businesses due to the prevailing global social-economic-geopolitical situation. At Soujanya Color, despite these trends, we have managed a modest growth. For FY 2023-24 we are targeting a growth of almost 25% which will be led by a thrust on exports, expansion, and diversification plans into newer markets, newer products, and newer industries.

Revenue mix within versus outside India for FY 2022-23 and revenue mix in FY 2024-25 with the coming up of the Mexico facility?

Revenue mix for within versus outside India for FY 2022-23 was 75:25. For FY 2023-24, we have targeted the mix to be 70:30. For FY 2024-25, the ratio should further change to 60:40. There is an increasing thrust on exports due to global opportunities in color for each of the industries we are present in. We have currently deferred our plans for the Mexico plant and will not have the facility functional this year.

The company has set up Soujanya Lifesciences to focus on key

ingredients in the Pharmaceuticals and Agrochemicals market. What's the update on this front?

While we started Soujanya Lifesciences division two years ago, we had made a beginning with a Research and Development lab in leased premises this year, we will inaugurate our own GMP certified state-of-the-art laboratory at Navi Mumbai where we can accelerate product and process development work. We will also cater to small pilot trials of lots of the ingredients. We are also looking to do a tie up for our own manufacturing facility, and we expect to start marketing our API's during this year. All our plans for this division are on track and we are hoping to become a preferred chemicals supplier for selected API's and specialty chemicals at a global level over the next few years.

The company is planning to expand its markets both within India and outside India. Products/solutions that you are planning to launch in the market?

For the paints and coatings industry we will be catering to a full range of color solutions for any kind of architectural or industrial paints and from in-plant tinting solutions to point-of-sale within the product categories there would be some high-performance colorants we will be launching for the automotive and wood coatings space. For the HPC (home and personal care) industry we will be launching the full range of water-based color solutions for personal care, high performance transparent color solutions for home care, and an exciting collection of color solutions for cosmetics such as lipsticks, hair color, hair dye, foundations, mascara, and eye shadow. For some of these solutions we would perhaps be the first company globally to offer sustainable bio-based solutions. We also will be making forays into the ingredients space in personal care with our beyond-color strategy. We are also launching some innovative bio-based solutions in the polyurethane space, which will be rolled out at a global level this year.

Capex investment in FY 2022-23 and projects/facilities where the company invested? Capex plans for the company in FY 2023-24 and how will it help the company in the long term?

In 2022-23, we made some Capex for the expansion of our existing facilities and for constructing, setting up of the R&D lab for our Life Sciences division. FY 2023-24, we will see a big investment in Capex this year as we have acquired about 10 acres of land at the JNPA Port SEZ. Given our thrust or exports, we propose to set up a 100% EOU for our colorants products here to use part of the land. Further, some new projects are on the anvil for utilisation of the remaining parts of the land over a 3–5 year time frame. The Capex will help Soujanya to double its turnover over the next 3 years.

The company's portfolio of products is marketed under different brands. Have you made any additions to this portfolio in FY 2022-23 or plan to do so in the near future?

New brands have been added in our home and personal care decisions with the Auratone series of water-based dispersion for soaps and detergents, the Aurablush series for color cosmetics with colors for lipsticks and nail enamels, and the Auratint series for home care applications.

What is the total installed capacity across your manufacturing plants and how much additional capacity is added during FY 2022-23? What is your current capacity utilization and strategy

New brands have been added in our home and personal care decisions with the Auratone series of water-based dispersion for soaps and detergents

to improvise it further?

Our total installed capacity was about seven million litres a year with the facility expansion that we undertook in FY 2022-23, this will get enhanced to nine million litres. The new EOU in JNPA-SEZ will see a capacity addition of a further three million litres over the next 2-3 years. We expect to utilize 70-80% of these capacities in the next two years.

Key innovations undertaken at the company's R&D centre? How will these innovations help the company in the long run?

We are an innovation focused company where technology is at the heart of our business and is a key driver. Each new product we launch or each new market or customer we acquire becomes a possibility only because of the innovation capability which we have built into our business. While we focus on product innovation for each new market and customer to customize a perfect solution for them, we have introduced some high-performance color solutions such as super jet black (a high jet-ness black colorant) for automotive applications during the year, which is really unique. Our entire colorant range for home & personal care was launched during the last year which comprises a collection of almost 100 new color products for different applications in this industry.

All of the innovations launched help secure and build the future plans of the company allowing us to gain market presence and establish the technology competence of Soujanya.

Level of automation and digitalization Projects carried out in FY 2022-23? How do you plan to move ahead on this front both on brownfield and greenfield projects?

Our flagship facility is an automated infra facility. As we go forward, we will continue the journey of further automation and digitalization. We are working on becoming more data-driven and having the use of analysis in operations and business decision making.

CSR projects undertaken in FY 2022-23 and plans for FY 2023-24?

We are committed to CSR projects in education, skilling, women empowerment, sports promotion, health care, and preservation of arts and culture space. We work with partners and strive to make a real impact in whatever we do. Being a part of the paint industry, we have also done some work with the PCSC (Paint & Coating Skill Council) for the skill of painters in the country.

How is the company striking a balance between sustainability and business growth? Key sustainability initiatives of the company?

All growth in future has to be within the sustainability agenda. Use of bio-based raw materials wherever possible, production of water-based products, development of solvent-free products, obtaining green certificates for products, decreasing use of plastics for packaging are some of the agendas which we follow. In terms of the environment, we undertake various initiatives in our operations for saving resources such as water, power, paper, wastage, etc. Our newer facilities will have green energy as a source of power. We are audited and certified for sustainability under various regulations such as ISO 9001, ISO 14001, ISO 45002, URSA, TFS (Together for Sustainability), and Ecovadis. Our life sciences pharma lab will also be GMP certified. Overall, we are committed to the preservation of the environment for the conservation of natural resources for the future generations.

When is Soujanya Color planning to achieve Net Carbon Zero and milestones set up by the company?

We will be defining these goals and taking up the agendas over the next two years. ■

INVESTING RS. 600 CRORE ON EXPANSION IN FY23 AND FY24

We are expanding ATBS capacity from 40,000 MT to 60,000 MT at our Lote facility

VINATI SARAF MUTREJA
MANAGING DIRECTOR & CEO
VINATI ORGANICS LTD.

What are the global trends in the Organic Chemicals and Specialty Chemicals sector in 2023?

There is a shift seen towards production of high-value chemicals and it is driven by an increasing demand for these chemicals in high-growth industries such as electronics, aerospace etc. Global companies have started adopting a China+1 policy to diversify supply risk which in turn has improved the opportunities for Indian manufacturers.

Vinati Organics is the world's largest manufacturer of IBB and ATBS. What's the next set of products you are looking for global dominance?

We have focused on manufacturing IB derivatives; we have added products like PTBT, PTBBA/PTBMB and commissioned Butyl Phenols plant consisting of PTBP, OTBP, 2,4 DTBP and 2,6 DTBP. We are the only manufacturers of these products in India. We have also stepped into manufacturing antioxidants for plastic additives. Butyl Phenols is one of the key raw materials for making these antioxidants. This will extend the integrated and synergic advantage that the company holds through its product profile.

Are you planning to expand manufacturing facilities in Mahad and Lote? Please talk about your expansion plans?

We are expanding our ATBS capacity from 40,000 MT to 60,000 MT at our Lote facility.

What is your Capex plan for FY 2023-24? Areas where you are planning to invest?

The company is having Capex plans of Rs. 600 crores which is spread across FY23 and FY24. This is being spent on expansion of existing capacity of ATBS and towards introduction of new products which will be used in polymerization inhibitors, flavours, fragrances, pharmaceuticals, and pesticides.

How is the company striking a balance between environment-friendly policies and sustainable growth? Would you talk about Green Practices and HSE Initiatives?

We continuously focus on reducing our environment footprint. In line with the company's Environment, Social and Governance (ESG) initiatives, the company has commissioned solar power plant and intends to meet almost 50% of our power requirement through renewable energy

When are you planning to achieve Net Carbon Zero? How are you planning to achieve it?

We drive our operations towards achieving our sustainability goals, with continuous monitoring round the year to measure our performance. The commissioning of the solar power plant is a step towards it.

What are the key CSR initiatives being undertaken by the company in FY 2022-23?

Our CSR initiatives are focused to achieve many of the Sustainable Development Goals like good health and well-being, quality education, gender equality, clean water and sanitation, sustainable cities and communities, etc. ■

We have added products like PTBT, PTBBA/PTBMB and commissioned Butyl Phenols plant consisting of PTBP, OTBP, 2,4 DTBP and 2,6 DTBP

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ERNEST SOLVAY, "FROM SCIENCE WE WILL DERIVE THE PROGRESS OF MANKIND"

Solvay's Research & Innovation Centre, Vadodara is a site with worldwide impact in areas of organic & polymer sciences. It is now significantly focusing on renewable materials and sustainable chemistry via various ongoing projects. Special attention is being paid to digitization for increasing efficiency of set-up & processes

BIJAL MATHKAR
R&I DIRECTOR
SOLVAY RESEARCH AND INNOVATION CENTER INDIA

In 2023, Solvay is celebrating 160 years of its existence. Please list some of the key achievements, which have helped Solvay make a difference in the world of chemicals?

A young Belgian named Ernest Solvay made a technological breakthrough, creating a more environmentally friendly ammonia-soda ash process, which changed the way glass was made. This allowed many industrial revolutions to happen. With this innovation, Ernest set up a company called Solvay, which was created with science, ingenuity, and globalization. This magical combination has had a positive role in the progress of humanity. That was 1863. Today, we are the 7th generation of builders of this extraordinary human adventure. We received this heritage as a gift, with the duty to build on our legacy and to pass it on to generations to come.

Ernest believed that science would derive the progress of humanity. He brought the brightest scientific minds together and these meetings laid the foundation of quantum physics. The Solvay conferences laid the foundation for future quantum physics. In addition, the Solvay Institutes further advanced research in Psychology and Social Sciences. He believed in social caring and put a strong emphasis on the well-being of employees.

The company survived two world wars, the Great Depression, and the financial crisis. The company has been at the heart of four industrial revolutions and emerged stronger from the Covid pandemic in a multipolar world, continuing to demonstrate more than ever that we are essential.

In the 19th century, Solvay enabled populations to access light, hygiene, and cleanliness. Later, the company explored opportunities in life sciences, solving health problems for humans and animals. The company multiplied solutions for a cleaner mobility, safer air, drinkable water, smart connectivity, and beauty. More recently, the company enabled solar impulse to tour the world without a single drop of fuel. These are examples of how our chemistry is part of the solution to save our planet for generations to come.

Our chemistry is the cornerstone of a sustainable future: it enables EV batteries, green hydrogen, circular materials, and bio-based solutions. Over the past four years, the company continues caring through The Solvay Solidarity Fund, which donated more than 9 million euros to employees,

Solvay R&I has reputation & connections with academia and going forward is planning to leverage it for a better future via open innovation in domains of sustainable growth

families, and communities facing hardship. The company continues raising the bar and delivering on its growth strategy. We are proud of our Solvay One Planet achievements and we continue driving the Solvay One Dignity towards more inclusion, equity at the service of diversity.

As a global leader in materials, chemicals, and solutions, Solvay brings advancements in planes, cars, batteries, smart and medical devices, and water and air treatment, to solve critical industrial, social and environmental challenges. How is Solvay contributing to the innovative solutions thereby helping a safer, cleaner, and sustainable future?

At Solvay, we believe that solutions to major humanity challenges will be led by scientific breakthroughs, while taking care of our legacies. Today, we put our expertise at the service of some of the most pressing issues of our planet. Through Solvay One Planet, we focus on areas where our innovation and sustainable solutions can have the biggest positive impact, directly and indirectly, in line with the ambition and requirements of the UN Sustainable development goals (SDGs).

Underpinned by our Purpose and G.R.O.W. strategy, our sustainability agenda will be brought to life by a set of clearly defined programs and actions, around measured ten key goals and enabled through a set of concrete actions and projects.

The journey is long, but our commitment remains stronger than ever. Like all industries, we are part of the problem, but we can also be part of the solution, by putting our activities at the service of sustainability and circularity. In fact, despite the major disruptions caused by Covid-19, we increased our ambitions in 2020, raising the bar in terms of our climate and resources objectives, while continuing to promote a better life for all Solvay employees.

All these actions are the consequence of the reinforcement of our Solvay One Planet goals. By 2030, we will work to fight climate change by phasing out coal-based energy and cutting greenhouse gas emissions by 26%; we will reduce resource consumption by generating 65% of our revenue from sustainable solutions and more than doubling our circular sales; lastly, we will continue to improve quality of life by aiming for zero accidents and accelerating inclusion and diversity in our workforce.

Additionally, Solvay is hard at work building a circular ecosystem, reaching out to our partners all along the value chain in order to use more waste as a raw material, boost recycling, and promote the switch to biomass energy.

Some of the key achievements of RIC Vadodara center in FY 2022-23?

R&I center Vadodara was inaugurated in 2012 and recently completed 10 years in India. In the past decade, the center has been recognized for its high standards of safety culture by both Solvay and external agencies. Recently, the center received the British Safety Council Award distinctions for its safety performance. “Safety KPIs are important to us. Yet what is utmost rewarding is our employees go home safe & unhurt back to their families at the end of each working day” says Ankit Thakar, Site HSE manager. Ankit recently received ‘Passion for Performance’ award from the CEO’s office as a part of global recognition program in Solvay.

In the past three years, we have invested significantly in infrastructure & people, which strengthens the center’s position as a worldwide research & innovation hub. The R&I focus is increasing in the field of sustainable chemistry & digital ways of working.

In addition to that we focus on science that creates value in society e.g.: major contribution in development of products in the field of medical dialysis membranes, medical implants, automotive & light weighting, home & personal care markets, agricultural markets, etc.

"I am a new member to the Solvay Family, joined only last year. I feel proud to work for Solvay as part of the HPC lab. It offers challenging and exciting opportunity to work on futuristic & innovative global home & personal care solutions, which are caring not just for people but also for the planet. Solvay's unique work culture focused on employee well-being and innovation leadership along with safety-first attitude sets it class apart in the industry. The well-equipped formulation research labs are supported with best in class in-house analytical facilities to expedite the innovation process. Solvay's sprawling Research & innovation center at Vadodara with world class research infrastructure and highly diverse talent pool with experienced scientists from Indian and Global prestigious institutions offers one of the best environment to cross fertilize ideas and bring path breaking innovations to life." quotes Vishal

Javia, Technical Leader (Formulations) Home & Personal Care market.

We also provide technical support to local manufacturing plants, support development of the Indian market by creating products adapted to this market.

To enhance Solvay's R&I innovation ecosystem, the company is joining hands with academia and partners in India. How are you leveraging this initiative in India?

Solvay R&I has reputation & connections with academia and going forward is planning to leverage it for a better future via open innovation in domains of sustainable growth. Taking the cue from DST's focus on increased collaboration between industry and academia, we have been in touch with many institutions in the field of Chemistry, Chemical Engineering, and Data Sciences etc. for opportunities of co-creation. We are involved in different activities like: Internships, CSR, PhD sponsorship, assignment based projects, teaching/talks on industrial safety, chemistry curriculum, and talks & interactions by eminent professors from academia; and more.

How is RIC Vadodara Centre planning to leverage more than €10 bn growth opportunity in Battery Materials; Thermoplastic Composites; Green Hydrogen; and Renewable Materials and technology?

R&I Vadodara Centre is matching the pace of growth with Solvay. Work is going on in some areas of battery materials supporting clean mobility. The center is significantly focusing on renewable materials and sustainable chemistry via various ongoing projects.

Are you planning to ramp up work force in RIC Vadodara Centre? If yes, areas where you are planning to recruit and number of people you want to recruit in the next two years?

R&I Vadodara is focused on areas of organic chemistry, polymers, and material sciences. We do have plans to ramp up our work force over the next few years. We do not hire in bulk but it is as per project requirements. We are open to profiles with background in above segments with sustainability and innovation mindset.

Solvay is a materials company with very high standards in safety and ethics. The company takes care of its employees by providing a safe & employee friendly work environment. R&I center is recognized with the employee's families & local community as a great place to work. In 2021, Solvay received an award from the Economics Times as Best Place to Work for Women owing to our DE&I policies.

When is Solvay planning to achieve Net Carbon Zero and steps taken by RIC Vadodara Centre?

Solvay is planning to achieve Net Carbon Zero by 2050 (except for its Soda ash business). Solar plant at the RIC Vadodara Centre provides upto 25% of total site energy. Going forward, we are moving towards zero waste and moving away from single use materials. R&I projects have sustainability scores as a part of the approval process. In addition to that, we are working in-line with Solvay's One Planet Goals (published) for sustainable growth. ■

TO INVEST RS. 3,000 CRORE IN NEW CHEMICAL VALUE CHAINS BY FY25

With the growing trend of China+1 and Europe+1 in the chemical industry, we believe that India is well positioned to attract long-term partnerships from global chemical firms

RAJENDRA V. GOGRI
CHAIRMAN AND MANAGING DIRECTOR
AARTI INDUSTRIES LTD.

Key milestones achieved by Aarti Industries during FY 2022-23?

In 2022, Aarti Industries Limited (AIL) sharpened its focus on building a company that is increasingly agile, resilient, and future-ready. The company reached new heights and set aims for bigger milestones in the journey of becoming a world class company.

Major milestones achieved during FY 2022-23 are: Catering to the third long-term contract, the company commercialized a new manufacturing unit at Jhagadia. The company anticipates plant expansion and production ramp-up in a phased manner as per the contract terms in the coming quarters. The company secured a binding 20-year term sheet with Deepak Fertilizers worth more than Rs. 8,000 crores, assuring a consistent and sufficient supply of Nitric acid, a crucial raw material used in manufacturing processes. This partnership will begin on April 1, 2023 and will eliminate the need for investment in concentrated Nitric acid backward integration. The company also demerged its Pharma division into a separate listed company called Aarti Pharmalabs Limited, enabling both companies to concentrate on their respective businesses and growth opportunities independently.

Capex investment in FY 2022-23 and plans for FY 2023-24. Projects where you are investing?

In FY23, we invested Rs. 1,200-1,300 crores in new projects, scaleup activities, asset restoration, debottlenecking, site development, setting up pilot plants and sustainability initiatives. In FY24 and FY25, we plan to invest a total of Rs. 3,000 crores in new chemical value chains and high-potential products to increase the addressable market size and meet the growing demand of key customers. Our upcoming Capex projects include NCB (Nitro Chloro Benzene) capacity expansion and downstream product plants that are expected to start contributing from H1 FY24.

We have started the initial work around expanding the Ethylation capacity at Dahej SEZ by 3x with an investment of Rs. 200 crores. Further, with our NT capacities reaching over 90% utilisations, we have commenced the work related to debottlenecking of Nitro Toluene capacities

Update on commencement of capacity expansion for NCB manufacturing facility at Vapi; Expansion cum asset upgradation for Acid Unit at Vapi; Expansion of Ethylation and NT capacities; and expansion, asset restoration, and sustainability Initiatives planned by the company?

Brownfield expansion of the NCB facility at Vapi and a few other Speciality Chemical blocks have been progressing well. These will become operational over

the next couple of quarters and start contributing from H2 FY24. We have started the initial work around expanding the Ethylation capacity at Dahej SEZ by 3x with an investment of Rs. 200 crores. Further, with our NT capacities reaching over 90% utilisations, we have commenced the work related to debottlenecking of Nitro Toluene capacities. We target the capacity increase by about 50% with an objective to cater to certain high-growth applications in agrochemicals. We expect both these units to commercialize in H1 FY25.

Update on site development work initiated on 100+ acre land at Jhagadia (Zone IV) and when are you planning to commercialize it? Products to be manufactured?

The project development work at Zone IV is progressing well, with the pilot plant currently under development. We have received environmental clearance and the facility will manufacture more than 40 products related to the Chlorotoluene value chain which will be commercialized in three phases.

Work for Phase - 1 has already begun. The project is expected to be commercialized from H2 FY25 and is likely to contribute significantly to the growth of the company. The project will provide a wide range of locally produced chemicals that are currently imported by the Pharmaceutical and Agrochemical industries. Around 50% of the products will be targeted for the export market. The introduction of new products will extend our value chain advantages further downstream. This will strengthen our relationship with existing customers and create new customer relationships. Additionally, the project will also enhance our chemistry and technology capabilities into newer areas that can be leveraged in the future to further expand product offerings.

The company is looking at growth through five pronged strategies - Introducing Chlorotoluenes Value Chain; Setting up Multipurpose Plants (MPP); Newer range of Value Added Products & Other Speciality Chemicals; Manufacturing Outsourcing/Strategic Alliances; and Custom Manufacturing Opportunities. How will these strategies transform AIL?

Earlier in our legacy Benzene value chains, we adopted a sequential approach of adding new products incrementally based on demand from existing or new customers. This meant making incremental investments in upstream and downstream capacities as and when needed. However, for the Chlorotoluene value chain, our strategy is a bit different wherein we have looked at the value chain holistically and planned product capacities in sync across the value chain. This will enable us to be Capex-efficient and facilitate faster ramp-up of capacities once commercialized.

The upcoming multipurpose plant will enable Aarti Industries to enter into higher value-added products that will build on its traditional value chain-centric approach. It would also enable faster commercialization of new products and reduce time-to-market (product inquiry/conception to commissioning). Over the past five years, we have achieved considerable success with our manufacturing outsourcing and long-term contracts that not only provide stable business to the company but also introduce our team to new technologies and global best practices. With the growing trend of China+1 and Europe+1 in the chemical industry, we believe that India is well positioned to attract long-term partnerships from global chemical firms. This will enable us to expand our business and capabilities further while also contributing to the growth of the chemical industry in India.

Initiatives for enhancing process safety across all processes? How are you collaborating with business partners to imbibe ESG practices?

In order to enhance process safety and ensure zero deviation for sustainable growth, we have taken several initiatives. We have established a dedicated Process Safety team at our corporate and manufacturing locations, and have also set up a world-class infrastructure and research facility - Aarti Research and Technology Center. We have strengthened the Hazards &

> We have received environmental clearance for Jhagadia and the facility will manufacture more than 40 products related to the Chlorotoluene value chain which will be commercialized in three phases

Operability study procedure by introducing different guidewords, and implementing applicable learning from external process safety incidents. Our process safety audits are conducted with external subject matter experts, and we have also introduced the concept of TACIT Knowledge sharing activities for learning and development.

Furthermore, we monitor daily process deviations, interlock bypass, and CAL mode on a daily basis, and have enhanced our Chlorine Handling System across AIL with the help of a Chlorine subject matter expert. We have a robust Hazard Identification and Risk Assessment procedure (HIRA) in place, which is done for each individual activity/step involved in Standard Operating Procedures (SOPs). Additionally, we conduct process safety studies for existing and new projects, including Thermal Safety Studies (DSC, TSu, RC1e) for all new and existing processes, and Powder Safety studies (MIE, MIT, LIT, Powder Resistivity, etc.) for all new and existing powder handling operations. We also validate process parameters at the pilot and commercial level, and conduct Criticality Class Study, SIL Study, QRA, and HAC study for all commercial plants.

We are committed to enhancing our sustainability performance in supply chain by engaging with suppliers on ESG practices. We have prepared a strategy for sustainable supply chain management, in which we screen all existing and potential suppliers on sustainability criteria to identify risk and ensure a sustainable supply chain. We also collaborate closely with our identified high-risk business partners to build their capabilities, strive to imbibe ESG practices in their operations, and encourage them to adopt best practices that align with our sustainability goals. We believe that by working together, we can create a sustainable ecosystem that benefits all stakeholders.

Sustainability roadmap of Aarti Industries and when are you planning to become Net Carbon Zero? Sustainability plans for FY 2023-24?

Aarti Industries is committed to sustainability and has signed the Science Based Target initiative (SBTi) commitment. We plan to set targets at the earliest in order to become a Net Carbon Zero company. We have identified a number of initiatives to reduce our energy consumption, including energy efficiency improvement projects and energy loss reduction. In addition, we have invested Rs. 18 crores to source 147 MW/day of renewable energy which is a significant step towards reducing our carbon footprint.

Furthermore, we aim to reduce our carbon footprint by replacing conventional fossil fuels with biomass. Moving ahead in FY 2023-24, we have set our sights on various additional sustainability initiatives, including exploring new technologies for clean energy and continuing to invest in renewable energy sources. We also plan to improve our energy efficiency and reduce energy consumption to become an environmentally responsible company. Through our investments in renewable energy sources and exploration of new technologies, we are well-positioned to achieve sustainability goals in the coming years.

CSR initiatives being undertaken by Aarti Industries in FY 2022-23 and plans for FY 2023-24?

At AIL, we continue to seek avenues to foster and support the aspirations of communities with a firm belief of touching and transforming lives of people around us. True to our belief that CSR projects must be robust and impactful to bring about transformational changes in the lives of our stakeholders, we collaborate with our trusted partners having strong grassroot presence for executing our CSR interventions. All our community actions are carried out through Aarti Foundation.

We do this by focusing on the themes of healthcare, education, and environmental protection. Towards education and skill development, we associated with Shri KVO Jain Mahajan for a project. This project aims to provide interest-free loans, scholarships for higher education and medical aid to the underprivileged.

In our endeavor towards upliftment of underprivileged clusters and communities, we have joined hands with Bhansali Trust and took up the Musher Integrated Development Project in Fatehpur, Gaya. This project focuses on education, health and hygiene, microcredit, and nutrition for the villagers. We also contributed to the reconstruction of the school building of Sheth M. P. Rashtriya Shala Trust in Mumbai to promote education. Additionally, we have assisted Matruvandana for the Navneet-Chandravallabh Mahila Arts College to aid needy girl students in completing their graduation and senior citizens in receiving better medical welfare, food, and milk.

In FY 2023-24, we plan to continue supporting our current projects. We also aim to strengthen our efforts towards sustainable development. Moreover, we have planned to initiate new projects that align with the United Nations' Sustainable Development Goals (SDGs) and make a positive impact on our society. With a commitment to creating long term value for all our stakeholders, we will continue to strive towards achieving CSR goals and positively impact society.

Other achievements in FY 2022-23?

As a testimony of our commitment towards sustainability, we received following recognition and certifications: Permission to use Responsible Care Logo for a period of 3 years from April 2022 - March 2025; Gold medal in EcoVadis CSR Assessment 2022; Best Environment Friendly Company of the Year at FICCI Chemicals and Petrochemicals Award 2022; Most Innovative Environmental Project Award at the CII National Award for Environmental Best Practices 2022; Platinum Title of 12th Exceed Environment Award 2022 in the category: Environment Preservation; “B” Rating in CDP Climate Change disclosure; “A-” Rating in CDP Supplier Engagement disclosure; For our futuristic approach and readiness to thrive in the age of uncertainty, we were recognized as the Economic Times Future Ready Organisation 2022 in the ‘Large Category’; and we became the only Indian company to win the Best Supplier Relationship Management Initiative Award during the prestigious CIPS Asia Excellence in Procurement Awards 2022. ■

PLANNING TO LAUNCH 6-8 NEW MOLECULES IN LIFE SCIENCE AND OTHER SPECIALTY SEGMENTS

Anupam Rasayan India's Capex is going on as per plan. In the last nine months, the company has invested over Rs. 100 crore in various Capex projects, including brownfield expansions, R&D facilities, and solar projects. For the next year, we would be deploying Rs. 300-350 crores

ANAND DESAI
MANAGING DIRECTOR
ANUPAM RASAYAN INDIA LTD.

For the next year, we would be deploying Rs. 300-350 crores In FY24, we are also 2023 global trends in agrochemicals, personal care, pharmaceuticals, pigments, specialty dyes, and polymer additives?

In 2023, the chemical industry is in a strong financial position. The growth of all the segments that we cater to is driven by increasing demand for certain specialized chemicals. The growth of agrochemicals is attributed to the increasing demand for crop protection products in the field of agriculture across the globe. Similarly, personal care is focused on innovative active ingredients and natural and organic products. Increasing demand for advanced drugs and demand for active pharmaceutical chemicals are major growth drivers of the pharma market. Pigments, specialty dyes, and polymer additives are witnessing demand from across allied sectors like aerospace, defence, aviation, textiles, and paints & coatings across the globe. Overall, the global trends in chemicals will be positive and sustainable.

We have around 90 products that are under the pipeline at the R&D and pilot plant, we are planning to commercialise 6-8 new molecules every year

2023 global trends in custom synthesis manufacturing in India?

One of the major trends in custom synthesis manufacturing in India is the increasing focus on innovation. As customers become more demanding and competition intensifies, manufacturers are investing in research and development to create new and improved products. This trend is driving the adoption of advanced technologies, such as flow chemistry and photochemistry, to accelerate the development process and enhance safety standards.

Another trend in custom synthesis manufacturing in India is the growing emphasis on sustainability. With an increasing number of customers demanding eco-friendly products, manufacturers are adopting sustainable practices and materials to meet this demand. This includes the use of renewable energy sources, such as solar power, and the development of biodegradable materials that reduce environmental impact.

In addition to these trends, there is also a growing demand for flexibility in custom

synthesis manufacturing. Customers are looking for manufacturers that can provide customized solutions that meet their specific needs and requirements.

Overall, the global trends in custom synthesis manufacturing in India reflect a growing focus on innovation, sustainability, and flexibility. As the industry continues to evolve, we can expect to see continued investment in research and development, as well as the adoption of advanced technologies and sustainable practices. Manufacturers that can provide customized solutions and flexible manufacturing processes will be best positioned to succeed in this dynamic and competitive market.

How has Anupam Rasayan performed during FY2022-23? Plans for FY 2023-24 for Life Sciences related Specialty Chemicals and other Specialty Chemicals?

Despite macro challenges and shut down of one of the units we have still delivered a good set of numbers till 9M FY2023. We have a strong product pipeline to be launched in coming quarters and we remain focused on strengthening our business development team. Going forward, our revenue growth will be driven by ramping up current products to new/existing clients and through higher wallet share through new product launches. In FY24, we are also planning to launch 6-8 new molecules in life science and other specialty segments.

Revenue mix is 62:38 with respect to outside India and within India. Do you see any change in FY 2024-25?

We expect export revenue to increase as we are signing a lot of new contracts with global MNCs, and recently we have also signed two new contracts with Japanese MNCs. So, we expect this ratio to be 70:30 going forward with majority revenue coming from Japan, Europe, and North America.

Have you completed the integration of Tanfac? How do you plan to leverage Tanfac with existing and future expansion plans in 2023?

Integration of verticals like Finance, HR, and IT has been completed. Tanfac acquisition would certainly continue to play a key role in providing uninterrupted access to raw material required for fluorination like HF and KF. This would support future expansion of product series under fluorination, will bring down dependency on overall import and also will create a sustainable supply chain.

The company has a strong order pipeline in FY 2022-23. What is the order pipeline till date and how do you plan to move with respect to its execution in FY 2023-24?

Yes, we have signed contracts and LoI (Letter of Intent) worth Rs. 2,620 crore in FY22. We have also signed two contracts with one of the leading European crop protection companies for supplying two niche life science-related specialty chemicals in Q3 FY23. Recently, we announced signing a letter of Intent worth revenue of US $120 million (Rs. 984 crores) for the next 6 years with one of the leading Japanese chemical companies.

We are starting to see the trend of India being chosen as the preferred manufacturing base for strategic chemical products. We plan to add a few more niche products in Anupam's product portfolio in the near term as part of Europe plus one strategy that will help us to add more clients from Europe, America, and Japan.

The company has deployed Flow Process technology but is now embracing technologies like Photo and Vapor Phase. How will this technology help the company?

The adoption of new technologies is always an exciting opportunity for companies like ours to enhance our operations and drive innovation. In this case, the deployment of Photo and Vapor Phase technologies is expected to bring numerous benefits to us. One of the primary advantages of Photo and Vapor Phase technologies is their ability to increase efficiency in the manufacturing process of the specialty chemicals we provide. These technologies allow for more precise and controlled reactions, reducing the amount of time and resources needed to produce the desired outcome of these chemicals. This can result in cost savings for the company and increased productivity.

In addition to improved efficiency, these technologies can also enhance product quality. The precise control offered by these technologies can lead to more consistent and reliable results, ensuring that the final product meets or exceeds customer expectations. This can result in increased customer satisfaction and loyalty.

Another benefit of these technologies in our segment is their environmental friendliness. These technologies typically use less energy and generate less waste than traditional manufacturing processes, resulting in a smaller carbon

footprint. This can help the company to meet sustainability goals and appeal to environmentally-conscious consumers. The adoption of new technologies can also improve a company's competitiveness in the market.

Capex invested in FY 2022-23 and projects where investment was made? Capex plans for FY 2023-24? Focus on the new plants which are coming up in Jhagadia and Sachin?

Our Capex is going on as per plan. In the last nine months, we have invested over Rs. 100 crore in various Capex projects, including brownfield expansions, R&D facilities, and solar projects. We expect this brownfield expansion project of Rs. 670 crores to be completed as per the planned schedule and this would provide enough capacity for growth in the next three to four years. For the next year, we would be deploying Rs. 300-350 crores.

On the R&D front, the company is focusing on green manufacturing and green growth. Likely impact of innovation on Anupam Rasayan in short term and long term?

We have adopted a holistic approach to sustainability that encompasses every aspect of its operations, including our research and development (R&D) approach. In our R&D approach, we place a strong emphasis on developing sustainable and environmentally friendly chemical processes. We have invested in state-of-the-art technologies that enable us to minimize waste, reduce energy consumption, and lower our carbon footprint.

We have also implemented green chemistry principles in our R&D activities. This approach involves designing chemical processes and products that are safe, efficient, and environmentally friendly. By adopting this approach, our aim is to minimize the use of hazardous chemicals and reduce the generation of toxic waste.

In house R&D located at Sachin Unit 6 has played a key role in expansion of commercialized portfolio. How many products were commercialized in FY 2022-23 and plans for FY 2023-24?

During the first 9 months (9M FY23) of the year, four numbers of products were commercialized and the final product count has reached 50. We have around 90 products that are under the pipeline at the R&D and pilot plant, we are planning to commercialise 6-8 new molecules every year.

OInitiatives for enhancing process safety across all processes to make operation intrinsically safe?

First let's start with manufacturing. This area is mainly focused on reducing process risks. Now, since we aim to reduce the risk of malfunctions, along with our in-house safety standards we also aim to achieve global reputed safety standards.

Our in-house safety standards are quite comprehensive as we conduct various tests at all stages of product development. This means right from the R&D laboratory Level to the Pilot test level, these tests help us collect and evaluate the safety data of a product which is then converted to an SOP for manufacturing prior to the product being taken into the plant for commercial production.

We also follow safety measures in transportation and storage processes too. We follow Chemical Transportation Risk Assessments where the chemical handling and movement guidelines/ procedures are prepared along with emergency management. Additionally, we have also invested in state-of-the-art safety equipment and infrastructure to ensure that its operations are intrinsically safe. We as a company aim to not only provide a safe working environment but also be leaders in the innovation of safety processes.

Sustainability roadmap of Anupam Rasayan and when are you planning to become Net Carbon Zero? What are your sustainability plans?

At Anupam Rasayan, we are aware of the effects of climate change and thus make an arduous effort to promote sustainable operations and reduce our environmental footprint. We have set a target of a 10% absolute reduction in GHG emissions by 2030.

Being in alignment with our corporate philosophy of 'Sustainable Manufacturing and Consistent Growth', we are transparent with our sustainable efforts and roadmap. This indicates our long-term, medium-term and short-term actions and non-financial goals that help increase our company's sustainability through value-driven management.

Waste management systems, investing in renewable energy resources and increasing training hours of employees are some of our goals going ahead. Our roadmap also helps us identify key risks, mitigation strategies, and priority areas. ■

EXPECTS TO SHELL OUT Rs. 350 - 400 CRORE ON CAPEX IN FY2023-24

Our future expansion plans will strongly support our ambition of Rs. 5,000 crore revenue. These future projects can be in the existing product line and even new product line where we will be first in India

MAULIK PATEL
CHAIRMAN & MANAGING DIRECTOR
MEGHMANI FINECHEM LTD.

What are the global trends in the chemical sector in 2023?

The chemicals sector is slowly but surely bouncing back and returning to pre-pandemic levels. With far reaching applications in multiple industries like oil & gas, construction, plumbing, paints, textiles, among others, the chemicals sector is bound to witness growth. In a long term perspective, domestic as well as global demand for chemicals is improving and is expected to grow steadily, however for 2023, we see it a bit subdued due to the global slowdown. Currently, global demand has hit rock bottom but we anticipate it to pick up very soon. India and the Asian region will see higher growth rates owing to increasing population and momentum from China+1 and Europe+1 strategies. Moreover, global players are also eyeing diversification of their supplier base as well. These factors make us deeply optimistic about the chemical sector.

How would you rate the company's financial performance in FY 2022-23? What's the forecast for FY 2023-24?

Our 9-month revenue in FY 2022-23, EBITDA and PAT have surpassed entire FY22 numbers. In 9M FY23, we achieved 55% revenue growth, 60% in EBITDA, and 80% in PAT. For Q3 FY23, we witnessed 18% YoY volume growth as our newly commissioned plant (ECH, CPVC Resin, and additional capacity of Caustic Soda) started contributing marginally. These plants will start optimum volume contribution from Q4 FY23 onwards. So, we are moving in line with our plans despite a volatile market.

In FY24, we expect all our newly commissioned plants to reach at optimum capacity levels, which will boost volume growth for this year. Additionally, as these are high-value products as compared to our previous portfolio, they will drive value growth for coming years as well.

MFL
Your essentials. Our expertise.

We are increasing our CPVC Resin capacity to 75,000 TPA and entering into the Chlorotoluene value chain. Both projects to be commissioned by the end of FY24

The company aspires to reach a revenue of Rs. 5,000 crore by 2027. What is the plan and strategy to achieve this target?

Over the last several years, we have progressed on the basis of volume growth as we continuously expanded. In FY23, we commissioned India's first Epichlorohydrin

plant, India's largest CPVC Resin plant, and also added an additional capacity of Caustic Soda. These will have a major impact on our volumes as well as revenues which in turn accelerate our FY24 growth.

Further, we are increasing our CPVC Resin capacity to 75,000 TPA and entering into the Chlorotoluene value chain. Both projects to be commissioned by the end of FY24. These plants will lay a strong foundation for our business in FY25. To add further, our future expansion plans will strongly support our ambition of Rs. 5,000 crore revenue. These future projects can be in the existing product line and even new product line where we will be first in India and where we can strengthen our integrated complex. The new land we bought in Dahej will help us implement our expansion plans for the coming five to seven years. So, we are all geared for continuous growth.

How has the performance of the company been in different segments - Caustic Soda, Caustic Potash, Chlorine, Hydrogen, Chloromethanes, Hydrogen Peroxide, Epichlorohydrin, and CPVC Resin in FY 2022-23. What's the future roadmap?

We witnessed good growth in the Chlor-Alkali segment (Caustic Soda and Caustic Potash) as the realizations were at an all time high compared to previous years, which resulted in good margins as well. As of now, realization from this segment is cooling off in line with raw material price variations. We commissioned an additional capacity of 1,06,000 TPA Caustic Soda in September 2022 which is expected to reach optimum levels by end of Q4 FY23 and will bring volume growth in FY24.

We also saw around 50% growth in our Derivative and Specialty segment, on account of major volume growth from Hydrogen Peroxide and marginal growth from Chloromethanes. Plus, the new products commissioned, i.e. CPVC Resin and Epichlorohydrin, also started contributing to volume and value growth.

CPVC Resin reached optimum capacity utilization in December itself, hence we are further expanding its capacity to 75 KTPA, by adding another 45 KTPA. We expect FY23 to end with the Derivatives & Specialty segment contributing around 30% of revenue compared to that of 25% in FY22. Contribution from the Derivatives & Specialty segment will keep on increasing as all our future expansion plans are in this segment.

What was the Capex investment in FY 2022-23 and projects/facilities where the company has invested? Plans for the company in FY 2023-24 and how will it help in the long term?

For FY2023, we have planned to spend around Rs. 370 crore in Capex. This is and will be utilised for expansions in Epichlorohydrin, CPVC Resin, Chlorotoluene and value chain, additional capacity of Caustic Soda, R&D, and new land. In FY24, we expect to shell out around Rs. 350 - Rs. 400 crore for Capex which will be spent towards Chlorotoluene and value chain, additional capacity of CPVC Resin, and other projects that we will announce as the board approves them.

This all and future Capex will bring us volume growth in the coming years. Amount spent on R&D will strengthen our position in the Specialty chemical segment while that spent on acquiring land in Dahej will be a step towards removing a bottleneck of land scarcity for our future growth.

MFL has commissioned an additional 106,000 TPA capacity of Caustic Soda. With this move, what is your total capacity currently and which industries/segments will this extra capacity cater to?

Our total capacity stands at 4,00,000 TPA of Caustic Soda and 132 MW of captive power plant. Our additional production will go to the industries which we are currently serving. Apart from these, our newly commissioned Epichlorohydrin plant will consume Caustic Soda, Chlorine and Hydrogen; and the CPVC Resin plant will consume Chlorine. Additional capacity of Caustic Soda expansion was in line with that of the Derivatives and Specialty segment (CPVC Resin and ECH), in terms of Chlorine and Hydrogen consumption. So this will further strengthen our integrated complex.

The company has commissioned India's 1st Epichlorohydrin plant and largest CPVC resin plant in 2022. What is the value additions and revenue expectations?

There are various benefits of entering into the products mentioned earlier. Epichlorohydrin and CPVC Resin will

consume Chlorine, Caustic Soda, and Hydrogen as a part of raw materials; hence, entering into this product will strengthen our integration. Again, Epichlorohydrin and CPVC Resin have good markets and are expected to grow in double-digit percentage in coming years. By entering into this product we will be equipped to cater to new industries unexplored earlier, so we have diversified our customer base and further de-risked our business model. If we consider current market price, then one can expect revenue of approximately Rs. 480 crore in Epichlorohydrin and approximately Rs. 360 crore from CPVC Resin.

Any update on the company's expansion plans into Chlorotoluene and its value chain? Capex planned for the project, capacity and expected timelines?

Our expansion into Chlorotoluene and its value chain is moving as planned and is on schedule and we expect to commission it in Q4 FY24.

Meghmani Finechem Limited (MFL) is also increasing its CPVC resin capacity to 75,000 TPA, by adding another 45,000 TPA. Capacity and expected timeline for completion?

We are coming up with an additional capacity of 45,000 TPA of CPVC Resin. This additional plant will get commissioned in Q4 FY24. Post this, our total capacity in CPVC resin will stand at 75,000 TPA.

MFL plans to set up an R&D facility in Ahmedabad to strengthen its position in Specialty Chemicals? What are key areas of focus for new innovations?

We are entering into the Chlorotoluene and value chain. The Capex that we have announced is Phase I. When we enter further down, the line value chain in Phase II, R&D will play a crucial role. Also, it will be playing a key role for future molecules in our Specialty Chemicals segment.

Level of automation and digitalization projects carried out in FY 2022-23? How do you plan to move ahead on this front both on brownfield and greenfield projects?

At MFL, we firmly believe that investing in technology is a continuous journey. However, all our plants have the latest technology and equipment through which we achieve improved efficiency, and better output with lesser input and wastage. For smooth functioning of plants, we have adopted modern automated technology which enables us to effectively monitor and control through central systems. It proves crucial to take key decisions and prompt actions in trying situations. We also have the latest tools and systems up and working for various departments that help us in analytics that give us an edge over the others.

MFL is foraying into green energy through a JV to set up an 18.34 MW wind-solar hybrid power plant. What is the Capex for this project and when it is expected to get commissioned?

We understand the need and significance of environmental conservation and are proactively working on reducing carbon footprints through efficient manufacturing processes and precautions thereof. We are entering into a JV with ReNew Green Energy Solutions - where we will invest around Rs. 20.5 crore in the form of equity for 26% stake in SPV - to set up an 18.34 MW wind solar hybrid power plant. This plant will equip us to fulfil our energy needs through renewable sources. We expect this project to get fully commissioned in Q1 FY24.

Key ESG projects initiated by the company and how have you fared?

Conserving the environment is always our prime focus while selecting products and technology. We have always used the latest and the best technology to manage critical resources, so as to moderate consumption of energy & water and also generate lesser wastage. This has been our continuous focus. For example, in our Epichlorohydrin plant, we selected Glycerol-based technology, where raw material is from renewable resource and the consumption of energy and water is far lesser as compared to traditional technology, i.e. Propylene-based.

We proactively invest in talent training, safety of employees and the community around the plant. We are focused on strengthening relationships with customers and vendors and serving the community around our plant.

We are focused on maintaining the highest level of governance at Meghmani Finechem. We have a strong board

consisting 50% of Independent Directors with vast experience and qualifications who are active in all our committees. We have regular and stringent internal audits that are reported to an Audit Committee chaired by an Independent director. We are quite focused on ESG and are in constant drive to make it stronger.

When is MFL planning to achieve Net Carbon Zero and what are the milestones set up by the company?

We have taken several steps to reduce carbon footprints and have adopted technologies to reduce usage of limited resources, control inputs while optimizing outputs. We have chosen Glycerol based technology for manufacturing Epichlorohydrin where major raw material Glycerine is from renewable resources and processes consume less water and power. We have entered into 18.34 MW wind solar hybrid power plant to reduce carbon emission and contribution to the environment. We have been able to strike considerable balance between manufacturing processes and

environmental impact. We have set internal targets and persistently work hard to achieve them.

CSR projects undertaken in FY 2022-23 in health, education, and sports? Plans for FY 2023-24?

We believe in inclusive growth and have taken up various initiatives to improve health, education and women empowerment in all these years. We provided education to marginalized sections through Sardardham, Margraksh and Achala Foundation Trusts. We provided shelter to 300 working marginalized women in Ahmedabad, Rajkot and Vadodara. We also addressed nutrition needs of around 500 people every Sunday at their homes and 150 patients in their hospital beds through Margraksh program. Similarly, we have contributed in many ways for skill development, educational assistance and medical assistance through various programs. We have been active to support the society in all possible ways and we will continue doing so in the future. ■

PHENOL ACETONE PLANT ACHIEVES MILESTONE OF 1 MMT PRODUCTION

A key growth driver will also be our state-of-the-art Research and Technology Centre which will combine its laboratories with world class scale up facilities that will double up as operations excellence initiatives

MAULIK MEHTA
CEO & EXECUTIVE DIRECTOR
DEEPAK NITRITE LTD.

Major global trends in the chemicals sector and its implications on India?

India's chemicals industry has been a global outperformer in demand growth and shareholder wealth creation for a decade. Its strong starting point could make it the next chemicals manufacturing hub. India's infrastructure costs, across construction, material, and machinery, are up to 70% lower than other global chemicals manufacturing hubs. India's material costs are 4.5 times lower versus Germany and 3 times lower versus Saudi Arabia.

Rising Domestic Consumption India is expected to account for more than 20% of incremental global consumption of chemicals over the next two decades. Domestic demand is expected to rise from US $170 billion to US $180 billion in 2021 to US $850 billion to US $1,000 billion by 2040. The growing demand for bio-friendly products globally could benefit India, as it is among the leading producers of many chemicals that are used in such products.

Abundant availability in petrochemicals India possesses abundant feedstock for higher carbon building blocks (C4, C6, and C8). Consequently, its combined surplus production of butadiene (C4) and benzene (C6). Allied companies are better suited to focus on products where feedstock is easily available in the merchant market.

Challenges The Russia-Ukraine crisis continues to disrupt the global oil and essential chemicals availability. Hence, there is sustained volatility and fluctuation in crude and countries around the world have to evaluate new sourcing trades and patterns. While it has world class refining capacities, India remains unusually vulnerable due to its outsized dependence on crude oil imports.

With an eye on meeting the climate control and G20 challenges, the environmental regularity keeps eco-conscious responsible chemistry companies like Deepak Group to ensure our operations have no adverse impact on the environment. Global economies are unstable with Europe, China, and the US grappling with inflation and the consequent fluctuations in exchange rates challenge us to conduct smart hedging and fiscal management.

This is a double-edged knife. While the western world has been seeking an option to de-risk from its dependency on China, India's appetite for Chinese imports has been increasing every year including the last. In fact, one of the largest foreign account surpluses that China has

While the western world has been seeking an option to de-risk from its dependency on China, India's appetite for Chinese imports has been increasing every year including the last

is with India. Reducing dependency on China requires long term planning and infrastructure buildouts which must include material movement and storage to minimize the value leakage between production and consumption.

Key milestones achieved by Deepak Group during FY 2022-23? Plans for FY 2023-24 and what are the growth drivers?

Deepak Group's Phenol Acetone plant, the largest private investment in PCPIR region at Dahej, Gujarat achieved a milestone of 1 Million Metric Ton Phenol production in 4.5 years.

Our debottlenecking exercises at our plants of DNL in Dahej, Roha, TCD, Hyderabad and Nandesari Unit enabled us to expand the existing capacity.

Many new projects were also initiated to significantly expand Deepak's market share in existing product portfolios, upstream integration as well as new process platforms. FY24 will see some of these projects get commissioned with order books tied up in advance.

A key growth driver will also be our state-of-the-art Research and Technology Centre which will combine its laboratories with world class scale up facilities that will double up as operations excellence initiatives.

Initiatives for enhancing process safety across all processes to make operation intrinsically safe. How are you collaborating with business partners to imbibe ESG practices in their operations to ensure a sustainable supply chain?

Deepak Group is working with key customers and third-party support to prioritize Scope 1 and Scope 2 initiatives for improvement in the carbon and water footprint at all its existing and forthcoming plants. These include yield improvement, multi fuel boilers, more efficient separation methods which use less energy and processes that improve atom efficiency. These will help catapult the company's holistic ratings for ESG.

Major CSR initiatives being undertaken by Deepak Group in FY2022-23 and plans for FY 2023-24?

Deepak Foundation, the CSR extension of Deepak Group, conducts a number of programmes focussed on education, healthcare, skill-development among women and infrastructure support, for the communities in villages around the plant sites. Deepak Foundation also offers NGO consultancy partnership and support to CSR projects supported by other companies.

Deepak Group is partnering with the Central Government Mission to end TB by 2025. In this regard, we have launched 'Nidaan' mobile health van for sample collection and diagnostic services for TB, Anaemia, x-ray, and eye check-ups for free to communities in villages.

To enable education for all, Deepak Group supports Sankul education centre for visually and physically challenged children at Vadodara. The centre also offers rehabilitation and palliative care to cancer patients.

Vadodara Centre for Prevention of Cruelty to Animal, a hospital and rehabilitation centre for stray animals operates its facilities at Chapad, Vadodara, supported by Deepak Group which is also building new shelter rooms and operative services at the centre and started mobile-animal care clinic to offer rescue and treatment services at doorstep.

Empowering women by infusing entrepreneurial spirit, Deepak Foundation conducts Women empowerment training and handholding services like organic soaps and edible condiments manufacturing and sale. Aimed to support, sustain and revive the indigenous craft of 'Sujni', Deepak Foundation partners to support artisans and handicrafts at a centre in Bharuch. ■

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EXPLORING EXPANSIONS TO FURTHER INCREASE MARGINS AND ROCE IN FY 2023-24

Vishnu Chemicals spent approximately Rs. 100 crore towards growth Capex on a consolidated basis to expand its Chromium chemicals capacity by 10,000 tonnes per annum and a brownfield expansion to introduce a niche speciality chemical in Barium Chemicals

CH. KRISHNA MURTHY
CHAIRMAN & MANAGING DIRECTOR
VISHNU CHEMICALS LTD.

2023 global trends in Chromium and Barium chemicals portfolio?

The extent to which Chromium and Barium chemicals are used in the production of everyday items is astonishing. Our products are a critical ingredient across the pharmaceuticals, consumers, and industrial sector. From acting as strong oxidants in pharmaceuticals to creating a shining and reflective surface in tiles and ceramics or the silver finish on faucets, towel holders, hardware – door knobs or handles, Chromium chemicals add to the aesthetic appeal of any vehicle that gives a good feel be it the shining logo, stylish front grills, premium leather seats or sturdy engines and pistons or be it colours, that don't fade away.

Chromium chemicals find their way in the production of super alloys by the world's most complex manufacturing powerhouses, which allows jet engines to operate in high-temperature, high-stress, and chemically oxidising environments. In addition, it is further used in aircraft to protect seal components against galling, corrosion, and wear, which is catalysing the growth of the industry.

The demand for Chromium and Barium chemicals is robust as it is a critical input in 12+ applications. Markets across Asia Pacific, Europe, and North America are aided by the growth in the construction and infrastructure industry, which is boosting the demand for Barium chemicals.

How has Vishnu Chemicals performed during FY 2022-23? Plans for Barium and Chromium portfolio in FY 2023-24?

FY 2021-22 was a successful and eventful year at Vishnu Chemicals as we crossed an important milestone of Rs. 1,000 crore in sales. It is even more satisfying that we delivered good growth in both Indian and International markets. Over the years, Vishnu Chemicals has nurtured the chemistry and mastered complex chemical processes by overcoming the gestation period of stabilisation. Deep process knowledge enables the company to track how a reaction unfolds and speed up execution to achieve greater operational excellence.

We feel good about our ability to deliver growth based on our historical

We also like to maintain a 50:50 mix of sales across India and international markets as it gives us access to world's leading markets like Japan, Australia, Spain, New Zealand, USA, and more

performance. Over the years, our product portfolio has expanded and so has our customer base. We are focused on the fundamentals of improving efficiencies and optimum utilization of capacities which should enable us to deliver robust performance. Going forward it will essentially make our initiatives RoI (Return on Investment) accretive and deliver the benefits of finest quality of specialty chemicals to our global customers.

Our unwavering focus on manufacturing has led the company to be one of the most efficient producers in our chemistry. In FY 2022-23, we have entered the prestigious club of companies with more than Rs. 100 crores of profit after tax. With one quarter to go, our 9M FY 2022-23 consolidated PAT is Rs. 101 crores, already 24% higher than previous fiscal FY 2021-22 PAT.

Since FY 2016-17, we have delivered a PAT CAGR of over 50% by meaningful capacity addition and improving our manufacturing processes that combine environmental and economic benefits through comprehensive use of resources and ability to handle complex reaction media. In FY 2023-24, we have bold targets set for production and in both chemistries, we aim to produce the highest volume ever in FY 2023-24.

Revenue mix is 50:50 with respect to outside India and within India. Do you see any change in revenue mix in FY 2024-25?

We are focused on balancing our sales mix geographically to continue mitigating the market risk. We also like to maintain a 50:50 mix of sales across India and international markets as it gives us access to world's leading markets like Japan, Australia, Spain, New Zealand, USA, and more.

Vishnu Chemicals manufactures specialty chemicals and is a dependable supplier for customers across industries like pharmaceutical, sports surface

paints, automobiles, ceramics, tiles, glass, refractory, and wood preservatives. The company's products and processes conform to global standards, which is a testimony of product quality and reliability. We look forward to maintaining the same revenue mix in FY 2024-25.

The company is focused on backward and forward integration initiatives leading to self-sufficiency and improved operating leverage. How will this initiative help in Barium, Chromium, and any new portfolio?

Our key tenet has been to manufacture high performance specialty chemicals that stand the test of time and quality, which instils huge confidence in our global customer base. With manufacturing being the core focus, we constantly study data from customer inquiries to create our production plan. Our forward integration helps us to reinvent and innovate to cater to a new range of applications and consequently, enhance our business prospects. Similarly, our backward integration facility gives us the ability to effectively use co-products and generate raw materials for indigenous consumption. A major step towards sustainability was the commissioning of backward integration at our flagship plant in Visakhapatnam.

Capex invested in FY 2022-23 and projects where investment was made? Capex plans for FY 2023-24?

From a total capacity of 1,10,000 tonnes per annum in FY 2020-21, we will operate at 1,70,000 tonnes per annum in FY2023-24, making us the largest producers in India in our chemistry. In FY 2022-23, we spent approximately Rs. 100 crore towards growth Capex on a consolidated basis to expand our Chromium chemicals capacity by 10,000 tonnes per annum and a brownfield expansion to introduce a niche speciality chemical in Barium Chemicals. In FY 2023-24, we will be open to explore organic and inorganic expansion to further expand our margins and ROCE.

The company is focusing on brownfield expansion to aid Barium portfolio diversification and it is expected to be commissioned in H1 FY24. How will this expansion help Vishnu Chemicals?

The ongoing brownfield expansion

will aid portfolio diversification in our Barium chemistry. We will be the only producers of this chemical in India giving us a first mover advantage to tap existing customers who are currently relying on imports for their material needs. This will help us gain market share in India, Europe, and North America, which is generally a growing market for these products.

Upon commissioning, we will be the largest producers of Barium chemicals in India giving us an opportunity to meet Indian consumption needs while tapping our existing network of international clientele for export sales. From 40,000 tonnes of capacity in Barium chemicals in January 2022, we will operate on an installed capacity of 90,000 tonnes.

On the R&D front, the company is focusing on launching newer grades and compounds for newer applications. Explain?

The company's improvisation strategy is underpinned by a strong commitment to research, development, and innovation. The company has built a world class infrastructure and emerged as 'a company of choice' in the industry owing to constant learning and continuous improvement.

Chromium chemicals are key to manufacturing superalloys required for critical applications in the aerospace, defence, land-based gas turbines to name a few. We are the producers of a range of Chromium chemicals and have pivoted into a variety of grades to meet the requirement of our customers globally. Led by addition of Chromium derivative products into its product portfolio since 2019, Vishu Chemicals average capacity utilization has increased from around 60% in FY16-18 to around 80% since FY19.

There is an ongoing expansion plan to introduce 'Precipitated Barium Sulphate' with a capacity of 30,000 TPA which is expected to be commissioned by H1 FY24. Globally renowned researchers have created the world's whitest paint using Barium chemical. This paint has entered the Guinness Book of World Records for its ability to reflect 98.1% of sunlight. Hence, it cools outdoor surfaces by more than 4.5°C thus cutting down the consumption of electricity and use of energy. Climate change is a real thing today and this innovation is path-breaking as it delivers results to homes and offices in the most cost effective manner.

We are really excited about this development as we ourselves are currently expanding to manufacture the best quality Precipitated Barium Sulphate under our Barium Chemicals portfolio. Our product is an inorganic compound and is a high-purity, synthetic additive that is produced in a carefully controlled manufacturing process. And, it contains almost no impurities, the whiteness is higher than natural Barium Sulphate so it can be used as the filler of pure white powder coating, and the finish glossiness can reach 95 degrees.

> The company is focused on the fundamentals of improving efficiencies and optimum utilization of capacities which should enable the company to deliver robust performance

Initiatives taken by Vishnu Chemicals for enhancing process safety across all facilities to make operation intrinsically safe?

People are at the heart of our business. Their health, safety and well-being have been and continue to be a top priority for us. With safety at the workplace being paramount, health and safety standards are continuously assessed, identified, and uplifted. With an intensive focus on safety, we have achieved a decline in Total Recordable Injury Rate (TRIR). We firmly believe that we can progress only as fast as the successful implementation and acceptance of our safety programmes

and initiatives. Our aim is to build a more mature and sustainable safety culture that will allow us to increase our productivity and operational discipline and facilitate highly competitive organic growth.

Sustainability roadmap of Vishnu Chemicals and key sustainability initiatives?

Sustainability is at the centre of all business processes at our company. The company considers it is essential to protect the Earth and limit natural resources as well as the health and wellbeing of every person especially employees/workers of the company. The company strives to achieve safety, health and environmental excellence in all aspects of its business activities. Acting responsibly with a focus on safety, health, and environment to be part of the company's DNA.

In line with the 'Go Green' philosophy, the company is continuously adopting new techniques to eliminate and minimise environmental impact. Various projects have been implemented by the company to use alternate sources of energy wherever possible.

The company does not just talk about 'Sustainability', it follows in true letter and spirit; sustainability is about how we operate. We strive to promote a circular economy and deliver societal value. Vishnu Chemicals approach is to innovate, collaborate, and educate communities.

The company takes required measures to mitigate impact to various environmental aspects like air quality, water, and noise. The company focuses on conservation of natural resources: minerals, water, and energy. Our philosophy for sustainability stems from individual action and collective responsibility. The company's plants are equipped with modern machinery operated with sustainable practices. Our teams regularly conduct awareness programs and impart training to all employees on sustainability practices.

In 2022, the flagship plant was integrated to capture and recover flue gases and use it as a vital input for its production in a sustainable eco-friendly manner. We are only one of the few companies globally to have this infrastructure.

Major CSR initiatives being undertaken by Vishnu Chemicals in FY2022-23 and plans for FY 2023-24?

We believe society is an inseparable stakeholder in our journey. Our CSR vision is aimed at achieving progress and value creation for all. In furtherance of our efforts to have long term impact on large communities in general, the company spent majority of its CSR funds on an initiative to build old age homes by Krishna Foundation to transform lives of elderly through care and support. The facility provides nutritious food, hygienic and comfortable environment, recreation activities among others. In FY 2023-24, we will continue to spend the CSR towards community service and providing economic independence and shelter to the needy. ■

APCOTEX INVESTS OVER RS. 200 CRORES ON TWO EXPANSION PROJECTS

Apcotex Industries has clocked highest ever annual revenue of almost Rs. 1,100 crore in the last financial year despite several challenges. The company recently invested in additional capacity for all its emulsion polymers and also entered the Nitrile Latex market for gloves

ABHIRAJ CHOKSEY
MANAGING DIRECTOR
APCOTEX INDUSTRIES LTD.

What are the global trends in Synthetic Rubber, Synthetic Latex, and Emulsion Polymers and their implication in India in 2023?

The global synthetic rubber market is expected to grow at a CAGR of 4.3% over the next 5 years. The synthetic rubber market is mainly driven by the tyre segment, the largest end-use segment of synthetic rubber, followed by automotive. Some synthetic rubbers with significant strength are replacing metal parts in vehicles. This reduces the weight of the vehicle and increases fuel efficiency without compromising performance.

The trend of reducing greenhouse gas emissions in vehicles has also increased synthetic rubber demand in the automotive industry. In terms of volume and value, the APAC region is anticipated to experience the highest rise in synthetic rubber use. Indian consumption of synthetic rubber is expected to increase at a CAGR of 6% over the next five years and hence India needs additional capacity in the future.

In addition, Synthetic Rubber demand comes from the manufacturing of footwear, sports goods, and other components. With our specialty grades of rubbers, powders and polyblends, Apcotex is well-positioned to cater to growing demand in India and the region. Similarly, synthetic latexes like SB latex, Styrene Acrylic, Pure Acrylic, Vinyl Acetate, Nitrile Latex, etc. are also expected to grow at a CAGR of 4-5%. The major applications are paper & paper board coating, carpet backing, construction, gloves, textile, paints and adhesives, etc.

In India, growth in demand is expected to be extremely strong at 8-10% due to population growth, consumer trends, and an increase in per capita GDP. Apcotex has one of the broadest ranges of specialty synthetic emulsion polymers and adds new grades and products every year.

We have recently invested in additional capacity for all our current grades of emulsion polymers and also entered the Nitrile Latex market for gloves.

> Indian consumption of synthetic rubber is expected to grow at a CAGR of 6% over the next five years and hence India needs additional capacities in future

Company's financial performance in FY 2022-23 and plans for FY 2023-24? Key achievements in FY 2022-23?

Apcotex had its most successful year

in FY 2022-23 across all its performance metrics. Despite several challenges, we clocked our highest annual revenue of almost Rs. 1,100 crores in the last financial year and a PAT of over Rs. 100cr. This was possible as a result of several debottlenecking and quality improvement projects undertaken over the last couple of years. We have made a concerted effort to diversify our business over the last few years – We supply to a range of industries like paper, paperboard, construction, carpet, textiles, tyre cords, auto components, rice rollers, footwear, etc. but the maximum exposure to any one industry is not more than 20%. Also, while we are primarily an India-focused company, more than 20% of our sales in the past year have been in export markets. We expect to increase the percentage of our export sales over the next few years.

Capex invested in FY2022-23 and plans for FY 2023-24?

Apcotex invested a little over Rs. 200 crores in the last financial year on two expansion projects – the first Nitrile Latex plant in India at Valia, Gujarat and the other for a multi-purpose emulsions plant in Taloja, Maharashtra. This will add 85,000 MT of emulsions or around Rs. 600-700 crores to our top line over the next couple of years as the production/sales start ramping up. FY 2023-24 will be a year of consolidation and we do not expect major Capex projects to be undertaken in FY 2023-24. In addition to that, keeping in mind ESG goals, we have invested in a Zero Liquid Discharge (ZLD) plant at our Valia facility.

Future expansion plan with respect to Nitrile Rubber capacity to cater to both domestic and export markets?

We have almost tripled NBR sales over the last six years from the same plant. Being the only NBR manufacturer in India, our intention is to increase NBR capacity from 21 KT to 36 KT at our Valia, Gujarat plant. We will continue to manufacture high-quality NBR grades for domestic and international markets. All the necessary statutory approvals have been obtained and we are currently working through the detailed design of this project. The final decision on the timing of the investment will be taken over the next few months.

On the export front, Apcotex has a strong global presence in South East Asia, Middle East, and Africa and intends to tap the Asian Markets. What's the strategy for tapping the Asian market?

The Apcotex team has done a fantastic job of growing in markets outside of India. We have learned that our business is quite unique and technical so each new country and customer comes with its own distinctive challenges. We have successfully and consistently delivered on our customers' requirements over the last few years. Our international customers range from small family businesses to large multinational corporations and this has given us the confidence to spread our wings further. Today, we sell successfully in many Asian

Being the only NBR manufacturer in India, our intention is to increase NBR capacity from 21 KT to 36 KT at our Valia, Gujarat plant

countries and the rest of the world. As we expand sales and distribution reach, we plan to penetrate many more markets in the coming years.

Apcotex has developed a strong R&D base which has enabled them to develop, manufacture, export products, and compete effectively against global players. What are the new innovations that Apcotex is working on and how it will help in increasing market share in different product categories?

One of Apcotex's top priorities over the next few years will be to further strengthen our R&D capabilities. An expanded infrastructure, diverse talent, and innovative projects are being initiated to ensure a strong product pipeline. For each industry we cater to, we continue to increase the breadth and depth of the products we offer. Of course, the main push over the next few years will be to move towards more environmentally-friendly products and sustainable processes. Additionally, we will be investing in exploring viable options for green chemistry.

Apcotex is the only manufacturer of NBR, HSR, and Nitrile Latex in India. Are you planning to set up more such exclusive manufacturing facilities in India? If yes, exclusive products that you are planning to manufacture in India?

As mentioned earlier, additional NBR capacity is in the works already. We have the option of further expanding some of our latex emulsion products at marginal investments. There are other adjacencies in specialty emulsions that we are evaluating or developing as we speak. We are also exploring several organic and inorganic opportunities to add to our unique products.

Key sustainability and CSR initiatives planned for FY 2023-24?

Apcotex believes that moving towards environmentally friendly processes and products is imperative. We have recently embarked on our ESG journey and over the next 10 years set short, medium, and long-term targets on several KPIs such as increasing green energy consumption at our plants, reducing hazardous waste, reducing energy consumption/MT, reducing water consumption/MT, planting 5,000 more trees at our plant sites, etc. We will also work with our vendors and customers to reduce GHG emissions across the supply chain. We have always believed in giving back to society even before CSR became the norm. Over the last 3 years, the company has undertaken several strategic projects in healthcare and education. These projects are in the areas surrounding our factories and offices. The company is working with Edelgive Foundation, Mumbai and NGO Utthan to conduct strategic, long-term CSR activities in water and sanitation around its Valia plant in Gujarat.

In Taloja, Maharashtra, the company has been working with Deepak Foundation for the skill development of youths and women in facility management & services. With Catalysts for Social Action, we have adopted three Child Care Institutions (CCI) in Navi Mumbai, Maharashtra under the 'Adopt a Home & Livelihood & Aftercare Support' project. With Seva Sadan Society, Mumbai we have committed to supporting an English Secondary School for underprivileged children. We continue to look for like-minded partners who can help us execute high-impact projects in Maharashtra and Gujarat. ■

ASPIRING FOR A VOLUME GROWTH OF 6-8% IN FY 23-24

The company has invested in expansion of R&D capacity and building a dedicated plant for R&D product incubation to accelerate commercialization

UNNATHAN SHEKHAR
MANAGING DIRECTOR
GALAXY SURFACTANTS LTD.

2023 global trends in Performance Surfactants and Specialty care products?

Globally, we are seeing a shift in consumers' preference towards products that not only deliver functionality but also promote healthy lifestyle and focus on sustainability. Most FMCG companies are focusing on premiumization of their portfolio because of this change in consumer behaviour. For e.g. people are incorporating skincare regimes as part of their daily personal care routines. Similarly, consumers are gradually shifting from laundry bars and powders to premium powders and laundry liquids. This has led to a positive momentum in demand for premium products in many markets across the globe. This shift is expected to change the product mix of performance surfactants while boosting the need for specialty care products in 2023.

How would you rate the company's financial performance in FY 2022-23? Forecast for FY 2023-24?

FY 22-23 has been a year of challenges on the macro-economic and geopolitical front. We had significant demand cutbacks and deteriorating economies. Despite the multifold challenges, we have consistently grown and achieved our FY 22 profit in the first 9 months of FY 23. For FY 23-24, we aspire for a volume growth of 6-8%, EBITDA growth higher than volume growth and PAT growth higher than EBITDA growth.

Performance of the company in different segments - Performance Surfactants and Specialty care in FY 22-23. What's the future roadmap?

While we did face demand cutbacks largely driven by the volatile macro-economic factors for major part of the financial year, with raw material prices stabilizing and most geographies having undertaken the necessary inventory corrections, we expect the degrowth in Performance Surfactants volumes of previous quarters to abate in 4Q FY 23 and begin the new financial year with the same momentum.

Our Specialty care products are largely driven by the export market (Europe, USA, and China). The Russia - Ukraine war and the resulting energy crisis had resulted in an overall slowdown in the European market. In China, the COVID induced lockdowns had an adverse impact on demand while the USA market was still sitting on higher priced inventories. All these factors impacted Specialty care volumes this year. Looking ahead, while we expect inventory corrections in the USA market to be complete by 4Q FY 23, the recovery of Europe and China will lead the way for volume growth of Specialty care products in FY 24.

Capex investment in FY 2022-23 and projects/facilities where the company invested? Capex plans for FY 2023-24 and how will it help the company in the long term?

We do see a growth Capex of Rs. 150-200 crores per year continuing for the next 2-3 years

Our annual Capex is around Rs. 150-200 crores and we have spent close to Rs. 120 crores in the first 9 months of this year. We do see a growth Capex of Rs. 150-200 crores per year continuing for the next 2-3 years. Typically, Capex is a combination of capacity enhancement as well as maintenance. During the year, we completed our additional capacity enhancement at Jhagadia.

Environmental clearances for expansion and additional land available at Jhagadia and Suez plants. What's your expansion plan?

We have the necessary statutory permissions for capacity enhancement at our Jhagadia and Suez plants. Our capacity expansion plans are always ahead of demand growth.

Update on expansion projects for Specialty care products at Jhagadia and Tarapur plants? What is the total installed capacity across and how much additional capacity was added during FY 2022-23?

Our pilot plant at Tarapur for new molecules commenced operations in FY 2022-23. This will help us in seeding the market for new applications in Personal care and Home care. At Jhagadia, we have completed our expansion project for various Specialty care ingredients in FY 2022-23.

Major product launches in Performance Surfactants & Specialty care products categories during FY 2022-23? Expected value addition and impact on overall revenue? Any major additions into your portfolio on cards?

In FY 2022-23, we marketed Taurates & Sarcosinates along with new grades of Isethionates. Our application team works very closely on joint development projects with our customers which allows them to offer products with unique benefits to the consumers. Galaxy also helps in customization of these compositions to give them exclusivity and help them maintain confidentiality of their products.

The constant endeavor of Galaxy has been to offer safer products to consumers. Accordingly, last year our team successfully improved the existing SLES process to consistently obtain the product with less than 5 ppm dioxane with our GalEcoSafe range.

Sustainability is a key focus and acceptance of sustainable formats in Personal care is rising among consumers. Shampoo Bar is gaining good traction. Combining our capabilities and competencies in Syndet & Hair care science, and with our comprehensive range of Mild Surfactants we have launched a Conditioning Shampoo Bar Syndet base for ready preparation of high conditioning shampoo bar.

Driving sustainability and convenience, we extended the range of Liquid Capsules/

pods concentrate for floor cleaner. This ready mix allows customers to make concentrated liquid floor cleaner capsules for DIY or Unit Dose use and save on utilities, fuel, water, and plastic.

Company's performance in global markets, especially Europe and China in FY 2022-23? How do you look at the future market potential in the emerging and mature markets?

Europe, one of the key mature markets for us, was reeling under the impact of the Russia - Ukraine war and the resultant energy crisis throughout 2022. As a result, there was an overall slowdown in Europe. While the global markets steadily recovered from the pandemic, China was still reeling under the impact of COVID-19. Recovery was much slower than expected as many cities continued to be under strict lockdown for long intervals thereby impacting business negatively. Several emerging market countries were under financial stress in 2022. This was primarily on account of surging energy prices as well as high food inflation.

For 2023, progress on climate policies, financial policies and multilateral issues will be critical to ensure we overcome the geo-economic pressures. In the long term, we do see a growing demand for Personal care and Home care products.

In recent times, the company has won the Best ESG Initiative to Improve Access to Clean Water Award and Golden Peacock Eco-Innovation Award 2021. How these achievements strengthen the company's commitment towards future ESG goals?

The Best ESG Initiative award encourages us to scale greater heights in corporate responsibility. The Golden Peacock Eco-Innovation award gives an impetus towards our Mission 2030; to serve customers with value added products, manufactured responsibly.

In 2022, the company has achieved water positive certification and become 1.4X water positive. How did it become possible and what does it mean to you and your customers?

More than a billion people across the globe lack access to water and nearly 2.7 billion face water scarcity at least one

month in a year. At Galaxy, we are cognizant of our water footprint. Reducing water consumption in operations and improving water quality have therefore been important business objectives for us. Guided by our Sustainability cell, the working committees across locations measure, monitor & review water related topics, both within the company and community areas. We define water stewardship as the usage of water that is socially equitable, environmentally sustainable, and economically beneficial, achieved through a stakeholder inclusive process.

All our sites in India are zero liquid discharge facilities. We are carrying out a substantial number of activities through CSR projects to conserve water. Rainwater harvesting within the company boundary and in community areas, check dam creation and desilting of water bodies are undertaken to improve water availability. These conscious and consistent efforts have helped us in achieving water positivity of 1.4X. As customers are also enforcing ESG measures, they need a mind partner to provide less water intensive solutions.

How is the company strengthening its in-house R&D capabilities to expand customized solutions to its customers? How many new products are expected from the innovation funnel in FY 2023-24?

The company aims to grow faster than the market by retaining existing accounts and by introducing new and differentiated products to capture new opportunities and newer areas of applications. The speed of launch of new products is critical for the growth in market share. Keeping that in mind, the company has invested in expansion of R&D capacity and building a dedicated plant for R&D product incubation to accelerate commercialization. These expansions are already bearing fruit. The expanded capacity will also support ramping up the strength of scientists to increase the rate of product introductions. We have also started providing unique customized offerings to our customers in the form of product/concept/formulation so that we are able to grow and be a part of their growth journey. In FY 2023-24, we will continue to introduce products in the Personal care and Home care segments

in line with customer trends.

Automation and digitalization projects carried out in FY 2022-23? What's the plan for brownfield and greenfield projects?

Our company has always worked to be contemporary in the application of technology for its business processes and its interface inter and intra organization. Towards this end, review of business processes, applications available, and digitization of processes with adequate controls is an ongoing work in progress. We have been working on the best known SAP ERP for over a decade, with substantive utilization of its features and are striving to move subsidiaries on the same to enable seamless availability of real time data on consolidated operations. Cyber security is at the heart of effort with a 24x7 surveillance mechanism in place to thwart any infringements in collaboration with renowned professional names in the domain to remain abreast with the technological advancements accessible.

When is Galaxy Surfactants planning to achieve Net Carbon Zero and milestones set up by the company to achieve it?

At Galaxy, we have integrated sustainability into our day to day working. We have adopted Science Based Target Initiatives (SBTi). Science based targets provide a clearly defined pathway to future proof growth by specifying how much and how quickly companies need to reduce their greenhouse gas emissions. Currently, we are in the process of target validation. We are sourcing renewable sources of energy - Almost 18% of power sources are renewable in FY 22-23; We are committed to using RSPO certified material; and number of energy efficiency projects are driven to ensure we are using resources effectively and efficiently. There is a long way to go in terms of creating an opportunity to make carbon capture and use feasible technologies. Removal of hurdles for shifting to a 100% renewable source of power will be key to achieving Net Carbon Zero.

CSR projects executed in FY 2022-23 and plans with respect to FY 2023-24?

At Galaxy, we believe that it is the society that makes us and therefore it becomes our responsibility to give back to the society. Our CSR activities focus on five critical areas that shape the society we live in today: Health & Hygiene (Aarogya Vardheeni); Education (Gyaan Sanjeevani); Community Development (Samajeek Utthan); Environment Protection (Vatavaran Suraksha); and Women Empowerment (Stree Unnati). Primary health center, building toilets, vocational skill development, watershed developments, tree plantation and community hall for women self- help groups were some of the key projects undertaken this year. Cumulatively, we have reached around 150,000 beneficiaries through our initiatives this year. For the coming year, we will continue to focus on these critical areas and reach out to a larger number of beneficiaries. ■

EXPANDING UV OLIGOMER, MONOMER, AND KETONIC RESIN PRODUCT RANGE

hubergroup is investing in research and development to develop new products and technologies that are more energy-efficient and sustainable. The company is also reducing energy consumption through energy-efficient technologies and process at our sites in India

SURESH KALRA
MANAGING DIRECTOR - INDIA & PRESIDENT ASIA
HUBERGROUP

Key achievements in FY 2022-23 by hubergroup Asia/India?

FY2022-23 was a challenging year. It started with challenges of higher demand, supply chain disruptions, raw material cost upsurge while it ended with a sluggish demand, pipeline correction, management of operational and business cost. Nevertheless, hubergroup developed innovative products with unique properties with efficient and environmentally friendly manufacturing processes to meet customer needs. We met sustainability goals by reducing environmental impact, improved safety, expanded into new markets, and collaborated with many new business partners.

We started our Global IT Centre of Excellence in India where services like network, security, and data centre of hubergroup worldwide are now delivered from one single location. Our innovative products MGA CONTACT and Oxygen Barrier Coating won awards for sustainability. The launch of our eco-friendly new water-based ink portfolio HYDRO-i, developed jointly by the R&D teams of India and Germany, has been accepted and appreciated by the packaging industry.

We started our Global IT Centre of Excellence in India where services like network, security, and data centre of hubergroup worldwide are now delivered from one single location

hubergroup is one of the leading international specialists for solutions and technologies relating to printing inks, printing aid, and raw materials. What's your Asia/India strategy for FY 2023-24?

hubergroup is a German-based company with a strong presence in India serving as a manufacturing hub for our global operations. We follow some of the best European business practices and yet produce products in cost-effective ways by leveraging our manufacturing footprints in India. Our Asia/India strategy in the current scenario is to focus on sustainability, energy efficiency, and collaboration with stakeholders to drive innovation and growth in a rapidly changing market. We are investing in research and development to develop new products and technologies that are more energy-efficient and sustainable.

We are also expanding into new markets to explore with a broader focus. We have separated our Chemicals business from our Print Solutions business in 2020 to be more focused and provide solutions tailored to our customers. We also continue to remain focused on our employees' well being and bringing in more diversity to the existing workforce.

How has the chemicals division

performed in Asia/India in FY 2022-23? Bouquet of products planned to be launched in this fiscal?

Our global Chemicals Division performed well in FY 2022-23. However, we have higher expectations from Asia/India due to the region's economic growth, and rapid industrialization, and urbanization. The industry also faces challenges such as rising raw material costs, environmental regulations, and increasing competition from other regions. The COVID-19 pandemic has also impacted the industry, causing disruptions in the supply chain, and reducing demand from certain sectors. Overall, the chemicals business in Asia/India is expected to grow significantly higher than GDP growth. Going forward our focus is to enhance business for radiation curing systems which includes UV oligomers (polyester acrylate, poly urethane acrylates, and epoxy acrylates) and monomers.

Recently, we participated in the European Coating Show (ECS 2023) to showcase our product portfolio in the Chemicals Division and received overwhelming responses.

hubergroup develops innovative solutions and technologies for the printing and packaging, the paint and coating, and chemical industries. New technologies/products that you are developing in R&D labs and its implication for the hubergroup?

We are working on developing new products with an increased use of bio-based raw materials to fulfill our commitment towards sustainability and offer eco-friendly products to our customers while ensuring compliance in changing regulatory requirements. Drawing on our knowledge of resin design, our focus is to provide resin products like UV oligomers, modified Rosin resin, polyurethane resin or polyester resin that meet various requirements of the printing, packaging, and coating industries. These efforts will enable us to expand our chemical business portfolio and cater to a larger market size.

New projects implemented in FY 2022-23? Expansion plans for FY 2023-24?

We are excited to expand our UV oligomer, monomer, and ketonic resin product range. At the same time, we are also exploring the possibility of collaborating with some of the leading companies for custom manufacturing. We are seeking synergies that can complement our assets and strong operational know-how to achieve greater business efficiencies and customer satisfaction. We will continue to provide updates on this through our official communication channels.

The company is offering a wide range of products for use in radiation-curing systems. Potential use cases and key customers for products for use in radio-curing systems?

Radiation-curing systems have a wide range of potential uses and customers in various industries. The printing industry is the biggest: Radiation-curing systems are used in the printing industry to cure inks and coatings on various substrates such as paper, plastic or metal. Additionally, they are often used in the coatings industry for automobiles.

hubergroup is also currently placing

a special focus on wood coatings. What's your overview of the Indian market and when are you planning to launch this product in India?

The wood coating market in India has been growing steadily over the years, driven by increasing demand from various end-use industries such as furniture, construction, and automotive. The market is expected to continue its growth trajectory in the coming years, thanks to rising disposable incomes, urbanization, and increasing construction activities in the country.

At hubergroup, we have some unique solutions like UV oligomers (polyester acrylate, urethane acrylate, and epoxy acrylate), functional resins, monomers (TPGDA, DPGDA, PETIA, GPTA, EOTMPTA, PPTTA, and DPHA), conventional resins (modified Rosin and polyurethane) specially designed for the wood industry to enhance coating performance.

hubergroup is also focusing on providing chemical substances such as PU resins and UV oligomers in their purest form and driving forward product innovations. How are you moving in this direction?

The progress for PU resins and UV oligomers is good with several products launched in 2022-23 that are technologically well accepted. We are now adding capacities to scale-up our production and optimize cost. We also have products for the wood coating segment now.

The company is taking a holistic view of sustainability and is also driving a circular economy. Steps taken by hubergroup India on sustainability and circular economy front?

At hubergroup, we have placed a great emphasis on sustainability for many years. We have been a pioneer for eco-friendly printing solutions such as cobalt-free inks and we will continue this approach for our Chemicals Division as well. We have taken several key steps to improve sustainability and adopt circular economy principles like measure and track environmental impact, adopt circular economy principles to design products for longevity, set sustainability targets, engage with suppliers, invest in renewable energy, promote sustainable products, and partnerships with stakeholders.

At our largest production site in Vapi, India, we have, for example, implemented photovoltaic systems and a Multi Effect Evaporator (MEE) into operation, a state-of-the-art technology which ensures efficient processing of the site's effluents.

What are the steps you are undertaking to achieve Net Carbon Zero?

We continue to build strategies and find innovative ways to minimize our carbon footprints. At our sites in India, we are reducing energy consumption through energy-efficient technologies and process improvements. We have also implemented photovoltaic systems in our plants. We are also fostering use of renewable energy sources like wind and solar.

In FY 2022-23, hubergroup India launched a healthcare initiative for rural areas in the Indian state of Gujarat, collaborating with Rotary Vapi Riverside. CSR activities undertaken by the company in FY 2022-23 and plans for FY 2023-24?

hubergroup has production sites in Daman, Vapi, and Silvassa – So many of our employees live in these regions. We believe in contributing and giving back to the people in our neighbourhood. Our endeavour is to provide quality healthcare services at the doorsteps of rural residents complementing the government promoted health programmes. Our services through two mobile medical vans were well accepted by villagers. This prompted us to add two more vans, one for dental and one for eye care in March 2023. Moreover, we donated a high-end digital mammography system to the newly inaugurated Mammography Department at Shreyas Medicare Janseva Hospital Vapi, India. Going forward, this year our CSR activities will once again be committed to service in the health and education sector. ■

We are now adding capacities to scale-up our production and optimize cost. We also have products for the wood coating segment now

INCURRING A CAPEX OF RS. 1,250 CRORE FOR FY23 AND FY24 EACH

Most of the Capex this year is towards expanding our new fluoropolymers portfolio and for the next year it will be more towards the EV segment, both battery chemicals, and fluoropolymers used in the EV space

KAPIL MALHOTRA
GLOBAL BUSINESS
UNIT HEAD - FLUOROPOLYMERS
GUJARAT FLUOROCHEMICALS LTD.

Gujarat Fluorochemicals Limited financial performance in FY 2022-23 and plans for FY 2023-24? Key achievements in FY 2022-23?

In the 9 months ended Dec 2022, we have reported a revenue of Rs. 4,213 crore as against Rs. 3,954 crore for the full year FY 2022, while our EBITDA and PAT for the 9 months ended Dec 2022 stood at Rs. 1,518 crore and Rs. 991 crore respectively as against Rs. 1,198 crore and Rs. 775 crore for the full year FY 2022. We are incurring a Capex of Rs. 1,250 crore for FY23 and FY24 each. Most of the Capex this year is towards expanding our new fluoropolymers portfolio and for the next year it will be more towards the EV segment, both battery chemicals, and fluoropolymers used in the EV space.

GFL is the only manufacturer of PTFE/ Flouropolymer in India. Are you planning to set up more such exclusive manufacturing facilities in India for other products?

Yes, we have plans of rapid expansion in terms of adding capacities to our existing Fluoropolymer portfolio for applications in electric vehicle batteries, solar films, and hydrogen fuel cells. Our vertically integrated operations help us to maximize value addition.

GFL's Jolva facility is focusing on Fluoropolymers, Specialty, and New Age Chemicals and presently is under phased commissioning. Please elaborate?

Our Jolva facility is a part of continuous expansion of the existing products and new age chemicals. Customers understand and appreciate our customized products, local presence, just-in-time deliveries, and continuous engagement with customers, which is reflected in the increase in demand for our products. We plan to start commercial operations of our New Age Chemicals by the end of 2023.

GFL is in the process of setting up an integrated battery chemicals complex. What's the update in terms of Capex, timeline, and battery chemicals products to be manufactured in the complex?

At GFL, we give utmost importance to sustainability and the environment. In an effort to contribute to global carbon neutrality goals, we have invested in the integrated battery chemicals complex. With our own fluorspar mines and electronic grade AHF manufacturing facility, we plan to manufacture electrolyte salts such as LiPF6 and other value-added products.

We have plans of rapid expansion in terms of adding capacities to our existing Fluoropolymer portfolio for applications in electric vehicle batteries, solar films, and hydrogen fuel cells

The company is setting up India's first PVDF solar film project which will be commissioned in the next financial year. What's the update in terms of Capex and timeline?

We leveraged our vertically integrated facility to enter the segment of PVDF films. At a time when India and the world have set aggressive solar energy targets, it is highly important to scale local production of relevant raw materials such as PVDF films. This plant is planned to be commissioned by the second quarter of the current financial year.

On the export front, the company is a major supplier of Fluoropolymers to Europe and USA. How are you planning to increase your export market share?

We will continue to work closely with our customers on upcoming projects and develop greener products to provide value addition. We will play our role as a preferred supplier of fluoropolymers that are of utmost importance for major applications in Europe and USA. We will also continue to take all necessary steps to make sure products are consistently supplied to customers at the right time.

Global trends in Bulk Chemicals and Fluorochemicals in 2023?

Due to Montreal protocol regulations the uses of HCFC have been restricted and are being phased out gradually. The demand for HCFC thus is shrinking globally. HCFCs are being replaced by HFCs. The markets for HFCs are growing globally at about 7-8%. However, GFL is targeting 20% annual growth for HFC.

Key sustainability and CSR initiatives planned for FY 2023-24?

As far as sustainability is concerned, the biggest challenge today in our industry to build a strong product life cycle is to balance economic and environmental sustainability.

This includes adherence to strict global regulatory compliance and meeting the challenging demands of customers for environment-friendly products. In addition, we also seek efficient and cost-effective methods of producing our products, reducing waste and emissions and ensuring safe handling/ disposal of chemicals throughout the product life cycle.

We consistently monitor dynamic regulatory changes and have consequently moved away from chemicals of concern in our fluoropolymer product line.

At GFL, giving back to the community is part of our corporate philosophy. As corporate citizens, we are committed to acting in an economically, socially and ecologically responsible manner and coordinating the interests of various stakeholder groups. We strive to create a more sustainable company and have a positive impact on our communities, society and the planet.

Are you planning to completely switch to green/renewable power? If yes, by what time frame?

We at GFL have already invested a substantial part in renewable power. For full switchover we shall abide by India's time frame.

The company has invested a Capex of Rs. 1,250 crores in FY 2022-23 and facilities where it has invested? Facilities where it is planning to invest Rs. 1,250 crores in FY 2023-24?

At this moment, we will mainly be investing in fluoropolymers, battery chemicals and intermediates. Going forward we shall be looking towards newer segments as and when we see a demand and opportunity arising at a domestic and international level.

DST approved Research and Application development centers are focusing both on new businesses as well as existing businesses. How are you planning to leverage your innovation centers?

If you look at the current investments that we are doing, it is basically by developing new grades of our products for new age sectors such as uses and applications in 5G, EVs, semiconductor, Green hydrogen, etc.

GFL has also taken up projects to indigenously develop and produce PEM membranes. Any update on this front?

Yes, as already discussed previously, lab products have been developed, a prototype plant is under construction. We shall soon be ready for commercially viable grades.

GFL is well equipped to cater to the fluoropolymers required for the hydrogen electrolysers, fuel cells, and charging stations. What kind of fluoropolymers are you planning to manufacture to cater to these segments and by when?

A variety of Fluoropolymers, like PFA, PVDF, and PTFE are already being used in such areas for the hydrogen electrolysers, fuel cells, and EV charging stations. We have several products for these segments and shall complete the remaining ones also in the next couple of years. ■

DEVELOPING TECHNOLOGY TO RECYCLE INGREDIENTS OF LITHIUM BATTERY

We expect the opportunity to be huge, both in India and globally, so will leverage the expertise of Silox Group entity in Hydrometallurgy, expertise in sourcing the key raw material and in effectively serving their global customers with our recycled products

PRAKASH RAMAN
MANAGING DIRECTOR
SILOX INDIA PVT. LTD.

2023 global trends in the inorganic chemical industry?

Global economic activity experienced a broad-based and sharper-than-expected slowdown, higher inflation, cost-of-living crisis, and tightening financial conditions in most regions. Russia's invasion of Ukraine, and the lingering COVID-19 pandemic all weigh heavily on the outlook. However, we believe India is in a better position to weather the impact of global slowdown, especially for sectors such as Textiles & Chemicals. The pandemic has thrown open fault lines in China driven supply chains, and offers opportunities for other Asian countries, especially India, as it stands to benefit the most on account of the large manufacturing base for Textiles & Chemicals. The Indian economy has the potential to emerge as a major supply source for the world in future.

How would you rate the company's financial performance in FY 2022-23? What's the forecast for FY 2023-24?

Silox India had solid performance during FY 2022-23. First part of the year was very strong with solid performance, supported by strong demand from our end-use market segments.

Performance of the company in different segments - Sodium Hydrosulfite, Sodium Formaldehyde Sulphoxylate (Safolite), and Zinc Formaldehyde Sulphoxylate (Safolin) in FY 2022-23. What's the future roadmap?

Silox India caters to diverse market segments such as textiles, automotives, coating, industrial, and consumer. Our end market segment both in India and overseas went through a slowdown owing to demand slump during H2 2022. Textile Industry in India has faced severe demand contraction since Q3 2022, arising out of cut down in orders from large global brands and Inflationary cost pressure. Most of the textile mills and process houses across the country were operating at 50-60% of the capacity during Q4 2022.

Globally, demand drop in key textile markets such as Turkey, Thailand, Mexico, Bangladesh, Brazil, etc. was significant owing to low demand from global brands during the Christmas and New Year season.

Another hallmark of 2022 was the steep increase in major commodity prices and energy prices, leading to significant increase in raw material and energy prices for Silox India Private Limited (SIPL). However, we could manage to pass on the cost increase through sales prices.

Majority of capital investment in FY 2022-23 were spent in improving our sustainability footprint and debottlenecking the capacity for our existing products

Another major challenge faced by us was the logistic disruption globally, major issues with availability of containers and record high ocean freight posed serious challenges in terms of not only higher costs but also delayed delivery of goods to customers. In the above background, while sales for SIPL's products remained strong during H1 2022, demand slowdown across end use segments was experienced in H2, however, SIPL strived hard to not only maintain but also improve its market share under these challenging market conditions during the second half of the year.

In this context, our main thrust for 2023 would be to continue to protect our market share and if possible, further improve it. SIPL is committed to sustain its growth journey of the last two decades in the future too and hence is in the process of pursuing newer growth areas for the company. Silox India shall remain committed to take advantage of all the opportunities that any recovery in the global economy or change in market conditions may offer us, by remaining alert and agile.

Capex investment in FY 2022-23 and projects/facilities where the company has invested and plans for FY 2023-24?

Majority of capital investment in FY 2022-23 were spent in improving our sustainability footprint and debottlenecking the capacity for our existing products. We expanded the capacity of our Zinc powder significantly with new capital investment. This investment will help us in maintaining our market leadership position and in serving growing needs of the end-use market segment. Capital investment in enhancing sustainability footprint will result in switching steam & energy dependence to sustainable sources of raw material and avoid use of fossil fuels. This will help us in reducing water consumption by more than 25% in one of our major sites.

Silox exports accounts for one third of annual revenue and the company exports its products to more than 65 countries. How are you planning to increase exports?

Silox India exports more than 40% of its products to more than 65 countries across the world. We continue to enhance our geographical presence by working with our strategic partners/customers and supplying effectively their global facilities. The company collaborates with Silox global entities in terms of optimally serving the global market without duplication and in ensuring our global customers continue to source from the region they belong.

Effective May 2023, we will be switching over 45% of our electricity source to a sustainable source of energy which is a combination of solar and wind

The company is focusing on innovation in a big way. Areas where you are focusing and what is its

impact on the company in the long run?

Innovation is one of our key cornerstones to enhance our future growth. We are currently working in developing a technology to recycle key ingredients of Lithium battery used majorly in automotive. We expect this opportunity to be huge, both in India and globally, we will leverage the expertise of Silox Group entity in Hydrometallurgy, expertise in sourcing the key raw material, and in effectively serving their global customers with our recycled products.

Silox is also working on an exciting new product in the EV mobility field. When are you planning to make it commercial and what is the market for these products in India and outside India?

We expect to have our industrial scale operation in India in the next two-three years.

Level of automation and digitalization carried out in FY 2022-23? How do you plan to move ahead both on the brownfield and greenfield projects?

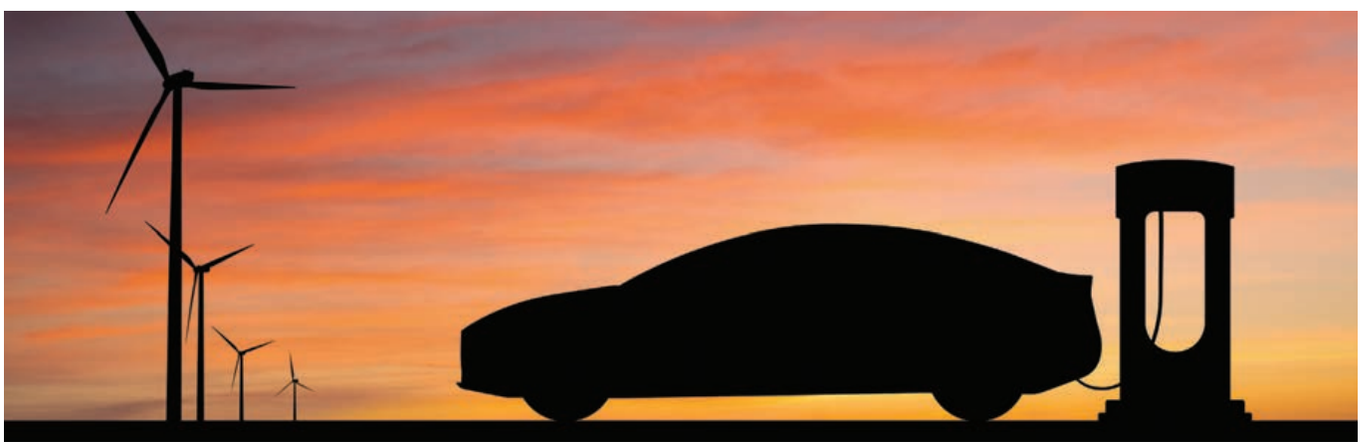
We started the digitalization initiative in a small and incremental way. We are initially focusing on bringing digital to manage our critical process in employee management with our digitalised HR process etc., We continue to work on this effort in enhancing and larger adoption of digitization in coming years.

The company is leading on sustainability. Key sustainability initiatives of the company?

With our continuous and sustained efforts on sustainability, more than 69% of steam generation of the company is from biosource and this switch has happened in the last three years in moving away from fossil fuel. Effective May 2023, we will be switching over 45% of our electricity source to a sustainable source of energy which is a combination of solar and wind. This will effectively reduce CO2 emissions of more than 15,000 MT per annum.

CSR projects undertaken by Silox in FY 2022-23 and plans for FY 2023-24?

On the CSR front, the company focuses on: Sustainable agriculture and animal husbandry and livestock management - Providing an alternate source of income generation to the community people, increasing farm yield, and increasing livestock poverty; Women empowerment - To empower community women and to develop employable skills amongst women; Project Janani Janeta - To address maternal and infant mortality due to anaemia; Integrated project on health and education - Hunger eradication along with increase in nutritional level among targeted children and to provide basic education skills to children for building their foundation; and Supporting women care institute - Improving self-worth and self-esteem among residents. Provide skill oriented education among residents and to improve skills and motivation of the women care institute staff.



What are the key innovations undertaken at the company's R&D facility? How will these innovations make an impact on the company and society?

Apart from our next generation of new products and innovation efforts, we continue to make significant R&D efforts in terms of enhancing the efficiency, use of sustainable materials, waste to wealth initiatives, reducing environmental footprint especially in reducing generation of solid and liquid waste from our process, optimising the use of water, and enhancing green and sustainable material use in our manufacturing process.

When is Silox planning to achieve Net Carbon Zero? What are the different milestones set up by the company to achieve it?

Silox India is progressing on various sustainable initiatives and at the Group level has hired a Head of Sustainability who is in the process of defining our goal for Net Carbon Zero and different milestones to be achieved in future. ■

PLANNING A TECH CENTRE IN NAVI MUMBAI AND MANUFACTURING SITE AT SAYKHA

Jesons Industries Limited has added several new products to its portfolio last fiscal and has a strong pipeline for the coming few years. In FY23, the company's capacity was around 283,000 MTPA with capacity utilization at around 65%

DHIRESH SHASHIKANT GOSALIA
CHAIRMAN AND MANAGING DIRECTOR
JESONS INDUSTRIES LTD.

We are currently at 75% automation in our plants and wish to enhance it to 90% by 2027

2023 trends in Construction Chemicals, Textile Chemicals, Carpet Chemicals, Leather Chemicals, and Paper Chemicals?

The industry is in sync with India's growth with a country focused on textiles and construction. We expect growth in textiles and construction to be around 12%.

Company's financial performance in FY 2022-23? What's the forecast for FY 2023-24?

In FY23, Jesons Industries Limited has shown a flattish volume growth and forecasts a volume growth of around 25% in FY24.

Revenue mix within India and outside India for FY 2022-23? What will be the revenue mix in FY 2024-25?

In FY23 exports contributed 26% of overall revenues whereas within India it was 74%. In FY24, the company is planning to increase its share of exports further to touch 28% of overall revenues.

The company is focused on Specialty Coating Emulsions (SCE) and water-based Pressure Sensitive Adhesives (PSA) in tape and label segments in India. Any new developments on this front?

Our technology centre at Turbhe, Navi Mumbai is churning out new products in the SCE and PSA categories for different applications. We are also in talks with a few global prominent players for collaboration.

Capex investment in FY 2022-23 and projects/facilities where the company has invested? Capex plans for the company in FY 2023-24 and how will this help the company in the long term?

In FY23, the company expanded capacities in Roorkee, Chennai, and Mundra locations. Capex plans for FY24 include a new technology centre in Navi Mumbai and a new manufacturing site at Saykha, Gujarat. With these expansions, we expect to introduce innovative products and show robust growth in the coming years.

The company holds about 30% market share as a specialty coating emulsions (SCE) supplier in the Indian paint sector? How does the company plan to increase it

We are currently at 75% automation in our plants and wish to enhance it to 90% by 2027

further? Any new product launches in the offing?

Jesons has several new products in the pipeline in the SCE category for various applications and end uses. We are also in talks with several players for joint ventures and collaborations which will help us increase our market share.

The company's portfolio of 170 products are marketed under seven different brands. Have you made any additions to this portfolio in 2022-23 or plan to do so in the near future?

Yes, it is a continuous process and we have added several new products to the list. Our pipeline remains strong for the coming few years.

What is the total installed capacity across six manufacturing plants and how much additional capacity added during FY 2022-23? What is your current capacity utilization and strategy to improvise it further?

In FY23, the company's capacity was around 283,000 MTPA with capacity utilization at around 65%.

What are the key innovations undertaken at the company's DSIR recognized R&D centre? How will these innovations make an impact on the company and society?

Innovations in Jesons are focused on enhancing customer productivity, delivering parallel innovative solutions, minimising impact on nature, and expanding our product adjacencies. The company is also focusing on minimizing natural resources such as water by developing high polymer content ready to use pressure sensitive adhesive for tapes and labels applications.

Focus is also on products that enhances customer productivity by running at higher speeds on the coater line, safer in-compliance with FDA, and with highest quality standards products for packaging adhesive applications such as lamination, side pasting, etc., CMR free products for furniture adhesive applications; Coating binder which acts as scavenger for carcinogenic emission in the atmosphere; Development of green paint binders with latent crosslinking technology to enhance paints shelf life; Elastomeric coatings using sunlight for crosslinking; Moisture barrier coating for reducing water demand required for concrete curing; and using in-house products as raw materials for formulating competitive high-performance construction chemicals.

We have undertaken several CSR projects for promotion of education and healthcare. We have also carried out CSR activities towards the Prime Minister Relief Fund (PMRF).

The company has received prestigious Responsible Care certification from Indian Chemical Council (ICC). How will this strengthen your commitment towards future sustainability goals?

Jesons Industries Limited is a Responsible Care (RC) Logo Certified organization which is an internationally recognized and global voluntary initiative through ICCA internationally and ICC in India. RC addresses community concern about chemicals and their impact on people and environment during processing, transportation, and use. This helps us to build trust and confidence with stakeholders i.e. employees, community customers, suppliers, contractors, and government.

RC covers process safety, employee health and safety, pollution prevention, emergency response and communication, distribution, product stewardship, and security. RC logo is a symbol of commitment towards EHS excellence and thus helps us to strengthen a move towards sustainability.

Level of automation and digitalization projects carried out in FY 2022-23? How do you plan to move ahead on this front both on brownfield and greenfield projects?

We are currently at 75% automation in our plants and wish to enhance it to 90% by 2027.

CSR projects undertaken in FY 2022-23 and plans for FY 2023-24?

How is the company striking a balance between environment-friendly policies and business growth? Key sustainability initiatives of the company across various segments?

In the energy sector, the company has installed 60 kw solar panels at Mundra; In water management, the company has developed a water harvesting system at 8 kl/hr at Mundra; In waste management, the company is opting for paperless work procedures at Mundra; Reuse of drums; In biodiversity we are increasing green belt with plantation of 1,588 trees at Mundra; In supply chain, the company is deploying nicer globe tracking system into transported vehicles; and Journey Risk assessment of transportation. Compliances with national environment compliances. Prepared & implemented QEHS (Quality, Environment, Health and Safety) policy & its goal and third party certification for our system like ISO and Responsible Care. The company is going to implement the EcoVadis and ESG certification process.

When is Jesons Industries planning to achieve Net Carbon Zero? What are the different milestones set up by the company to achieve it?

We have appointed PwC as our ESG implementation partner and the milestones are under development. ■

CAPEX COMMITMENT TO BE IN THE RANGE OF RS. 200-300 CR

Sajjan India Ltd. is looking for expansion, both organically and through acquisitions, to achieve planned growth

DR. R. ANANTHANARAYANAN
CHIEF EXECUTIVE OFFICER
SAJJAN INDIA LTD.

2023 global trends in agrochemicals, pharmaceuticals, specialty chemicals, and intermediates?

Global trends in 2023 are: Increasing demand for generics specially for pharmaceuticals leading to need for cost effective APIs and intermediates production; Growing importance of sustainability is becoming an essential factor for companies across the industry to reduce environmental footprint; Emphasis on R&D and innovation leading to Indian CDMOs investing heavily in technology and capability building; Increased outsourcing activities by global giants to remain cost competitive and focus on complex steps; and supply chain diversification - China +1 strategy adopted by most global giants to diversify risk and reduce dependency on China due to the geopolitical risks, rising labor costs, and trade wars.

Financial performance of Sajjan India Limited in FY 2022-23? Plans for FY 2023-24?

Sajjan India Limited (SIL) has performed reasonably well in FY 2022-23 despite a tough external environment. Our revenues are likely to be in the range of Rs. 1,450 - 1,500 crore and shown a growth of 10% for FY 2022-23 with a strong EBITDA and PAT margin. We continue to remain focused on building product pipelines and deepening our relationships with the customers. This gives us confidence for consistent revenue growth and sustained profitability in coming years. We are looking for at least 20% growth in FY 2023-24. For the future, the company will grow both organically and through acquisitions. We are looking at all divisions and consolidating our relationship with the non-GMP pharmaceutical space.

Has Sajjan India streamlined its operations in FY 2022-23?

It is ten months since we acquired Sajjan India and the first task that we took was stabilising the business delivery of products on time for customers. After acquisition, we created a new management structure in 4-5 months. We got new leaders from outside and retained existing manpower by focusing on career growth. We have created an organization geared for FY24 and beyond. Significant focus was on EHS (Environment, Health & Safety) and sustainability.

Our entire business model is based on offering Contract Development & Manufacturing services. Our customers are international innovators who supply products in global markets

How have different divisions - Agrochemicals, pharmaceuticals, specialty chemicals; Contract development and manufacturing; and intermediates performed in FY2022-23? Plans for FY 2023-24?

We have become efficient and optimized our manufacturing by focusing on better asset availability, reliability, planning and scheduling, improved batch cycles, focusing on turnarounds without

compromising on safety, compliance, and environment sustainability.

How has the company performed internationally? Are you focusing on any new geography/product for the international market?

Our entire business model is based on offering Contract Development & Manufacturing (CDMO) services. Our customers are international large scale innovators who supply products in global markets. Our customer base is spread across the US, Europe, and Japan.

Capex investment made in FY 2022-23 and projects where the company has invested? Capex plans for FY 2023-24? How will these investments help the company?

The company has been investing significantly for the past few quarters in upgrading its infrastructure, plant and machineries, capacity augmentation, safety, health & environment, and towards development of various new chemistries. Research & Technology (R&T) has always been the backbone of the company and in this direction, the company is setting up a large R&T centre in Navi Mumbai.

This new R&T centre is likely to be operational in 2023. Besides this, the company has recently inaugurated its state-of-the-art R&D lab at its Ankleshwar plant. Investment plans are afoot for setting up a pilot plant and multi-purpose plant at the company's manufacturing facilities located at Ankleshwar and these are likely to be operational in 2024.

Overall, the company has made capital investments in the range of Rs. 100-125 crores in FY 2022-23 and for the next financial year, the Capex commitment is likely to be in the range of Rs. 200-300 crores. The company is open for growth and has invested in the future for downtimes to decrease and reliability to increase. Our investments are increasingly shifting towards better engineering controls and gearing towards manufacturing 4.0. We are equally committed to the safety of our people and partners by digitization and better analytics to focus on our aspiration to be a Zero Harm enterprise. As a Responsible Care signatory, we are also committed to make our products the right way by investment in renewable energy portfolios.

On the R&D front, what are the new innovations that the company is working on? How will these innovations help the company in the long run?

We are a process and technology driven company, so our focus is on process innovations for developing cost effective and safe manufacturing processes. We are developing new technologies like Photochemistry, Bio catalysis, Fluorination, Flow Chemistry, Green Chemistry, etc. New technologies development will widen our offerings to our partners.

The company is planning a new R&T Centre at Navi Mumbai. When are you planning to make it operational and what all activities will be driven from this facility?

The company is in-process of setting up a state of art new R&T Centre at Navi Mumbai which will be in operation by October 2023. All technology development activities will be done at the new R&T Centre. We will have a pool of scientists from all fields, like Chemistry, Chemical Engineering, Analytical Development, Knowledge Management, Process Safety, Process Simulation, etc. for developing cost effective, scalable, and safe processes. We are confident with the new R&T Centre, technology offerings to our partners will increase by many-fold. The investments in R&T Centre are fully backed-up with investments in new pilot plant and multipurpose plant facilities at our manufacturing site to accommodate quick realization of new technologies developed at commercial scale.

Plans related to automation and digitalization across manufacturing facilities be it greenfield or brownfield? How are you planning to leverage it?

Sajjan has already pivoted towards Manufacturing 4.0 and automated operations. We believe it will not only

Research & Technology has always been the backbone of the company and in this direction, the company is setting up a large R&T centre

be safer but make us nimble and agile in our operations. Therefore, we have started digitizing our utilities, production, and E2E supply chain. 40 percent of our manufacturing is on digital. We have plans coupled with investments over the next 3 years in this critical and forward-looking space.

How are you balancing growth and sustainability at the same time?

At Sajjan sustainability, ESG, and growth go hand in hand. We strongly believe as a responsible enterprise that both should happen symbiotically. Climate change is real, and we are going to play our part to ensure that our operations have minimal or no impact in the future. We have invested in renewable energies, better water reuse and recycle technologies, and better waste recycling initiatives. We have digitized our entire footprint in the past quarter to know the real time footprint and its impact on environment sustainability projects which are yielding. By the end 2023, 1/4th of our operations shall be renewable, 1/3rd of operations will be water recycled, and half of our waste would be recycled. We have strong 2030 aspirations which we shall be firming through our OESG Committee that is a Board level Committee to monitor ESG progress.

When are you planning to achieve Net Carbon Zero? Landmarks that you have set up for achieving it?

We have tied up with various partners and are currently undergoing Science Based Targets Initiative (SBTi) exercise to ascertain the timelines for achieving Net Carbon Zero and beyond. Request you to hold tight on that, as by mid-2023 we shall be coming out with our detailed plan based on talk with our Top 5 partners and in alignment with partners. We are already ahead with our investments on renewable energy, switching to cleaner energy, reducing water usage, reuse/recycling water, and being a zero waste to landfill enterprise by investing, reimagining, and adjusting our processes and systems.

CSR initiatives being undertaken by the company with respect to education, health & sanitation, environment sustainability, and rural development in FY 2022-23? Plans for FY 2023-24?

We at Sajjan have our CSR program in line with Sustainable Development Goals (SDGs). We are committed to this because a better, healthier, and cleaner community has a direct impact in achieving growth ambitions where we operate. In health, we have arranged health check camps in which 650 people participated. We sponsor community events such as Ankleshwar Marathon to encourage better health and lifestyle of our communities. Education and upskilling is vital to prepare a resilient future workforce that helps in the development of the nation. In October 2022, we inaugurated AEPS Institute of Science at Ankleshwar College which would annually cater to 300 students on better education and upskilling.

On the environment sustainability, we are committed to planting 2,000 trees in a green redevelopment of a land parcel by the state government in Ankleshwar, equally we have committed that our new expansion at Ankleshwar shall be carbon neutral operations.

How do you see the future of Sajjan India?

We are excited with Sajjan 2.0 which will help in the transformation of the organisation and also leveraging growth opportunities. ■

AIMING REVENUE OF RS. 350 CRORE AND EBITDA OF 11% FOR FY 2023-24

We are setting up a comprehensive team to support Industry 4.0 and other automation needs for our projects

VIKAS R. BHATIA
MANAGING DIRECTOR
RIECO INDUSTRIES LTD.

Major milestones achieved by Rieco during FY2022-23? Key targets set by the company for FY 2023-24?

Rieco has achieved record levels of order booking, both in international and domestic markets. Order growth of nearly 100% over last year and a substantial order backlog is a positive sign for us. The targets for this year will be to further accelerate by innovating, adding more solutions by investing in R&D, adding to our customer footprint and industries that we serve. One of the focus areas for Rieco would be to add more Industry 4.0 solutions which involves robotics, Artificial Intelligence/Machine Learning (AI/ML), etc. Through these product and solution level innovation, we will strive to be ahead of other players in the market.

Rieco recently bagged two large contracts worth Rs. 100 crores from the paint and petrochemical sector? Would you like to share the details? Key deliverables and timelines of the two projects?

In the first contract, we are overseeing construction and commissioning of paint raw material storage silos across three locations in India. The customer is making a big foray into the paints business and aims to challenge the market leader Asian Paints. In this construction of more than 80 silos with capacities up to 550 cubic meter, lot of critical technologies like tractor welding machines, auto beveling machines, and high capacity cranes of 500 T lift are being used. The deliveries have already started and it is expected to be completed by July 2023.

Secondly, we have been engaged by a Lithuania-based client who is a leading player in the oil and gas sector. Our scope of work for this project involves the supply of material handling systems to feed catalysts to the reactors. The demanding nature of industry and environment means that most equipment is being designed for operations at freezing temperatures of -35 degree centigrade. Additionally, they must be certified for safe operations in zone 21 and 22 and must confirm to CE/ATEX standards.

Currently, the plans are to add a fourth facility are under evaluation. Possible locations could be in Gujarat or Uttar Pradesh other than Pune

Being a leading player in powder and bulk solid technology, what have been your notable deployments in FY2022-23?

Apart from the two very large projects, we have several firsts and notable projects deployed. One is a very large size fluidized bed with diameters of 28 m for an aluminum storage silo. Then

others involve complex material handling needs for wall putty (dry mortar) making and mixing plant for large paint players. We also got orders for ATEX rated equipment in which we are designing and constructing screw conveyors.

How is the company leveraging its new facility in Ankleshwar and other facilities in Alandi and Chakan Phase 3? How have these facilities helped in capacity expansion for the company in terms of production?

All these plants have been equipped with both CNC high precision machines and also conventional manually operated machines. Through these, we can manufacture very high precision and quality equipments which are critical to the working of the integrated systems we design for our customers. Through these facilities, we have been able to witness better traction and confidence from our customers. Apart from direct addition to the revenue, there is a huge multiplier effect in our ability to get business.

Tell us more about your plans to add a fourth facility in FY 2023-24 in terms of Capex, location, and manufacturing?

Currently, the plans are to add a fourth facility are under evaluation. Possible locations could be in Gujarat or Uttar Pradesh other than Pune. The exact numbers are still to be worked out, but the quantum of investments would range from Rs. 15-20 crore.

Objectives behind hiring 200+ new employees in the next 18 months? Expected outcomes and how will it drive the company's growth?

We are now 300+ already. We are a project-based company and with the robust inflow of orders, we also need to ramp up the employee resources to be able to fulfill the growing demand. The

addition of human resources to our pool would increase our delivery capabilities, directly increasing the revenue.

Your revenues and profitability numbers during FY 2022-23? What is the forecast for FY 2023-24?

For FY 2023-24, we expect to have a revenue of Rs. 350 crore and EBITDA of around 11%. Our current year numbers are being audited so cannot disclose these now.

How do you see the industry trends unveiling during the upcoming year and how is Rieco planning to leverage it in the long run?

Industry is moving towards adopting higher levels of automation and making the processes energy efficient. We are setting up a comprehensive team to support Industry 4.0 and other automation needs for our projects.

How has the company managed consistent technology upgrades to fulfill its customers' evolving needs both nationally and internationally?

Technology upgrades are necessary, and we have added several new products and solutions to our portfolio. One of our successful products has been the Powtran which is a vacuum unloading system. Through these world class solutions we aim to serve the evolving needs of the customers. ■

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COMMISSIONING A RENEWED TECHNOLOGY DEVELOPMENT AND CUSTOMER EXPERIENCE CENTER IN PUNE

Huntsman introduced a new range of materials that offer exceptional strength, durability, flexibility and are designed to meet the growing demand for lightweight, high-performance materials in various industries

RAHUL TIKOO
MANAGING DIRECTOR
SOUTH ASIA REGION
HUNTSMAN CORPORATION

2023 trends in Polyurethanes, Advanced Materials, and Performance Products?

We are very optimistic about the future of Polyurethanes in India, given the country's position as one of the fastest-growing markets. Over the past decade, we have seen exponential growth in the Polyurethane industry, driven by diverse opportunities in consumer sectors such as footwear, automobiles, appliances, and construction. This growth has been further supported by a sizable middle-class and affluent youth population.

We believe that sustainability will be a key focus for the industry going forward, and we are committed to developing new materials that are both high-performing and environmentally responsible. In addition, we see a growing demand for advanced materials that offer unique properties and characteristics, such as improved durability and enhanced comfort.

> We have an ambitious plan for 2023 that focuses on innovation and growth across all business segments, including Polyurethanes, Advanced Materials, and Performance Products

At Huntsman, we are investing in research and development and collaborating with our partners to develop solutions that meet the evolving needs of our customers and the world around us.

The composites industry has also received a huge boost with the transition from conventional rebar to composite options. This shift represents a significant step towards a future where more substantial structures can be built using reinforced materials. If the construction market can rely on composite materials, it will be a major achievement for the industry. Overall, we are excited about the possibilities for Polyurethanes and advanced materials in India and around the world, and we are committed to leading the way in innovation and sustainability.

Key milestones achieved by Huntsman India in FY 2022-23 with respect to Polyurethanes, Advanced Materials, and Performance Products?

We have reached several significant milestones that reflect our unwavering commitment to excellence. We were honoured to be recognized by the industry for our outstanding performance in safety. Our retention of ICC approval to use Responsible Care underlines our commitment to sustainability and environmental stewardship. We also introduced a new range of materials that

offer exceptional strength, durability, and flexibility. These materials are designed to meet the growing demand for lightweight, high-performance materials in various industries. Additionally, we launched new formulations of epoxy resins and curing agents that provide superior adhesion, corrosion protection, and mechanical strength.

Our commitment to sustainable innovation in the chemical industry is evident in our development of TEROL. This bio-based alternative to traditional materials is derived from recycled PET bottles and has been advanced for use in footwear and insulation applications. Incorporating TEROL into our products not only makes a statement on sustainability but also provides customers with high-performing, eco-friendly solutions that meet their needs while reducing waste and environmental impact.

Furthermore, we're proud to have made significant strides in addressing the changing needs of the automotive industry, particularly with the rapid growth of Electric Vehicles (EVs) in India. Our Polyurethanes business has developed a renewed portfolio of Polyurethane solutions to meet the demands of the evolving automotive market, including materials for thermal management, lightweighting, and noise reduction in EV battery systems. At Huntsman, we're committed to creating a better future through our sustainable products and practices.

Are you planning to manufacture battery materials in India? If yes, battery material products that Huntsman India is planning to manufacture and market?

We are committed to contributing to the growth of the Indian Electric Vehicle (EV) market and the country's transition to a cleaner and greener future. As a leading Specialty Chemicals manufacturer, we provide comprehensive casting and impregnating resin systems for various EV components, including batteries. We are currently exploring various opportunities, which would further support the government's vision of developing a robust domestic EV ecosystem.

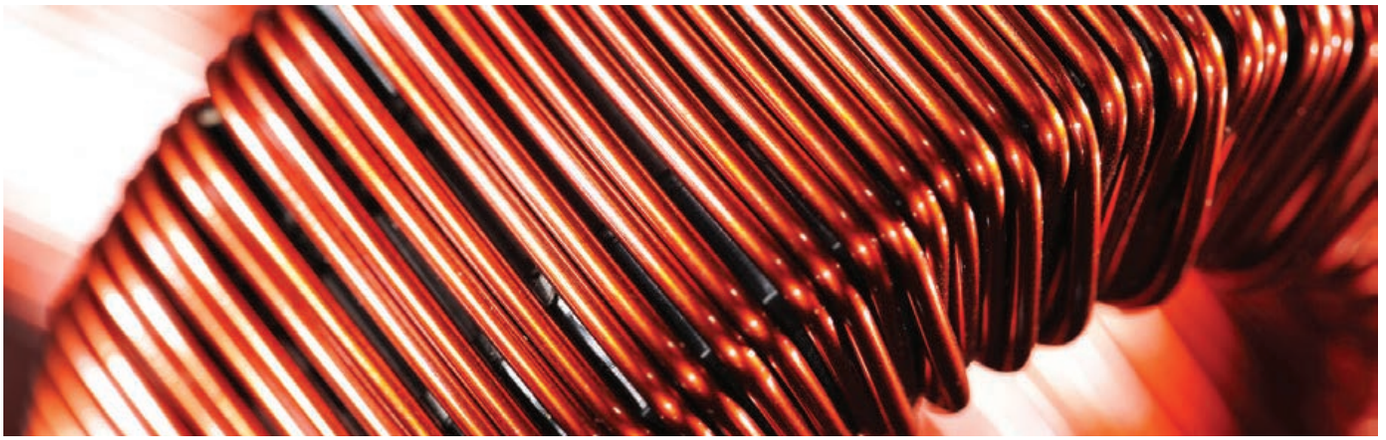
Our battery material products are specifically designed to meet the unique requirements of the Indian market, including increased safety, lightweighting, and improved performance features. We offer technical support and expertise to assist EV manufacturers in selecting the right materials for their specific applications, ensuring that they meet the highest standards of quality and reliability. Through our innovative products and services, we are committed to accelerating the transition towards a more sustainable transportation system. Our goal is to provide cutting-edge solutions that support the growth of the Indian EV industry and contribute to a cleaner, greener future for all.

How is Huntsman India striking a balance between environment friendly policies and sustainable growth?

Huntsman India is committed to promoting sustainable growth while minimizing our environmental footprint. We strive to balance our growth objectives with environmental responsibility by implementing policies and practices that reduce waste, conserve resources, and promote sustainable development. Our Responsible Care commitment is the cornerstone of our approach, and we have established several initiatives to support this effort, such as improving our energy efficiency, reducing our greenhouse gas emissions, and launching a water conservation project aimed at improving water efficiency and reducing net water usage. We also leverage our expertise in chemistry to develop innovative products and processes that promote sustainability. For example, our TEROL product line offers a credible recycled alternative to traditional materials that reduce waste. We are constantly exploring new ways to innovate and provide sustainable solutions that meet the needs of our customers.

In summary, Huntsman India is committed to promoting sustainable growth by implementing environmental policies and practices, leveraging chemistry expertise to develop sustainable products and processes, and engaging with all stakeholders to foster collaboration and promote responsible practices. Our goal is to contribute to a cleaner and greener future for all.

Sustainability plans for Huntsman India keeping in view carbon neutrality, full circularity, and sustainable chemistry with respect to Horizon 2025 targets?



Huntsman India is committed to achieving the ambitious goals outlined in Huntsman Corporation's Horizon 2025 sustainability strategy. This strategy sets targets for reducing the company's environmental footprint, promoting sustainable chemistry, and advancing the circular economy.

With respect to carbon neutrality, Huntsman India has already made progress towards reducing greenhouse gas emissions and improving energy efficiency through initiatives such as the installation of a solar facility at our manufacturing plant in Chakan, Pune. We will continue to pursue a variety of measures to reduce our carbon footprint, including the use of renewable energy sources, energy-efficient technologies, and process improvements.

Huntsman India is also committed to advancing the circular economy by developing innovative products and processes that promote the use of recycled materials and reduce waste. We are actively exploring ways to incorporate circularity principles into our manufacturing processes and supply chain management practices, with a goal of achieving full circularity.

Finally, we are committed to promoting sustainable chemistry by developing products that meet the highest standards of safety, performance, and environmental responsibility. Our Bio-based product line is just one example of our efforts to develop sustainable alternatives to traditional materials, and we will continue to invest in research and development to identify new opportunities for sustainable chemistry.

CSR initiatives completed by Huntsman in FY 2022-23 and plans for FY 2023-24?

At Huntsman, we place equal importance on the safety of our employees and the health and wellbeing of the communities in which we work. Several initiatives have been carried out by our dedicated corporate social responsibility team across our locations which enables us to access the ultimate key: the licence to operate. These include a setting up of a high school near our plant in Chakan Pune, our primary health care facility supported the administration of over one lakh COVID-19 vaccines in and around Chakan, setting up a drinking water supply unit benefitting 5,000 villagers around Padra and also offering scholarships worth Rs. one lakh to deserving students in the Padra region of Gujarat.

We are running medical mobile clinics which have covered 55,000 people from 18 villages in Chakan and over 25,000 people in Navi Mumbai. Our integrated rural development project Badlav has benefitted around 30,000 villagers across 10 villages both in Maharashtra and Gujarat. Under Anandi, our holistic education development programme, we have covered over 7,000 students. Lastly, our initiative to make rural Chakan an open defecation free region is going well. We have already covered two villages by building sanitation facilities in each house of the village thus benefiting over 300 people in the region.

Huntsman India plans for FY 2023-24 with respect to Polyurethanes, Advanced Materials, and Performance Products?

We have an ambitious plan for 2023 that focuses on innovation and growth across all business segments, including Polyurethanes, Advanced Materials, and Performance Products.

Polyurethanes: We have amended our manufacturing capability to produce a broader range of Polyurethane materials such as Footwear Polyester systems. We have invested in Chakan to locally manufacture PU and Polyurea Coatings. We are on the verge of commissioning a renewed Technology Development and Customer Experience Center in Pune.

Advanced Materials: We continue to develop innovative products that meet the needs of its customers across a wide range of industries, including aerospace, electronics, and automotive. The company is exploring new applications for its cutting-edge Araldite adhesives and composites, which are known for their strength, durability, and reliability.

Performance Products: We are expanding our portfolio of performance products focusing on sustainability, developing new products and processes that reduce waste, conserve resources, and promote circularity.

Overall, Huntsman India's plan for 2023 reflects its commitment to innovation, growth, and sustainability across all business segments. The company is poised to build on its successes and continue to drive progress in the Indian market and beyond. ■

WITNESSING STEADY ORDER FLOW FOR ENGINEERING, CHEMICALS, AND SERVICES

With the current order backlog and faster conversion of orders from the bid pipeline, Ion Exchange (India) sees a strong visibility for sustaining growth in the next 2-3 years

AJAY POPAT
PRESIDENT
ION EXCHANGE (INDIA) LTD.

Global trends in water treatment chemicals and ion exchange resins market?

The global ion exchange resins market, even in its maturity stage, is growing at an impressive CAGR of 4.2% and is projected to reach US $2.2 billion by 2025. The growth trends are already visible in APAC countries and emerging economies such as India, China, and Brazil which offer many untapped and unexplored opportunities.

The trend in growth strategies adopted by companies in this business includes development and launch of new products through sustained research & development initiatives, mergers and acquisitions, and investment in brownfield and greenfield projects. In order to sustain the robust demand from major ion exchange users like thermal power plants, chemical and petrochemical industries, steel, rising number of nuclear power plants, and high purity ion exchange resins for the pharmaceutical and electronic industries.

Expandable markets for ion exchange resins also include life sciences through bio-pharma applications and production of ultrapure water for solar/semiconductor applications.

The global water treatment chemicals market is also growing at a healthy CAGR of 4.4%. The growth can be attributed to growing requirements of utility and process chemicals from sugar and ethanol, petrochemical and refining, steel, alumina, and geothermal power generation, especially in emerging economies.

The global trends also indicate that the major factors for the growth of water treatment chemicals are increasing demand from chemical treatment of wastewater in South-East Asia. Further, it is predicted that the market for water treatment chemicals will grow due to demand for clean water in mining, pulp and paper, chemical process, oil & gas, and power plants. Coagulants and flocculants which dominate the market with largest market share for chemicals will continue to see good growth for use in water treatment in developed economies like North America and Europe.

> We will also continue to improve operation efficiency and operational throughputs along with various capacity expansion plans to take advantage of the China+ strategy

Global water treatment chemicals market size is projected to grow from US $39.1 billion in 2021 to US $61.1 billion by 2026 at a CAGR of 9.3% whereas global ion exchange resins market is expected to reach US $2.26 billion by 2026. How are you planning to leverage these opportunities?

The growth momentum in ion exchange resins and specialty water

treatment chemicals is quite good despite the slowdown in demand, earlier due to the pandemic and presently because of the geo-political situation in the Eastern part of Europe. This is mainly due to preference of Indian customers for our products and associated services. Our ion exchange resins and water treatment chemicals have good acceptance in global markets where we already have a presence. Robust CAGR, diverse range, customization and consistency in quality, and timely supplies, will help the company to benefit from growth of these products in coming years.

Company's financial performance in FY 2022-23? Forecast for FY 2023-24?

For nine months of FY 2022-23, on a consolidated basis our operating income increased 24% YoY. Profit after tax increased 45% on a YoY basis. We also expect our operating income for the FY ending March 2023 will be in the range of 25-30%. Considering a good backlog of orders we predict our growth in FY 2023-24 should be equally good.

The company has a revenue mix of Engineering (58%), Chemicals (34%), and Consumer Products (8%). Do you see any change in revenue mix in FY 2023-24?

We do not anticipate any appreciable change in the revenue mix in FY 2023-24.

Key achievements of Ion Exchange (India) Limited in FY 2022-23?

The company witnessed steady order flow, both in the domestic and international market for engineering, chemicals, and services. This includes a 40 MLD seawater desalination project for a leading EPC company in North Africa. We also received EPC contracts for desalination and complex waste treatment from one of India's largest offshore oil exploration units. Other significant orders include complete zero liquid discharge plant at Indian Oil Corporation, Panipat Refinery at a contract

In the current year, we have formed a European subsidiary for penetrating the European market as part of our sustainable growth strategy

value of Rs. 343.36 crores, a turnkey contract from Indian Oil Corporation's Panipat Refinery capacity expansion at contract value of Rs. 726.13 crores. The scope of work includes supply of water treatment plant including reverse osmosis based demineralization plant, condensate polishing unit, zero liquid discharge plant with comprehensive operation & maintenance for two years and annual maintenance charges for five years. We have also received several EPC contracts for water treatment, recycling and complete zero liquid discharge plants from leading companies in paint, food & beverages, steel, textiles, to name a few. Our Zero B range of home water solutions also had good growth in a highly fragmented market dominated by several regional unorganized players.

In FY 2022-23, the company has also bagged orders from NRL. What are you doing in the NRL?

NRL (Numaligarh Refinery Ltd.), for Assam location has awarded a contract for design, supply, construction, and erection & commissioning of 4X250 m3/hr resin based DM plant and 2X120 m3/hr for Condensate Polishing Unit. Further, our scope also includes pre-treatment of raw water by 9 X 400 m3/hr Horizontal Dual Media Filters and 2X383 m3/hr Rapid Gravity Sand Filters.

The company has an approximate total order book of Rs. 2,923 crores with more than Rs. 8,405 crores in the bid pipeline as on December 22, 2022. How are you planning to leverage these enquiries?

With the current order backlog and faster conversion of orders from the bid pipeline, we see a strong visibility for sustaining our growth in the next 2-3 years. We are well placed to undertake a significantly increased pace of execution in the coming years, in line with our customers' expectations.

The company has seven manufacturing and assembly facilities across India and one assembly facility each in UAE, Indonesia, Bangladesh, and Saudi Arabia. Any plans of increasing manufacturing and assembly facilities in FY 2023-24 and Capex investment in greenfield and brownfield expansion?

Consistent with increased demand for ion exchange resins, we have planned a greenfield expansion project for manufacturing world-class ion exchange resins in Roha, Maharashtra. The state-of-the-art manufacturing facility will also be aligned with internal sustainability goals and environment quality management practices.

Exports contribute around 29% of total sales to Africa, Japan, Middle East, Russia, South East Asia, Europe, UK, USA, Canada, and neighbouring countries. Are you looking to enter the South American and Australian market?

For nearly three decades we have built a favourable position as a reliable exporter of quality ion exchange resins, water treatment plants, chemicals, and services. The plan is to further consolidate our position in these geographies and increase business volume with existing and newer products and technologies, all backed by efficient after-sales-service in these regions. In the current year, we have formed a European subsidiary for penetrating the European market as part of our sustainable growth strategy.

R&D activities undertaken in FY 2022-23 and plans for FY 2023-24?

The state-of-the art R&D and technology centres manned by scientists and technologists have been the strength of our company since 1965. Apart from synthesis of new chemistries, polymers, formulations, R&D centres have developed specialty water treatment chemicals using green chemistry thereby offering our customers in India and abroad environment friendly products meeting their sustainability ESG goals.

Our technology centre has developed several engineering products and processes for separation, purification, and concentration using novel membranes, ion exchange resins, adsorbents and thermal evaporation processes benefitting a large number of industries. Some of these exciting commercialized technologies include Zero B Hydrolife range of alkaline water purifier machines, standardized range of state-of-the-art high purity water system for artificial kidney dialysis, the Quencher series of Bottling plant – an innovation that fulfils the processing need to replace plastic with glass bottles for hospitality industry.

Company's future strategy focuses on three pillars: Increasing export volumes for resins; Newer chemistries and formulations; Capacity expansions to meet increased demand in local and international markets and increasing market share in domestic markets with 'Make in India' and China + strategy. How are you planning to move in this direction?

We are excited by the success of world-class membranes (UF, RO, and NF) supplied from state-of-the-art manufacturing facilities in Goa to a large cross-section of customers including OEMs. With earlier than planned capacity expansion we are now aiming to further increase our market share in India and to export membranes to geographies where we have local presence. We will also continue to improve operation efficiency and operational throughputs along with various capacity expansion plans to take advantage of the China+ strategy.

CSR projects executed in education, health, and hygiene in FY 2022-23 and plans for FY 2023-24?

Ion Exchange is committed to sustainable development and through its CSR arm – Ion Foundation, has been engaging in various social and community initiatives in the health, water, education, women empowerment, agriculture sectors over the last many years. These initiatives undertaken directly by the company and also through various organisations, are majorly spread across Maharashtra, Telangana, and Gujarat. In FY 2022-23, our activities included providing equitable, inclusive, high-quality and sustainable education through various initiatives focussed on education infrastructure, innovative learning methodologies, supporting NGOs for the Science on Wheels program, providing after-school support and scholarships, to name a few.

On the healthcare front, our CSR initiatives aim at providing quality and affordable healthcare services. We have been supporting the Indian Red Cross Society, a unique humanitarian organization that plays a pivotal role in providing safe blood transfusion services to patients suffering from Thalassemia Major. Last year, we helped support almost 6,000 patients through our initiatives.

We also continued to provide safe drinking water to various schools/residential care units for the underprivileged/disabled people in states of Maharashtra, Gujarat, Tamil Nadu, and Delhi by setting up RO water plants across urban and rural communities. Initiatives planned will focus on Sustainable Development Goal 6 (SDG 6) and include providing adequate access to safe drinking water in high-water-risk communities or households; improved hygiene, and sanitation practices. The key objective will be to benefit close to one lakh people directly and indirectly by March 2024.

When are you planning to achieve net carbon zero and plans for achieving it?

We have definite plans for investments to become net carbon zero by the year 2032. This includes sustained transition from use of fossil fuel to renewable, maximizing use of alternate sources of water. ■

DEVELOPED A SPECIALTY PRODUCT ‘SOLAR GRADE NITRIC ACID’

Deepak Fertilisers and Petrochemicals Corporation Ltd (DFPCL), the largest manufacturer of isopropyl alcohol (IPA) in India, is planning to introduce other pharmacopeial grade solvents apart from IPA which are being used in the pharma industry

SHANMUGANANTH M.
PRESIDENT
INDUSTRIAL CHEMICAL
DFPCL

What is DFPCL's role in India's growth story and sectors that you are focusing on?

Deepak Fertilisers and Petrochemicals Corporation Ltd (DFPCL) plays a significant role in India's growth story, particularly in verticals like petrochemicals, fertilisers, industrial chemicals, specialty chemicals, and solar and semiconductor manufacturing. As a leading producer of industrial chemicals and fertilisers, DFPCL is well aware of the challenges facing these industries. We are a top producer of nitric acid, isopropyl alcohol (IPA), food-grade liquid carbon dioxide, and ammonia. Additionally, as mentioned earlier, we have developed a specialty product called Solar Grade Nitric Acid to be used by the PV cell manufacturers, and are planning to introduce other pharmacopeial grade solvents apart from IPA, which are being used in the pharma industry.

How is DFPCL contributing to the growth of India's pharmaceutical industry?

India is fast emerging as a global pharmaceutical hub, and we showcased our abilities during Covid-19 when the world was looking towards us to meet the vaccine requirements. To secure India’s future as global pharma leader and ensure safety of human health, the need of the hour is to manufacture safe and high-quality drugs. Safety and quality of drugs largely depends on the solvents, excipients, intermediates, and other substances used in manufacturing the formulation and API both, as well as other parameters like stringent quality control, certification, etc. The drug manufacturers must use materials only of recognised pharmacopeial grades (Indian Pharmacopoeia, US Pharmacopeia, EU Pharmacopeia, etc.). In India, as the largest manufacturer of IPA, the most used solvent in the pharma industry, we are capable of supplying any pharmacopeial grade IPA to support the requirement of the pharma industry. We are also planning to introduce other pharmacopeial grade solvents apart from IPA which are being used in the pharma industry. Keeping in mind the importance of safety of the end customer, DFPCL’s increased focus on pharma grade IPA shows its long-term commitment to the wellbeing of the end user.

Looking at the emerging opportunities at sectors like stainless steel and scope for enhancing customer value, DFPCL is planning to launch one-of-its-kind specialty offering exclusively for the sector

What is the link between downstream industries (agro, explosives, and specialty chemicals) and India's economic growth, and how does DFPCL aim to

contribute to the "Atmanirbhar Bharat" mission through innovative products?

Looking at these downstream industries closely, it is evident that these industries are directly linked to India's growth story. Agro products are essential for food security of the growing nation. With economic development, both quality and quantity demand for food has increased. To secure this food availability, the role of fertilizers and other value-added products are undeniable.

Explosives are majorly consumed by the mining sector and infrastructure sector. Coal, metals, cement, etc. are the most important sectors for growth of the economy and heavily dependent on mining activity. Increased disposable income and growing urbanization continues to play a role in the growth of the Indian economy. This in turn is one of the key drivers for new solutions and in turn growth for specialty chemicals. India ticks many boxes that are required for growth of specialty chemicals, with the biggest potential being a large market.

The opportunity that the specialty segment offered made it exciting for us to venture into this sector. DFPCL's legacy of leadership and delivering 'value to our customer' ensures that we are always thinking about innovative product ideas which are key to customer value creation. This also resonates well with the government 'Atmanirbhar Bharat'.

Emerging opportunities for DFPCL in solar, stainless steel, pharmaceutical, and semiconductor manufacturing sectors in India? How is DFPCL addressing the specific needs of each sector with its innovative and specialized products?

In the last few years, India has emerged as a solar power leader across the globe. However, despite having a large chunk of solar instalments, India's presence in PV cell manufacturing is very low. The Indian government recently launched the PLI scheme to attract investment in this sector and launched programs like 'National Programme on High Efficiency Solar PV (Photovoltaic) Modules'. According to estimates the Indian PV cell manufacturing capacity will soar from 4 GW in FY 2021 to about 35 GW by FY 2026. DFPCL sees a huge opportunity in this sector and to enable the sector to design one-of-its-kind specialty products - Solar Grade Nitric Acid. PV cell manufacturers can use this product to get more efficiency out of PV cells. The stringent quality measures and use of very high-quality materials is helping DFPCL in becoming the preferred supplier for PV cell manufacturers.

Looking at the emerging opportunities at sectors like stainless steel and scope for enhancing customer value, DFPCL is planning to launch one-of-its-kind specialty offering exclusively for the sector. This will be an innovative product for this sector in our country.

Like the solar sector, as India tries to establish its credentials as a hub for semiconductor manufacturing, DFPCL is ready to play a role as a partner to the sector in its growth. The company is working on an array of specialty products which will address the specific needs of this industry and help with our self-sufficiency narrative on a world stage.

The company is planning the demerger of the Mining Chemicals and Fertilizer Business. What's the update on this front?

In December 2022, Smartchem Technologies Limited Board of Directors authorised a corporate restructuring plan to maximise the growth potential of its businesses. The demerger was necessary to significantly improve customer experience, increase market share, and develop a sustainable brand. Both TAN and Crop Nutrition businesses have grown to a strategic size and importance that deserve standalone corporate identities and focused leadership in terms of growth trajectory and value creation. The strategic flexibility needed to promote long-term growth and value creation for the end users, employees, and other stakeholders will be provided by this demerger.

On January 25, 2023, the National Company Law Tribunal, Mumbai Bench (NCLT) admitted the composite scheme of arrangement filed by the company's subsidiaries, Smartchem Technologies Limited, Deepak Mining Services Private Limited, and Mahadhan Farm Technologies Private Limited. The company will abide by the NCLT's directives in due course.

Major CSR initiatives being undertaken by DFPCL in FY2022-23?

Through the Ishanya Foundation (IsFon), DFPCL has been supporting holistic rural development and empowering communities in the areas of dairy development, health, vocational training and income creation initiatives for the past 15 years with a focus on women's empowerment. By acting as an effective catalyst in DFPCL's geographies of operations, Ishanya Foundation is creating a self-reliant and respectable society with a secure and sustained means of livelihood through employment skills and resource support. In FY23 alone, Ishanya Foundation's community development initiatives touched the lives of almost 33,000 people across all locations.■

STRENGTHENING R&D CAPABILITIES WITH A NEW AGRO LAB AT IIT

The company initiated the implementation of SAP ERP across Rossari Group and completed SAP implementation by April 2023

SUNIL CHARI
CO-FOUNDER & MANAGING DIRECTOR
ROSSARI BIOTECH LTD.

2023 global trends in Home, Personal care and Performance Chemicals (HPPC); Textile Specialty Chemicals (TSC); and Animal Health and Nutrition (ANH)?

The global specialty chemicals market size was valued at US $616.2 billion in 2022 and is anticipated to witness a compounded annual growth rate (CAGR) of 5.1% from 2023 to 2030. The growth of specialty chemicals is also attributed to the growing demand from construction, water treatment, pharmaceuticals, food & feed additives, and flavors & fragrances, among others. The demand for flavoring agents has increased as processed food and beverages have become more popular in developed nations. Further, rising customer preference for novel flavors and fragrances in food products is estimated to contribute to the market growth.

Home and Personal Care Chemicals registered a 5% CAGR in 2022 to 2023, HPCC sector is the fanciest growing sector in the modern world, Textile Specialty Chemical is anticipated to observe a CAGR of 4.7% from 2022 to 2030; and Animal, Health and Nutrition is expected to register a CAGR of 8.8% from 2023 to 2030.

> Our Dahej facility became fully operational in FY 2021-22. No major Capex incurred in FY 2022-23. We have planned some small Capex in FY 2023-24 for projects in AHN and Textile division

Key milestones achieved by Rossari Biotech during FY 2022-23? Performance of HPPC, TSC, and AHN in FY 2022-23 and plans for FY 2023-24?

One of the key milestones achieved during the year was unlocking the synergies through our acquisitions of Unitop Chemicals and Tristar Intermediates along with the investment in Romakk Chemicals which were done in FY 2021-22. This has not only expanded our capacities but has also opened up opportunities for technology and knowledge-sharing, cross selling of products, development of new product lines in adjacent Specialty Chemicals divisions as well as expansion of customer base and target geographies. Our acquisitions are expected to strengthen Rossari's position in the Indian Specialty Chemicals space and unleash our full potential.

During FY 2022-23, our Textile division witnessed some headwinds due to subdued demand on the back of the ongoing challenging operating environment. Our HPPC and AHN division continued their growth momentum on the back of new products, customers, and geographies.

We remain optimistic that a stabilized macroeconomic environment will drive long-term sustainable growth and enable us to deliver a stronger performance in the future. We have been prudently expanding

our business with a focus on products with better margins. We are now seeing some stabilization in the market. As the operating environment stabilizes, we believe we are well-equipped to pursue high-growth opportunities, given our comprehensive product offerings, flexible capacities, and R&D capabilities and we look to continue with our growth plans in the coming quarters.

Revenue mix for within India and outside India in FY 2022-23? Do you see any change in FY 2024-25?

About 75% of our total revenue is contributed by customers within India and 25% by customers outside India. We are continuously expanding our footprints globally across all our business verticals. Going forward we expect that contributions from customers outside India will show growth momentum.

How has synergistic acquisitions and strategic investments helped Rossari Biotech? How are you planning to leverage it moving forward?

These acquisitions have ensured a greater synergy and additional dimensions like larger international exposure, pooling of related technologies which increased our technical capabilities, and an expanded product portfolio. The acquisitions have further strengthened our positions in Home, Personal Care, and Performance Chemicals with addition of new sectors of Agrochemicals, Oil & Gas, Preservatives, and Aroma Chemicals. Going forward we are planning to further scale up the cross-selling opportunities backed by an enhanced product portfolio, increase our presence in the new and existing geographies, access new technologies, and create sustainable value for all stakeholders. We envision our acquisitions to provide us with greater knowledge, expertise, and complementary growth dimensions for us to prosper together.

Are you looking at any new acquisitions/strategic investments in FY 2023-24? Verticals where you are focusing?

We keep exploring acquisitions/ investment opportunities within our core chemistries.

Capex investment incurred in FY 2022-23 and projects where it was invested? Capex plans for FY 2023-24?

Our Dahej facility became fully operational in FY 2021-22. No major Capex incurred in FY 2022-23. We have planned some small Capex in FY 2023-24 for projects in AHN and Textile division.

Company is focusing on green & sustainable chemical solutions. How will this impact the company's topline and bottomline and new areas that the company is focusing on?

Sustainability for us is a way of creating a massive change. It is about making choices keeping long-term perspectives of business, society and the environment in mind. We aim to deliver sustainable products to our customers backed by a sustainable business model. Our dedication toward sustainability is reflected in our customised, environmentally responsible, and cost effective solutions on the operational front that we constantly keep working on. As a domestic market leader in creating environmentally friendly products across all categories, we have campaigned for sustainable procedures and green chemistry as an organisation right from our outset. We believe this will be an important growth lever for us in the future as sustainable competitive advantage takes centre stage.

In surfactants, our focus continues to be on Bio-degradable and greener products. We are also looking at Bio-surfactants where SOPHOROLIPID and RHAMNOLIPID are the focus areas. In Agro, the focus is on developing surfactant formulations which are greener and also

developing formulations which are based on a combination of technicals.

How is the company strengthening its in-house R&D capabilities to expand innovative and customized solutions for customers? New products expected from innovation funnel in FY 2023-24?

We are constantly trying to innovate and develop products that meet our customers' evolving requirements without disturbing the balance between the business, society, and environment. We are targeting new product formulations and the adoption of advanced technologies to create sustainable value. Rossari believes in being innovative and agile and providing customised services to customers. Our knowledge of our four pillars of chemistry and innovative product formulation is what has kept us ahead of the curve. Consequently, our R&D lab at IIT Bombay focuses on product development in these lines. With the acquisitions, we have strengthened our R&D capabilities with the addition of a new agro lab at IIT facility in addition to the existing R&D facility at Unitop, Dahej.

Products under development include: Enzymatic Bio scouring - To drive the sustainability concept and reduction with utilities; One bath dyeing of Polyester/ cotton blends, saving time and increasing productivity; Eco friendly substitute of Soda ash, a big boon to the industry reducing the BOD/COD levels drastically; Plant based softener; Antibiotic replace growth promoters; and Vitamin encapsulation products.

We are planning to further scale up cross-selling opportunities and increase our presence in the new and existing geographies

Level of automation and digitalization carried out in FY 2022-23? How do you plan to move ahead on brownfield and greenfield projects in FY 2023-24?

In FY 2022-23, the company has initiated the implementation of SAP ERP across Rossari Group and completed SAP Implementation by April 2023. This will help us in better integration within entities, better planning & reporting, and enabling faster decision making. Our Dahej facility which got operational in FY 2021-22 is a state of art, highly automated facility. Going forward, we will endeavour to bring in newer technologies and high levels of automations in all our new projects.

Key sustainability initiatives started by the company?

At Rossari, we believe sustainability is the key to a better and safer future and we strive to take a holistic approach towards it. This approach testifies Rossari's commitment to providing a balanced tomorrow, built on a sustainable environment through strategic business activities. Some of our initiatives undertaken in this direction include: Introducing green chemistry through relentless efforts of 'Greenovation'; Enhancing human wellness with innovative solutions; and addressing environmental issues through sustainable business activities by installing solar capacity in the

Silvassa Plant of 50 KWP. The company started using 'Bio-Fuel' instead of 'Light Diesel Oil' which is used for Boiler, Thermic fluid heater, and Incinerator. Further we are planning to set up 100 MV solar panels across our plants and have installed aircon devices to reduce energy consumption in air conditioning units. Further, we are also planning to plant 5,000 trees in the specified area allocated by GIDC at Dahej.

When is Rossari Biotech planning to achieve Net Carbon Zero and milestones set up by the company?

As a responsible corporate citizen, we have implemented environmental management systems across our organisation as a step towards environmental conservation. We examine the environmental impact of all our actions on a regular basis and create continuous improvement objectives and targets. These are closely monitored on a regular basis to ensure their achievement at the individual and corporate levels.

Some of our initiatives undertaken in this direction include: Moving towards sustainability by ensuring carbon abatement and absolute carbon reduction; No releasing of hazardous emissions or pollutants at both Silvassa and Dahej plants throughout the production process; Both facilities conform to Zero Discharge of Hazardous Chemicals (ZDHC) foundation and Global Organic Textile Standards (GOTS); and The stack monitoring data represent low carbon footprint of GHG generation at production sites.

CSR projects executed in FY 2022-23 and plans for FY 2023-24?

In FY 2022-23, the company has majorly focused its CSR activities towards the area of medical healthcare and support and has contributed to Rotary Trust Mulund South which undertakes Pediatric Heart surgeries for underprivileged children born with congenital heart diseases. The other major project of the company was contribution to Tata Memorial Hospital for marginalized patients suffering from Hematolymphoid Malignancies which are primary cancers of blood, bone marrow, and lymphoid organs associated with high mortality.

The company also contributed to Rotary Club of Deonar who has arranged to set up about 10 MultiPara Monitors in the neonatal unit of Lokmanya Tilak Municipal Medical College and General Hospital (Sion Hospital). The Neonatal Intensive Care Unit (NICU) of this Department provides yeoman services to sick and preterm newborn babies born in the hospital as well as those referred from outside for specialized care.

For FY 2023-24, we continue to focus on medical healthcare and support, education support, human life upliftment and support, animal health and welfare, sports support, protection of heritage, art and culture, and environment protection in consultation with the CSR Committee. The CSR Committee is actively involved in the selection of the project and evaluating its impact on the society as a whole. For FY 2023-24, the company will ensure that the CSR funds are utilized in an optimum manner that uplifts the weaker sections of the society. ■

NOTES

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PLANNING CAPEX OF RS. 250 CRORE IN FY 2023-24

Our team has developed several API intermediates for which we will consider setting up manufacturing facilities and commercial production in coming times

ANKIT S. PATEL
EXECUTIVE DIRECTOR
BODAL CHEMICALS LTD.

What are the global trends in Dyes Intermediate, Dyestuff, Sulphuric Acid, Chlor-Alkali, and Pharma sector in 2023?

India's Chemicals and Petrochemicals (CPC) industry is one of the most critical and indispensable industries and a consistent GDP contributor. The ship of growth has started its journey from ashore towards a sea of unrealized potential on the backdrop of amenable government policies and initiatives and ever-rising demand and strong markets. This extremely diversified industry is transforming into a powerhouse, providing a fertile ground for stakeholders to grow and thrive.

Talking of global trends, global inflation is weighing heavily on the end market textile, paper, pharma, plastic, agrochem, water treatment, etc. Consumption of end users' industries has been sluggish due to overall slowdown in the global market. Uncertainty about the European market has further decelerated the demand scenario of the chemical industry. When it comes to China, the policy of zero covid has slowed the economic growth for a while.

The global sulphuric acid market reached a volume of almost 284.4 million metric tons in 2020. The industry is further expected to grow at a CAGR of 1.5% between 2023 and 2028 to reach a value of almost 311 million metric tons by 2026. The major drivers of the industry such as the rising population, increase in fertilisers and chemical industry, the rising demand for the developing regions, and the increase in the demand from major consuming industries like agriculture are expected to aid the market growth.

Chlor Alkali business will continue to perform well and will contribute meaningful business in the coming period. We foresee demand for Caustic Soda to remain healthy from FMCG, textile, and paper industries. The global Chlor Alkali market size grew from US $74.34 billion in 2022 to US $80.35 billion in 2023 at a compound annual growth rate (CAGR) of 8.1%. The Russia Ukraine war disrupted the chances of global economic recovery from Covid-19 pandemic at least in the short term. The war between these countries has led to economic situations in multiple countries, a surge in commodity prices, and disruption in supply chain causing inflation across goods and services, and affecting many markets on a global level.

The Saykha greenfield project is progressing well and is expected to start by December 2023

Key milestones achieved by Bodal Chemicals during FY 2022-23? Performance of different divisions - Basic Chemicals, Dyestuff, Dye Intermediates, Caustic Soda, and TCCA? Plans for FY 2023-24?

Milestones achieved during FY 2022-23: The company has successfully completed the technology upgradation of the Rajpura Chlor Alkali unit. The company can now meet the increased Caustic Soda

demand for the north India market and also cut energy costs owing to the technology upgrade. This will establish the company for the next growth phase and strengthen its Chlor Alkali chemical market position.

Performance of different divisions: Overall business performance for 9M FY23 has been weak with total revenue of Rs. 1,178 crores, a de-growth of 20% on a YoY basis. Consumption of end user industries has been sluggish due to overall slowdown in the global market. Uncertainty of the European market has further decelerated demand for the chemical scenario of the chemical industry. Revenue contribution from dye intermediates chemical stood at Rs. 258 crores in 9M FY23.

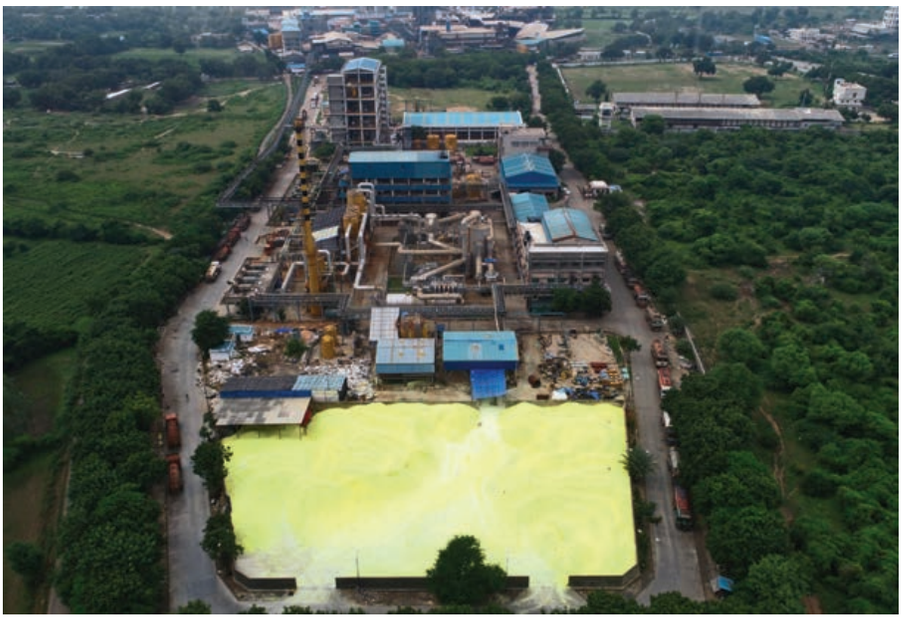
Coming to our dyestuff business end application industries like textile, leather, paper, and other dyestuff consuming industries have not been performing well during the last few quarters. The dyestuff business for nine months FY23 stood at Rs. 442 crores.

More than 50% of our basic chemicals are captively used for dye intermediates. Overall basic chemicals contributed around Rs. 134 crores. Chlor Alkali business performed reasonably well with a revenue of Rs. 229 crores for the nine-month FY23.

Plans for FY 2023-24: Completion of greenfield Saykha project and addition of Benzene downstream products at Saykha Location. We anticipate significant quantity growth in Chlor Alkali business after the successful completion of technology upgradation at our Punjab plant.

How have three subsidiaries - BCTPL, Sen-er Boya, and BCL China performed in FY 2022-23? Plans for FY 2023-24?

Most of our subsidiaries have reported a weak performance due to a soft demand except for Sener Boya which has reported total income of Rs. 56 crores in 9M FY23 and has reported noteworthy profitability. Performance of other subsidiaries has been lower than expected due to soft demand.



Plans for FY 2023-24: Due to a severe earthquake, Turkey is disturbed and that will not allow us to do growth at Sen-er Boya. At the same time in the initial part we have to struggle for breakeven. No significant improvement is expected at other subsidiaries due to soft demand worldwide.

Revenue mix within India and outside India in FY 2022-23 and do you see any change in revenue mix in FY 2024-25?

Total revenue stood at Rs. 1, 178 crores for 9M FY23.This Included exports of 33% and domestic sales of 67%. We do not expect any significant change in revenue mix.

Capex investment incurred in FY 2022-23 and projects where it was invested? Capex plans for FY 2023-24?

For Punjab Rajpura Plant, we spent about Rs. 150 crore as far as acquisition is concerned and another Rs. 160 crores we spent for modernization and capacity expansion as well as some normal replacement Capex. In toto, we spent a total about Rs. 310 crores in Rajpura Plant.

The company has invested a Capex of Rs. 270 crores during FY 2022-23 and plans to spend Rs. 250 crores during FY 2023-24.

What's the update on the Saykha greenfield project for manufacturing Benzene Derivatives and when are you planning to restart the Sulphuric Acid & Derivatives project?

The Saykha greenfield project is progressing well and is expected to start by December 2023. Civil structure is almost completed and detailed engineering of the process plant is also completed. Major machineries have already been ordered and start deliveries of the same by June 2023. Project is going as per revised schedule.

Currently, we have put the Sulphuric Acid & Derivatives project on hold seeing the present situation. Overall demand for Dyestuff and dyes intermediates is not good considering the current global situation. Once we have decent visibility of demand for our product portfolio and the new site is stabilized, we will restart the Sulphuric Acid project.

How is the company strengthening its in-house R&D capabilities to expand innovative and customized solutions for customers? How many new products are expected from your innovation funnel in FY 2023-24?

We have modern well-equipped in-house laboratories for testing and continuous improvement of existing products, particularly to inspect the quality. Our R&D team has been working on process reengineering and downstream derivative products based on Benzene chemistry. As a result, our laboratories are actively evolving in Chlorination, Nitration, and now Benzene chemistry. Our team has developed several API intermediates for which we will consider setting up manufacturing facilities and commercial production in coming times.

Level of automation and digitalization projects carried out in FY 2022-23? How do you plan to move ahead on this front both on brownfield and greenfield projects in FY 2023-24?

In upcoming projects at Saykha Gujarat, Bodal has acquired state-of-the-art technologies for Nitration reaction from Germany and Crystallization from Switzerland. This technological upgradation has allowed us to venture into an arena where automation and digitalization holds paramount importance because of the critical nature of such operations. This will ensure high quality products and services to our customers.

Key sustainability initiatives started by the company?

We have restructured our safety functions and enlarged their role as Environment, Health, Safety & Sustainability (EHSS) Function. We are reducing our environmental footprint, conserving natural resources and managing waste is the key to our circular economy approach. Some of our pollution control systems include Effluent Treatment Plant (ETP), Brine Treatment Plant (BTP), Multiple Effective Evaporator Plant (MEE), and Effluent Spray Dryer Plant (ESDP). The company has taken various environment friendly measures in its different units for promoting a better environment.

> We have put the Sulphuric Acid & Derivatives project on hold seeing the present situation

When is Bodal Chemicals planning to achieve Net Carbon Zero and milestones set up by the company to achieve it?

Technological advancements, across the globe, have opened new avenues for aspiring economies like India to ensure a more sustainable work ecosystem, be it in chemicals, textiles, power, etc. So this opportunity has been grabbed by Bodal Chemicals as well. By virtue of imbibing newer and greener technologies like Nitration and Crystallization, Bodal is on its way to becoming a minimalist contributor in carbon footprints in short version. However, as a firm believer in sustainable and reciprocating business, Bodal management is committed to becoming zero carbon emitter in times to come. And, for this, we promise ourselves to improve upon every day to fulfill our vision in order to create a win-win situation for the country and this universe at large.

CSR projects executed in FY 2022-23 and plans for FY 2023-24?

Corporate Social Responsibility (CSR) is a mirror that reflects the company's internal workings from outside. The fundamental goal of Bodal's CSR programme is to create social value via activities in the area of healthcare, education, infrastructure development, sports promotion and social concerns. Major CSR activities undertaken by the company are in the areas where the company's manufacturing plants are located.

The CSR activities undertaken during FY 2022-23 are: Promoting healthcare and sanitation; Drinking water facilities; Conducting of regular health check-ups; and Promoting sports and individual talents in various fields. Further, the company as a whole will be continuing with several future initiatives under the CSR program directly as well as through different agencies. ■

CREATING INNOVATIVE AND SUSTAINABLE SOLUTIONS FOR CUSTOMERS

We are right on track to generate additional sales of more than €1 billion with our innovation growth fields by 2025

VINOD PAREMAL
PRESIDENT & MANAGING DIRECTOR
EVONIK, INDIA SUBCONTINENT

What are the global trends in specialty chemicals in 2023?

Last year, the effects of the Ukraine war, high inflation, and fluctuating energy prices brought significant challenges to our operations and also the chemical industry, and they still do. At Evonik, we are cautiously optimistic for 2023. Much will depend on how sustainably energy prices and inflation will soften and how strong the recovery of the global economy is going to be, especially with respect to China. In the first quarter of 2023, in particular, the negative trend of the second half of 2022 continued. From the second quarter onwards, the situation is likely to gradually improve.

Amid the headwinds, the industry is pressing on with its transformation towards sustainability. So is Evonik. With our next phase of strategic transformation, we have fully and systematically integrated sustainability into all elements of our strategy. We are executing targeted and massive investments in green growth and making sustainability our central innovation driver. In this context, we are strengthening our sustainability portfolio and reducing our footprint by cutting emissions from production and processing.

Evonik's R&D centre would also play a role in tapping the needs of the Indian market and developing products to suit the specific requirements of Indian customers

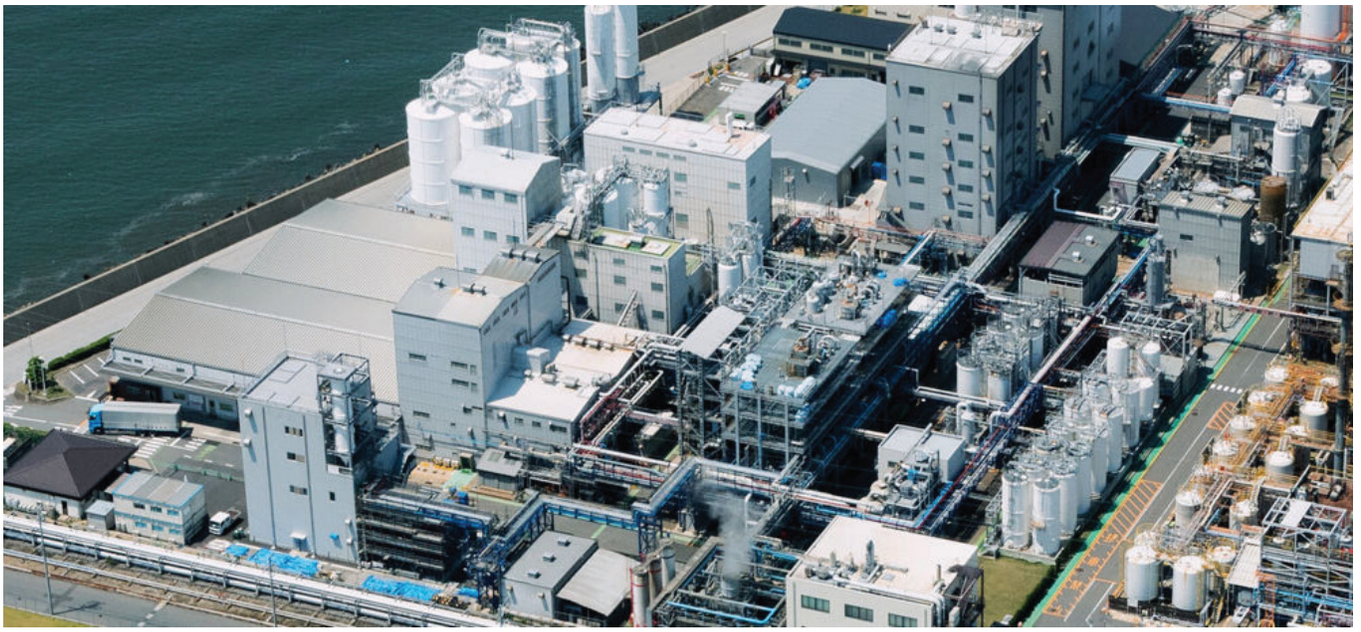
Evonik India's performance in FY 2022-23? List the key achievements for Specialty Additives, Nutrition & Care, Smart Materials, and Performance Materials division in FY 2022-23?

Evonik's India cluster had a strong growth in FY 2022–23 compared to FY 2012–13, with robust performance across the Specialty Additives, Nutrition & Care, and Smart Materials divisions, and steady performance in the Performance Materials division.

Globally, Evonik is focusing on transformation through sustainability and profitability. What's your strategy for India and how are you making it a reality? Sustainability is a central element in Evonik's purpose 'Leading Beyond Chemistry'. Evonik India sustainability plans for FY 2023-24?

Evonik goes far beyond chemistry to create innovative, profitable, and sustainable solutions for customers. As a specialty chemicals company with presence throughout the world, Evonik sees sustainability and long-term business success as two sides of the same coin.

In line with Evonik's sustainability approach, our endeavour for India assets is to reduce carbon footprint by significantly cutting greenhouse gas emissions from



production and processing. Also, in India, we are exploring ways to utilise available bioresources to improve the sustainability of our products. The inauguration of the Zero Liquid Discharge Plant at our Dombivli (Maharashtra, India) site last year is evident of how we accept responsibility for our businesses, our employees, the environment, and society.

Further, in India, we can also play an enabling role in the country's sustainable journey by providing solutions to our customers and industry. The so-called Next Generation Solutions from Evonik not only make our customers' products more sustainable but also help them improve their climate footprint.

For example, in line with India's net zero target by 2070 and 500 GW renewable energy target by 2030, the Sustainable Alternative Towards Affordable Transportation initiative, Evonik is supporting our customers by providing sustainable products and solutions like Sepuran Green membranes for Bio-CNG applications, CAPLUS for CO2 removal, Vestamin IPD for wind turbine applications, etc.

Evonik is making targeted investments in six defined innovation growth fields that promise high returns. Please explain?

Our innovation portfolio focuses on six growth fields, which are assigned to our growth engines in highly attractive markets with above-average growth rates. The six growth fields are: Sustainable nutrition for livestock and people; Healthcare solutions; Health-enhancing substances and nutritional supplements; Gas separation membranes; Cosmetics solutions; and products for additive manufacturing.

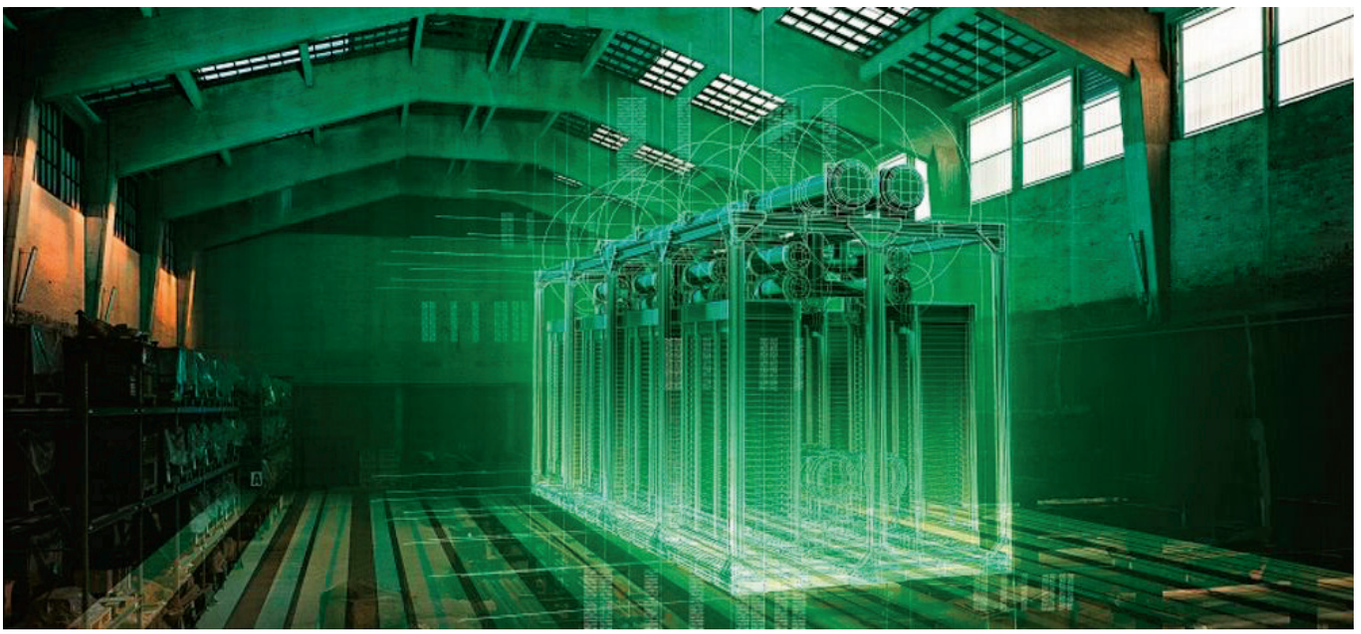
We are right on track to generate additional sales of more than €1 billion with our innovation growth fields by 2025. Sales from these innovation growth fields rose more than 20 percent last year to €600 million.

> We are exploring sourcing of renewable energy for our production assets in India. We are also evaluating the utilization of biomass as an energy source to further reduce scope 1 and 2 emissions

The company has set a goal of investing more than €3 billion in the growth of Next Generation Solutions by 2030 in order to increase their share to more than 50 percent. Areas where you are investing?

Next-Generation solutions are products with superior sustainability benefits. That includes, for example, drug delivery technologies for controlled release of pharmaceutical active ingredients, gas separation membranes for biogas and hydrogen, as well as natural-based active ingredients for cosmetics. Examples of investments include: Battery materials: We have opened a new research centre for lithium-ion batteries in China. In Japan, we are expanding production capacity for alumina for the battery market; Biodegradable surfactants: Production plant for biodegradable surfactants is being built in Slovakia; and Pharmaceutical lipids: In the USA, we have just begun construction of a plant for pharmaceutical lipids required for mRNA-based medicines.

Do you see an increased role of Evonik India's R&D centres in the global scheme of things? New areas



where you would be focusing?

India is the 5th largest economy in the world. With the pace at which the economy is growing and also with the impact of the budget for 2022–2023, domestic demand is also expected to increase. Under these circumstances, Evonik's business is expected to grow at a good rate. With most of our products being technology-driven, I would definitely expect Evonik's R&D centre to play a very important role in areas of new product and technology development. Evonik's R&D centre would also play a role in tapping the needs of the Indian market and developing products to suit the specific requirements of Indian customers.

The Research Centre India (RCI) was established in 2002. RCI is Evonik's Oral Competence Centre, providing global support in formulation development for the pharmaceutical, nutraceutical, and food industries. RCI has been identified as a differentiator by continuously enhancing its competencies and footprint to support the global health care business.

Aligning with this centre is the Catalyst R&D facility at Dombivli, located in the industrial corridor on the outskirts of Mumbai. Catering to regional and global customers across varied industries such as pharmaceuticals, agro, fine chemicals, food, and edible oil, this site supports the product line Life Sciences and Performance Catalysts, which comprises oil and fat hydrogenation catalysts, precious metal catalysts, and activated metal catalysts.

Over the last two decades, the R&D centres in India have played an important role at a global level in delivering new products and technologies. The potential of the Indian technical talent pool has been acknowledged over the years. I feel confident that the role of Evonik's R&D centres will become even larger over the coming years, and organic synthesis will also be a focus in India, along with Oral and Catalyst. The focus will be on next-generation solutions with clearly positive sustainability benefits that are above the market reference.

Important step in the sustainable transformation is the rapid overhaul of energy supply. What's your India strategy with respect to purchasing green/renewable electricity and how are you making it a reality?

We are exploring sourcing of renewable energy for our production assets in India. We are also evaluating the utilization of biomass as an energy source to further reduce scope 1 and 2 emissions.

CSR initiatives planned for FY 2023-24?

We are deeply committed to improving the social environment in any way possible and consciously reach out to support causes across the board, primarily in the realms of children's education, women's empowerment, and healthcare. In 2023, we are entering into a partnership with CARE India to support the STEM education of girls from underprivileged areas. Evonik will support the setup of seven vibrant STEM learning spaces called the "innovator's laboratory". These are community-level tinkering spaces for children to build STEM thinking skills using digital and non-digital tools. Also, onsite mentoring, community events, and student-driven projects will be organised to improve the science, mathematics, and digital literacy skills of girls. ■

OFFERING SOLUTIONS IN PRODUCTION, PROCESSING, AND RECYCLING

We are planning to double the size of our facility in Vadodara to cater for increased volume of rotor grinding, pelletizer assembly, pump skid assembly, and overhauling of pumps

BONAFEDE CLAUDIO
MANAGING DIRECTOR
MAAG IFI

KIRAN PARMAR
GENERAL MANAGER
MAAG INDIA

Describe about MAAG Group and its area of operations?

The MAAG Group is solution provider for customizable systems and integrated solutions in process technology for the Polymers, Chemicals, Petrochemicals, Pharmaceuticals, and Food industries. We offer customized product solutions and services from a single source to maximize your performance and create a competitive advantage. All the components, products, and systems of our product brands AMN, Automatk, Ettlinger, GALA, MAAG, Reduction, Scheer, Witte and Xantec are of the highest quality and deliver outstanding performance in their respective segments. Within the MAAG Group, innovation and cutting-edge technology, paired with comprehensive after-sales service, form the basis for offering outstanding solutions to meet demanding customer requirements in production, processing, and recycling.

Ongoing Petrochemicals and Chemicals plant expansion will increase demand for gear pumps for critical applications

Global size of Pumps & Process Solutions in 2023. What are the global trends in Pumps & Process Solutions?

We see the Chemicals market is growing with the CAGR of 9.2% by 2025. Ongoing Petrochemicals and Chemicals plant expansion will increase demand for gear pumps for critical applications.

Performance of the Indian subsidiary in FY 2022-23 and plans for FY 2023-24?

Maag India team was established in 2015 and since then the company has been continuously growing and providing best services in the India market.

What products/solutions are you manufacturing in India? Verticals which will benefit from this product portfolio and how?

Maag India currently focuses on

the aftermarket sales and service with a dedicated well trained service team to cater Indian customers locally. We have a state-of-the Haas CNC machine for rotor grinding which is in line with the highest quality performance provided by Maag globally. We have localized smaller size pelletizers from size 100 mm to 300 mm for compounding and masterbatch industry. We are assembling pump skids for industrial pump and extrusion pump, where pumps are imported from the respective center of excellence and remaining parts are sourced locally.

What are your future expansion plans with respect to Vadodara facility for leveraging polymer, extrusion, industrial line filtration system, pelletizers, and underwater pelletizers? How are you planning to leverage it?

We are planning to double the size of our facility in Vadodara to cater for increased volume of rotor grinding, pelletizer assembly, pump skid assembly and overhauling of pumps. Additional capacity will increase our supply strength and reduce significant lead time.

How will this expansion plan lead to additional synergy within the MAAG group portfolio and how do you plan to leverage it?

Certainly, this will help all our centers of excellence globally to focus more India centric on the future plans for the India market.

The company also provides downstream solutions for plastic recycling? Solution portfolio which will help in plastic recycling?

Well, recycling plastic is a growing circular economy. MAAG is providing the complete turnkey solution for recycling of plastic. With specialized continuous Ettlinger Filter, Melt Pump, Underwater Pelletizer, Strand Pelletizer & Dryer.

Our expertise in downstream equipment enables us to meet the rigorous demands of the virgin polymer industry. This is why MAAG is also regarded as an important partner to the recycling industry; delivering energy efficiency, productivity and product quality. Our solutions save resources through smart design, compact construction and durability of components.

MAAG Group's downstream equipment recycling systems help users to quickly and efficiently remove heavy contaminants such as paper, aluminum and wood to produce reusable pellets. MAAG equipment is the right choice for mechanical, chemical and advanced recycling.

MAAG Downstream Equipment recycling systems are coordinated to each other, and can be operated via our proprietary control system.

Aftermarket services being provided by MAAG Group? Are you planning to expand your team in India to cater to aftermarket services?

We already have a dedicated team for the aftermarket service, and we have plans to add more resources in the current year as well to leverage growing demand in the market. ■

SHIVA ENGINEERING SERVICES BAGS EPCM PROJECTS WORTH CAPEX RS. 2,500 CRORE

The company focuses on greenfield and brownfield plant engineering which includes plant engineering services (basic and detailed engineering), plant digitalization services (laser scanning, drone, twin), procurement support, and project & construction management

ASHISH PARIKH
BUSINESS HEAD
SHIVA ENGINEERING SERVICES

What is the overall size of Global EPC business in FY 2022-23 and what percentage comes from the Chemicals, Petrochemicals, and Energy sector? Forecast for FY 2023-24?

The global EPC (Engineering, Procurement, and Construction) market is expected to be around US $8,000 billion in FY 2022-23. Favorable government norms towards reduction of carbon emissions and increasing production of renewable energy will boost EPC market growth. With a lot of old infrastructure, the demand for redevelopment projects is expected to be high in future.

Increased government expenditure on infrastructure as well as private Capex would boost the Indian EPC sector and will have an impact on the steep increase in Capex outlay of around 32% from Rs. 7.5 lakh crore to Rs. 10 lakh crore.

Brief about Shiva Engineering Services (SES) and the kind of work that the company is undertaking for Chemicals, Petrochemicals, and Energy vertical?

Shiva Engineering Services (SES) is a leading engineering, procurement, and construction management (EPCm) and EPC company that specializes in providing turnkey solutions for various industries, including chemicals, pharma, food processing, petrochemicals, and energy. The company focuses on greenfield and brownfield project engineering which includes: Plant Engineering, Facility Master Planning, Engineering (Basic & Detailed), and Project & Construction Management.

With respect to Plant Digitalization and Management Services, the focus is on Laser Scan, Digital Twin, Drone Survey, Project Management, Architectural, Civil & Structural, LEED, Green Building, Warehouse, Safety Studies, Utility and Offsites, and Fire Protection. EPC segment focuses on Construction & Turnkey and Solar EPC.

In the Chemicals, Petrochemicals, and Energy sector, SES has undertaken several projects and provided services. The company has a team of highly experienced professionals who have expertise in their respective fields. SES uses the latest technologies and innovative solutions to deliver high-quality projects within a given timeline and budget.

SES has completed a considerable amount of work in the chemical, specialty chemical, agrochemical, paint, aroma, food processing plants, bromine & its derivatives

Key greenfield and brownfield orders bagged in the Chemicals,

Petrochemicals, and Energy sector in FY 2022-23? What's the total order value in these sectors till date?

SES has completed a considerable amount of work in the chemical, specialty chemical, agrochemical, paint, aroma, food processing plants, bromine & its derivatives, and numerous adjacent markets in India and across the globe over the past 13 years. In the fiscal year 2022–23, SES won projects worth more than Rs. 2,500 crore Capex.

SES Digital focuses on next-gen smart solutions to help industrial business leaders to grow into smart organizations. Technologies where you have gained mastery to deploy smart manufacturing? Services that you are providing to customers?

SES Digital's next-gen smart solutions focuses on Industry 4.0 and smart manufacturing initiatives with cutting-edge technologies along with our domain expertise in engineering services that helps our customers to build smart organizations. top- notch technologies like 3D laser scanning, drone survey, AR & VR tech for project reviews, helped our customers with reducing various engineering spends as well as decreasing the overall projects timelines. These technologies also helped us by providing us with market wide competitive advantages.

What's the impact of digital transformation technologies on SES? How are you helping your client?

SES is at forefront while adopting digital solutions for quality and quick delivery and helping them to operationalize their Capex cycle and investment. Some of the key solutions that we regularly use are Laser Scan and Drone Survey.

Laser Scan – They are very effective for any capacity addition, modification, debottlenecking, or brownfield project requirement. All the data related to existing plant setup can be very accurately captured using a laser scanner. This data can be used for super imposed modelling, where you can see old plants and new recommended modifications together. This helps in construction sequencing, reducing the downtime, and optimization of existing setup. We are focusing on drone survey, construction camera, 3D Modelling and VR (Virtual Reality).

Drone Survey – Contour mapping, topography survey, remote construction progress monitoring, thermography survey, inspection and many applications are associated with drones; Construction Camera – Construction progress, real time update, comparison, contractor mobilization details, security all these applications are associated with construction camera solutions. With app base interface SES helps its clients to monitor their sites remotely; and 3D modelling & VR – Visualization of your plant and immersive walkthrough and training are well known use cases of these solutions.

Are you working on sustainability and EV initiatives?

Shiva Engineering Services is working very closely with leading industrial players to develop sustainable and green infrastructure which includes green industrial building setups, solar infrastructure, recycle material process, and manufacturing plants. For example, SES is working very closely in bromine, bromine derivative manufacturing plants, PVDF films, fluorine chemistry, sustainable packaging plants, and many more.

How is Shiva Engineering Services managing sustainability and growth at the same time?

Creating sustainable value and enhancing market performance has never been more challenging. Being a company with a mission, we've integrated sustainability into our core business strategy with the goal of expanding our firm's circle of responsibility beyond just doing long-term good. Our focus on the needs of the consumer, along with technological advancements, has always given us a competitive advantage. ■

PLANNING TO INVEST OVER RS. 1,200 CRORES ON EXPANSION IN FY 24

Epsilon Carbon is installing a 500 KTPA Coal Tar distillation plant at its second site and with state-of-the-art specialty chemicals complex of import substitution products to cater several industrial applications

SAIPRASAD JADHAV
CEO & DIRECTOR
EPSILON CARBON PVT. LTD.

How would you rate the company's financial performance in FY 2022-23? What's the forecast for FY 2023-24?

Our performance for FY22-23 was as per our projections and aspirations. In FY23, we celebrated crossing the milestone of Rs. 3,000 crore topline with 23% EBITDA. Our FY23 topline is 65% more than the previous year. The continuous growth and success of our business is cemented on our robust, sustainable business model, powered by the innovation and quality of our products, and commitment of our team.

Performance of the company in different segments - Aluminum, carbon black, construction chemicals, specialty chemicals, wood preservatives, coal chemicals, tyres, mechanical rubber goods, and masterbatches in FY 2022-23. What is the future roadmap?

In FY23, we became the major exporter of solid CT Pitch globally. 40% of the Aluminum segment in India consumes our products, we integrate operations, provide uninterrupted supplies, ensure superior quality, and adhere to best industry practices for manufacturing, supply chain management, and sustainability. Our commitment to quality, stringent safety protocols and standards, ethical governance principles, and industry certified processes sets us apart in the industry.

With the projected expansion of the aluminum business as well as reduced CT Pitch availability from China, we have an opportunity for organic growth. We are installing a 500 KTPA Coal Tar distillation plant at our second site in India and with state-of-the-art specialty chemicals complex of import substitution products to cater several industrial applications other than Aluminum industry.

> We are innovating new grades of Coal Tar Pitch and Carbon Black. We are continuously working to produce high quality Carbon derivative products

Capex investment in FY 2022-23 and projects/facilities where the company invested? Capex plans for the company in FY 2023-24 and how will these investments help the company in the long term?

In FY23, we invested strategically in various projects, with Capex exceeding Rs. 525 crores, to expand our current production capacities and development of a township for our employees and their families.

For the upcoming FY24, we plan to invest more than Rs. 1,200 crores in projects like setting up a new carbon derivative complex in Jharsuguda, Odisha; to increase the

capacity of our carbon black, captive power plant at Vijayanagar; construct another new township and many more. These investments will help double our topline by FY26.

By when Rs. 550 crore projects for adding 1,15,000 - 2,15,000 tonne capacity in Karnataka will get completed? How will this project enhance the overall capacity, market share, and overall revenue of the company?

We're making good progress on our project in Karnataka, and it is projected to be completed by the first half of 2024. This will almost double our Carbon Black capacity, giving us a major share of the domestic market, and further enabling us to compete in the international market. We anticipate this project will generate revenue of approximately Rs. 900 - 1,000 crore annually. This plant will produce niche grades for high performance automobile tyres.

The company has collaborated with edible oil refiner Sri Anagha Refineries to construct molten pitch storage tanks with capacity of 10,000 metric tons at Mangalore port. Expected completion date and long-term outcomes in terms of scaling up coal tar pitch production?

Currently, we are focusing on creating India's first 'liquid CT Pitch port' for exports. The facility will be ready before the end of Q1 FY24. This port will enable us to expand our reach in international markets for our products. By leveraging the utilization of this facility, we anticipate an estimated 3 lakh MT of exports in the next five years and adding over Rs. 2,000 crores to the top line.

What are the key R&D projects under progress by the company? How will these innovations make an impact on the company's revenues?

We are innovating new grades of Coal Tar Pitch and of Carbon Black. We are continuously working to produce high quality Carbon derivative products, such as Naphthalene, Indene, Anthracene, Phenols and Cresols. These products will substitute imports in India and have the potential to significantly increase our current business revenue.

Level of automation and digitalization projects conducted in FY 2022-23? How do you plan to move ahead on this front both on brownfield and greenfield projects?

Currently, our plants are automated using DCS systems, and we have complemented this with digital solutions for greater process efficiency. We are now driving an overall organizational digitization program, in collaboration with one of the top consultants, which will enhance our existing operations and future projects and further upgrade us to Industry 4.0 level within the next 2-3 years.

CSR projects undertaken in FY 2022-23 and plans for FY 2023-24?

In FY23, we strengthened our Corporate Social Responsibility (CSR) projects in sectors like healthcare, education, sports, and infrastructure development. These initiatives have positively impacted over 3 lakh people. We plan to continue our efforts of strengthening educational infrastructure by providing basic educational amenities, drinking water facilities and digital classrooms. We are further prioritizing preventive healthcare through the Mobile Health Clinic initiative, which has impacted 32,000 individuals in 8 villages. In the coming years, we intend to extend our support to women's Self-Help Groups in the villages through livelihood interventions within the vicinity.

How is the company striking a balance between environmentally friendly policies and business growth? Key sustainability initiatives of the company across various segments?

We constantly integrate sustainability into our design & operations and the concept of circularity has been designed to ensure minimum wastage and emissions across the manufacturing facility.

Our second sustainability report was published in December of 2022 based on the Global Reporting Initiative (GRI) Standard. We have planted 47,500 trees to help minimize air pollution. We are continuously optimizing our operations and usage of non-renewable utilities like water and power which is prioritized in our consumption trends of utilities per metric

ton on a year-on-year basis.

Our company is committed to sustainable business growth, providing a secure source of captive raw materials and long-term contracts. Additionally, our manufacturing methods reduce emissions by using cleaner fuels, low Sulphur feedstocks, and zero discharge.

The residue gases produced during our process is used to generate steam and electricity in our captive power plant. This helps us to reduce our carbon footprint significantly, to the extent that our product Carbon Black has nearly 20% less footprint compared to our domestic peer industries. Also, our value-added product which is a synthetic graphite for Anode material has nearly 77% less CO2 footprint compared to peers.

Our CSR and CER goals are aligned with the United Nations' SDGs for Good Health & Wellbeing, and economic growth, zero hunger, quality education, sustainable cities and communities, clean water and sanitation, and gender equality. We have contributed to supporting the elderly, Covid-19 care, and especially abled people, as well as hospitals. Over 4 lakh lives have been benefited in the last 4 years. Quality education is another goal we are actively supporting; we have upgraded teaching & learning facilities in 4 Direct Impact Zone villages and developed model libraries which have helped more than five thousand students.

We are also working to support animal welfare trusts and restore ecological balance through afforestation and wildlife conservation. We have contributed to women empowerment, sports development, village street lighting, livelihood programs, relief funds, solid waste management programs, and many other initiatives. Our efforts towards sustainability are well recognized by many rating agencies. We are a Responsible Care logo holder and EcoVadis -Silver Rated company.

We upgraded our ISO certifications of 9001 for QMS, 14001 for EMS, 45001 for OH&SMS, 50001 for Energy Management System. Also, we are certified by IATF 16949:2016 Automotive QMS, ISO/IEC 17025:2017, ISO 27001:2013 - Information Security Management System, ISO 28000: 2022 Supply Chain Security Management which highlights our approach to data credibility and integrity. We are now preparing for SA 8000 certification, which is an international certification standard that encourages organizations to develop, maintain and apply socially acceptable practices in the workplace.

Currently, we are focusing on creating India's first 'liquid CT Pitch port' for exports. The facility will be ready before the end of Q1 FY24

When is Epsilon Carbon planning to achieve Net Carbon Zero and what are the different milestones set up by the company?

We are continuously working through various initiatives to reduce our environmental load and carbon footprint. These efforts are gauged, and monitored by doing life cycle assessment through recognized third-party experts. Currently, we are in discussion with one of the top consultants to design a long term ESG roadmap for the organization and charter a time bound milestone plan. ■

AIMING REVENUE OF RS. 1,000 CRORE IN THE NEXT 5 YEARS

Sauradip's knowledge based and solution driven approach continues to improve and change the quality of life of Indians

DR. KISHORE SHAH
CHAIRMAN
SAURADIP CHEMICAL INDUSTRIES PVT. LTD.

RAJIVE SHAH
MANAGING DIRECTOR
SAURADIP CHEMICAL INDUSTRIES PVT. LTD.

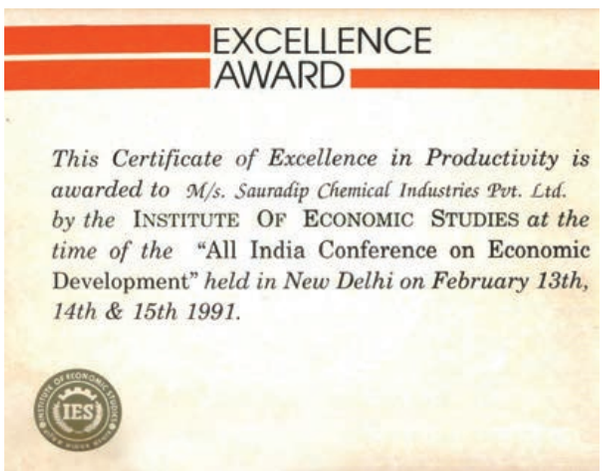
JAIDEEP SHAH
EXECUTIVE DIRECTOR
SAURADIP CHEMICAL INDUSTRIES PVT. LTD.

What are the global trends in the Specialty Chemicals sector and its likely impact on Indian manufacturers?

The Indian specialty chemicals industry is expected to register 15% growth annually. Foreign companies are shifting their manufacturing base to India, owing to the highly motivated creative workforce, huge pool of scientists and chemical engineers besides low labor and equipment cost. Indian companies must master the art of constantly developing and adopting new techniques and practices to tap the opportunities. In addition, India needs a modern regulatory framework that drives innovation and encourages growth and productivity. There is a need to promote innovation, better interactions between industry and academia and more chemical clusters.

Most of the chemicals produced by the industry are commodity chemicals. Industry faces intense competition with international players on account of poor infrastructure, high capital cost, taxes, low economy of scale among others. Poor infrastructure, lack of storage facilities, poor road infrastructure, shortage of power and its costs deter the growth of the specialty chemical industry. At the same time, the advantages are price and raw material for specialty chemicals, innovation, and technology. Increasing the diversification of the product portfolio is extremely important for the industry to

Our products play a vital role in the green value chain by allowing its customers to deliver safer and less carbon intensive products to their consumers



maintain competitiveness. It will require companies to invest heavily in R&D. To sustain themselves in the tough business environment, intensive research to produce innovative products is the key.

Changing market dynamics within the Specialty Chemicals industry in FY 2023-24?

Specialty chemicals are finding more application in the construction, automotive, electronics, and water treatment sector. These segments are most likely to drive the growth of the Indian specialty chemicals market. Therefore, upgrading the product quality through innovation and diversifying the product portfolio are extremely important for the industry to maintain the competitiveness and the overall momentum.

Key milestones achieved by Sauradip Chemical Industries in FY 2022-23 and plans for FY 2023-24?

Sauradip Chemical Industries was founded in 1974 with a philosophy of Care, Trust, and Bold Creativity, which have now become our core values. In the last 50 years, we have built unparalleled goodwill with our customers, suppliers, and our team.

We are constantly raising the bar in the industry by developing highly customized green products in consultations with customers. Our efforts have been to make available green products to customers at an affordable price and we have been touching the lives of people across the globe. Today, we have a strong presence in India and are relatively exporting to five continents across 40 different countries. Our dedicated sales and marketing team is in constant touch with customers. They deliver high performance solutions and solve challenges across various industrial segments.

Sauradip's knowledge based and solution driven approach continues to improve and change the quality of life of Indians. We have been well recognized in the industry with many accolades.

Dr. Shah was a president of the Indian Specialty Chemical Manufactures' Association from 2007 to 2012. For the first time in 60 years, the Indian Specialty Chemicals Manufactures's Association (ISCMA) awarded the life time achievement award to Dr. Kishore Shah on the occasion of their annual function in 2013. The award was bestowed to him by Shri. Rajubhai Schroff Chairman of United Prosperous Ltd, for meritorious service rendered to Indian Specialty Chemicals Manufactures's Association. Dr. Kishore Shah wrote world class books (1) Handbook Synthetic Dyes & Pigments-5 editions (2) Handbook of Industrial chemicals - 4 editions which are used as reference book throughout the world.

Please explain the product basket of the company?

Sauradip is a manufacturer of customized performance chemicals and works closely with customers to offer them Tailor-made cost-effective solutions. We believe in the philosophy of "Sustainable Solutions for a greener planet so that we can make a positive impact in the lives of people Globally".

We cater to customers for Water Treatment Chemicals, Paint & Coating Additives, Fiber Finish for Synthetic yarn, Additives for construction chemicals, Metalworking additives, Performance chemicals for Oil Exploration & Refining, Green surfactants for Home & Personal Care, Antistatic Agents for plastics & Coatings, High-performance Disinfectants for Industrial cleaning, Specialty chemicals for mining.

We have developed a concentrate through our unique technology for the paints industry to reduce carbon footprint

Revenue and profit during FY 2022-23 and forecast for FY 2023-24? Key growth drivers?

We have been doing good in terms of revenue, registering a year on year growth of 25%. We are launching a lot of new products including paints and additives, green surfactant. We have recorded a revenue of Rs. 250 crore in the last fiscal

and plan to reach Rs. 1,000 crore in the next 5-10 years. Our continuous efforts to improve the product basket and the green products will drive this growth. To increase exports, we are putting in place new distribution of networks. We are not importing anything yet we are exporting to the US, Australia, Africa, China, Russia, and other nations.

Kindly elaborate on Sauradip's knowledge-based, solutions-driven approach to develop highly customised applications in collaboration with its customers?

Sauradip's highly customized applications are developed in collaboration with their customers. Whenever a customer seeks a customized product based on his experience with some other products, we try to develop an alternative in the best possible time. We deliver performance improvements and solve challenges in a range of industrial sectors. Our customers include global leaders in paints and coatings, textiles, oil field exploration, personal care and cosmetics, dyes and pigments, adhesives, industrial cleaning, and plastics. Everyday, hundreds of millions of people enjoy a better quality of life, thanks to Sauradip's knowledge-based, solutions-driven approach.

Please take us through your key R&D initiatives and how it will help in expanding Specialty Chemicals product offerings?

A science company with skills in research & Innovation. Research and Innovation has been Sauradips' focus and forte for the past forty years. The company has been spending 6-7% of its revenue on the R&D initiatives. Our hi-tech research facilities are home to highly qualified and skilled scientists who are constantly raising the bar in the industry by developing non-toxic, eco-friendly and high quality solutions. Sauradip's research helps clients manage costs, reduce environmental impact and manage volatility in production. Scientists and technicians at Sauradip are continuously looking for innovative solutions to increase the efficiency and competitiveness of manufacturers. A result of those efforts is the comprehensive range of antistatic agents and lubricants that lower the yarn to metal and fiber to fiber coefficient of friction with high-speed spinning efficiency.

How is the company striking a balance between environment-friendly policies and sustainable growth?

Sauradip is a pioneer of green thinking in the performance chemicals sector. Proprietary green technologies mean Sauradip's manufacturing processes emit zero discharge and zero effluent. The products play a vital role in the green value chain by allowing its customers to deliver safer, less carbon intensive products to their consumers. We are developing a good number of green products each year. We scientifically design our products for human and environment safety, protecting mother earth and saving our resources such as energy, water and time. We have developed a concentrate through our unique technology for the paints industry to reduce the carbon footprint. In the personal and home care segment, we have innovated the non-toxic products, thereby replacing toxic ones with highly innovative green ones.

CSR initiatives being spearheaded by Sauradip Chemical Industries in FY 2022-23 and plans for FY 2023-24?

Sauradip has been at the forefront of many CSR initiatives. The company has donated to ICT - Institute of Chemical Technology for renovation of the BTech Undergraduate Laboratory in the Department of Polymer and Surface Engineering. The company has also introduced "Sauradip Chemical Industries Visiting Fellowship" in the Department of Polymer and Surface Engineering of ICT. We also took up the cause of building a Bhojanshala at Lonavala. It has a 6,000 square feet hall and a 2,000 square feet kitchen area with a capacity of 300 people who can dine at a time, and was completed in February, 2022. ■

Sustainability

Shaping Resilient
Economies and Societies

PIVOTING TOWARDS A STRONG CIRCULAR ECONOMY

India's transition to a circular economy holds immense potential for driving sustainable economic growth TEAM ICN

As the chemical industry landscape continues to evolve, new business models are emerging, creating abundant opportunities to capture value and drive growth at every stage of the circular economy. By improving internal operations and responding to downstream industry demands, chemical companies can adopt fresh approaches to turn disruptive change to their advantage.

A circular economy in India can drive innovation and competitiveness by promoting resource conservation through reduction, reuse, and recycling. From 18% waste processing in 2014 to 70% in 2021, India is steadily progressing towards the United Nations (UN) Sustainable Development Goals (SDGs) "Agenda 2030" commitment. The current disruptive changes lead to an urgent call for action to strategize development and spur economic growth while tackling climate change and building future programs for waste management and resource preservation. The circular economy encourages a transition from linear approach to multi-life cycle circular value chains in business models, integrating the design-thinking approach for more effective and judicious use of resources.

Currently, almost 377 million citizens reside in urban areas, producing 55 million tonnes of municipal solid waste (MSW) annually. Moreover, this amount is predicted to increase significantly, reaching 125 million tonnes annually by 2031. Despite the immense relevance of the circular economy, the industry currently has a varied awareness of the concept, which poses a significant challenge concerning its widespread adoption in India. It is estimated that by 2050, India would reap yearly benefits of US $624 billion (Rs. 40 lakh crore) reducing the negative externalities.

It is estimated that by 2050, India would reap yearly benefits of US $624 billion (Rs. 40 lakh crore) reducing the negative externalities

Wider Impact

Even though the circular economy in India is at a nascent stage, it has attracted investments of US $1.8 billion during the period 2016-21. Mitigation-oriented innovations in energy and transportation, account for over 60% in terms of volume and 80% in terms of deal value. This is consistent with the popularity of energy and mobility start-ups worldwide. The significant technological and commercial progress, favourable policy environment, and the evolution of standardized frameworks have bolstered the adoption of a circular economy in the last decade. Funding rise is a positive trend given that these industries account for a significant portion of the world's GHG (Greenhouse Gas) emissions (more than 70%).

The report by the World Economic Forum has projected the generation of

up to 50 million jobs with an economic impact of US $15 trillion. About 1.2 billion jobs may require upskilling to transition to a circular economy. This can lead to the development of new products, services, and technologies that are more efficient and sustainable, creating circular jobs, new business opportunities and differentiating companies from competitors.

The transition to a circular economy could result in an additional US $4.5 trillion in global economic output by 2030. Moreover, in contrast to the current growth environment, India's circular economy development route might generate an annual value of US $218 billion (Rs. 14 lakh crores) by 2030 and US $624 billion (Rs. 40 lakh crores) by 2050. The implementation of a circular economy in India would require an enabling ecosystem that encourages the identification and adoption of new business models.

Presently, 377 million people living in urban cities, produce approximately 55 million tonnes of Municipal Solid Waste (MSW) (like organic waste, recyclables like paper, plastic, wood, glass, etc.) per year, with these numbers expected to skyrocket to 125 million MT per year by 2031. Moreover, only 75-80% of the MSW gets collected; out of which only 22-28% is processed, and the rest is dumped in dump yards. MSW generation is projected to increase to 165 million tons by 2031, and further rise to 436 million tons by 2050.

Consumer Driven Sustainability

The chemical industry touches us all in countless subtle and unseen ways. From life-saving healthcare devices and personal care goods to food, transport and clothing, around 100,000 chemicals are used in the world today, impacting every aspect of our daily lives. But the industry is at a tipping point, with disruptive pressures set to drive new business models and value chains,

while creating opportunities for those ready to embrace them. By capturing a share of this rapidly expanding market for reusable, renewable and recyclable products, chemical companies can turn these changes to their advantage and drive growth while helping to shape a greener, cleaner, more sustainable future.

Globally, resource constraints and rising concerns about sustainability are changing how consumers think about chemicals. They are calling out brands and retailers on social media and petitioning for more responsible corporate stewardship of our planet. They are also flexing their purchasing power. According to new Accenture research of 6,000 consumers in 11 countries, just over half of those surveyed said they would pay more for sustainable products, and almost three-quarters (72%) are more likely to buy eco-friendly products than they did five years ago. In response, downstream industries (for example, automotive, clothing, electronics, food, and toys) are rethinking the design of their products, packaging and use of chemicals to embed circularity throughout the entire product lifecycle.

As consumers seek ways to bring more environmentally friendly products with cleaner ingredients to life, they are looking to the chemical industry for answers. By creating greater transparency for consumers, greener innovation for manufacturers and accountability to stakeholders, chemical companies are uniquely positioned to lead the shift to the circular economy and hasten its adoption. While adoption of green chemistry may require initial investment costs, these will be offset as sustainable product design increases demand. What's more, investing in green products now will protect market share as new players seek to enter and disrupt the market. Opportunities for growth abound, but with changing perceptions driving new buying behaviors, companies must act fast or risk getting left behind.

The Road Ahead

By 2030, India is expected to be the world's third-largest economy, accounting for approximately 8.5% of the global GDP. The circular economy has the potential to fuel India's growth while also providing significant environmental benefits, making a sustainable and resilient framework. The recycled

Polyethylene Terephthalate (PET) plastic industry in India is estimated to be worth around US $400-550 million, according to National Chemical Laboratory (NCL) and PET Packaging Association for Clean Environment (PACE).

India's rapidly evolving market and high potential for development can provide a competitive advantage over mature economies. The aspirational long-term vision of a circular economy is based on the current strengths of the Indian market and the integration of diverse stakeholders that has the potential to pave the way for fast-tracked sustainable, and resilient prosperity. Circular economy advancements will not only improve urban and agricultural economies' resilience, but will also provide benefits such as climate mitigation, food, and water security, increased biodiversity, job creation, and empowerment of underprivileged communities.

Transitioning to a circular economy necessitates a comprehensive and systematic implementation of a roadmap. The net-zero future is such a significant necessity that it will affect every aspect of our daily lives. As a result, start-ups will have a plethora of opportunities, ranging from plant-based proteins and carbon emission trackers to electric vehicles and new battery technologies, involving waste management in the design phase to assist in closing the loop and contributing to a more sustainable planet. ■

GREENER ECONOMY

- Reduces the need to extract and process new raw materials
- Saves on the cost of inputs and conserving natural resources
- Increased resource use efficiency and lower production costs
- Boosts competitiveness and increases productivity
- More diversified and resilient economy
- Less susceptible to fluctuations in commodity prices
- Reduces environmental impacts
- Lesser impact on human health

KEY BENEFITS

Chemical manufacturers can unlock trapped value through cost savings by embedding circularity within internal operations

Green substitutes: Invest in products that improve the sustainability profile of existing applications, such as biodegradable polymers

Green feedstocks or processes: Improve existing products with renewable inputs, either bio-based or recycled, to reduce carbon footprints

ADITYA BIRLA CHEMICALS

The transition to a circular economy could result in an additional US $4.5 trillion in global economic output by 2030

RECYCLE ENGINEERING: CHALLENGES & OPPORTUNITIES

Why ban Single Use Plastic (SUP) when better technological alternatives exist?

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Sustainability

Sustainability is just now a buzz word but must be a ritual to be adopted by all stake holders. The UN Sustainable Development Goals (SDG) cover 17 of them but my personal opinion is that many of these might have been derived from the Grand Engineering Challenges mentioned in the 1999 report by the US National Academy of Engineering. We are all concerned about sustainability, health, vulnerability, and the joy of living and have been used to the linear economy. The material needs of society will require 3 Earths if the 3-R (reduce, reuse and recycle) strategy is not adopted for achieving the so-called circular economy. Plastics are an integral part of modern society. But plastic is the most misunderstood material due to the pollution associated with it and totally irresponsible society. So, the moot question is "Can we live without plastics?" The answer is resoundingly no but what about pollution? We must convert the waste into wealth by using novel and cheap technologies. Recycle engineering by physical, chemical and biological rate processes for the material and energy needs will be practised in the future by all stake holders and quite interestingly chemical engineering as a discipline will be at the hub.

There are enormous quantities of solid wastes lying all over, including plastics, tires, food, animal manure, woody biomass, construction debris and the like. Generation of heterogeneous and toxic MSW, heaps and heaps of it presenting an ugly site, is a real cause for concern. Among these solid wastes, plastic has received the maximum attention due to the widespread littering, production scale and visible environmental damage. Plastic was supposed to be a cheap and better alternative to paper which was responsible for denudation of forests. However, the benefactor became a curse over the years. Plastics are usually used for packaging because of their light weight, low cost, processability, high performance and easy availability. Polyethylene (PE) and polypropylene (PP) are some of the most used plastics in multilayer film packaging, among other applications. The Single Use Plastic (SUP), namely, polythene bags available freely are mainly responsible for their being discarded after use. It has no value as the commoner thinks. High durability of plastics leads to huge quantities of waste accumulation in landfills and oceans because most synthetic polymers are designed for longevity and performance rather than recyclability and degradability. The SUPs are used for sterile packaging, storage, transportation, and disposable medical parts which contribute to global waste. Approximately 380 million tons of plastics are produced annually worldwide and resulting in huge contributions to global waste and environmental pollution.

Approximately 8 million tons of plastics find their way into oceans per year and the plastic pollution in oceans is predicted to outweigh the oceanic fish by 2050

The Menace of Plastic Waste

Plastics have been widely used as materials since the 1950s. The raw materials used for manufacturing plastic products mainly originate from non-renewable crude oil. The use of non-renewable feedstock for plastic production may increase from 6% in 2014 to 20% by 2050 considering the strong growth of plastic usage. It is estimated that over 9.2 billion tons of virgin plastics had been produced and the global annual production of plastic has already increased to 368 million tons in 2019. Due to the low production cost and versatile applications of plastic-based goods i.e., food industry, clothing, housing and transportation, the amount of produced plastic material is projected to still increase in the future. In contrast to the huge production, only 10% of total worldwide plastic waste has been recycled, while 14% has been incinerated and the rest has been discharged to landfills or ended up in the environment. The mismanagement and the lost opportunities in the recycling of plastic waste have resulted in global concerns, mostly related to widely spread plastic pollution of terrestrial and marine ecosystems. When plastic waste ends up in the environment it undergoes mechanical and chemical weathering down to micro and nano-plastic particles, which are considered emerging pollutants and attract significant attention as their impact on human health is not yet understood. Waste plastics, however, are considered as valuable but misplaced resources, which are complementary to non-renewable fossil fuels. The mismanagement of plastic waste urges the development of effective methods for common plastic recycling, until fully biodegradable and economically feasible plastic replacement solutions become available. Figure 1 provides some technology options to deal with waste plastic.

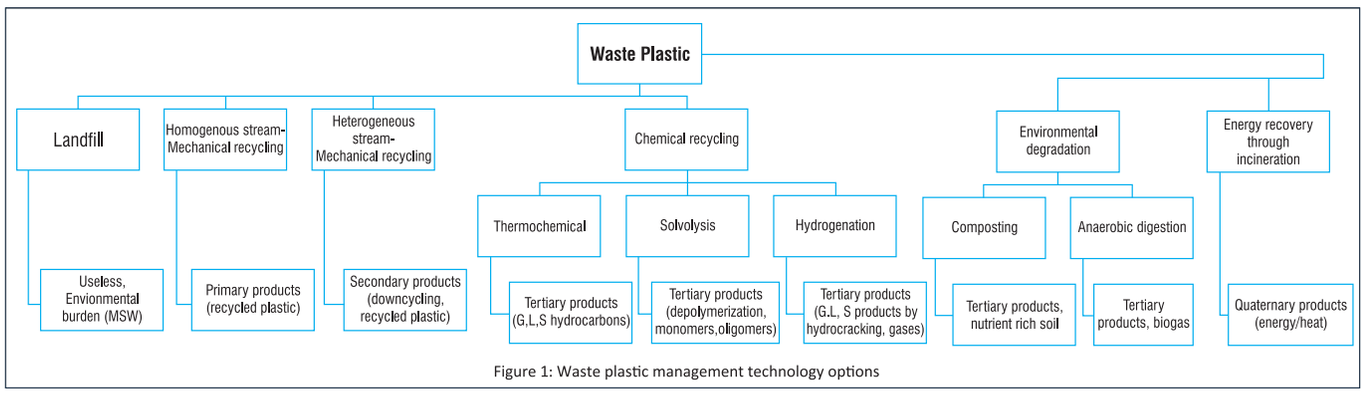


Figure 1: Waste plastic management technology options

Municipal Solid Waste

The world generates 2.01 billion tons of municipal solid waste (MSW) annually, in which it is predicted that one-third is not managed in an environmentally safe manner. Currently Waste generated per person per day averages 0.74 kilogram but ranges widely anywhere from 0.11 to 4.54 kg depending on the income level and place of residence (Figure 2). Even though they only account for 16 percent of the world's population, the developed nations generate about 34 % or 683 million tons of the total waste. Single-use multilayer flexible packaging is a typical example of such non-recyclable waste that ends up in landfills and, eventually, in natural habitats. Approximately 8 million tons of plastics find their way into oceans annually, and the plastic pollution in oceans is predicted to overshadow marine fish by 2050. One-third of all plastic produced worldwide is too complex (e.g., complex structures, complex mixture of different polymers) or small to recover or recycle in a practical and cost-effective manner. The restrictions and ban on the use of

Approximately 1.6 billion tons of carbon dioxide equivalent GHG were generated from solid waste treatment and disposal in 2016, or 5 percent of global emissions. Disposing of waste in open dumps and landfills without landfill gas collection systems is very common. Food waste accounts for nearly 50% of

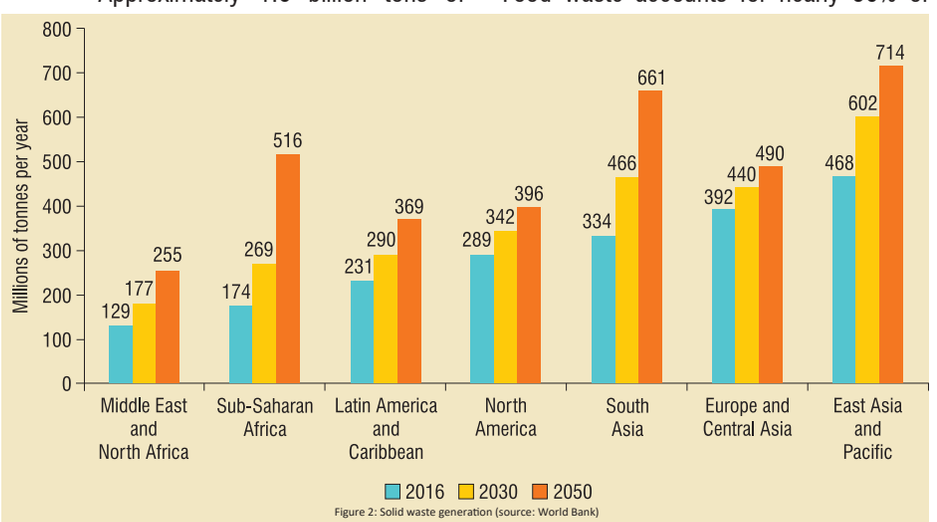


Figure 2: Solid waste generation (source: World Bank)

emissions. Solid waste–related emissions are anticipated to increase to 2.38 billion tons of CO2-equivalent per year by 2050 if no improvements are made in the sector.

Complexity of Recycling

Recycling is often complicated because post-consumer plastic waste often consists of mixed plastics of unspecified composition and often contains various contaminants, including organic and inorganic matter. Most of this plastic waste is either incinerated in power plants or discarded to landfills or oceans, resulting in a low or lost value. Single-use multilayer flexible packaging is a typical instance of such non-recyclable waste that ends up in landfills and, ultimately, in natural habitats. Approximately 8 million tons of plastics find their way into oceans per year and the plastic pollution in oceans is predicted to outweigh the oceanic fish by 2050. One-third of all plastic produced worldwide is too complex (e.g., complex structures, complex mixture of different polymers) or too small to recover or recycle in a practical and cost-effective method. Since plastic waste is largely chemically inert, estimates suggest that existing material would require around 250–500 years to completely degrade. Furthermore, the constituents of plastic waste can enter the human food chain through crops and animals. For example, crops might absorb and accumulate nanoplastics (e.g., dimensions < 6 nm)

Chemical Recycling, Upcycling, and Downcycling

Plastics refining is a GHG intensive process. Carbon dioxide emissions from ethylene production are projected to increase by ~ 34% over the period 2015-30. For instance, PVC is an extensively used thermoplastic due to its excellent properties such as stability, being cheap, and workability. It is a multipurpose general plastic commonly used in construction, piping and many other consumer goods. PVC is highly polar and possesses a good insulation property, but it is inferior to other non-polar polymers like polypropylene (PP) and polyethylene (PE). PVC, PE and PP are usually used in piping, water sanity, and medical industries, etc. whereas PP is extremely thermally resistant, and it can withstand much higher temperatures than PVC. All these polymers including PET, nylon, and PU contribute to carbon footprint and global warming. PVC is demonstrated to have higher energy consumption and CO2 gas emissions which that show its high potential in global warming than other plastics. Likewise, the recycling of PVC has shown substantial contributions in lowering the effect on climate change.

About 40% of plastics are used in packaging globally. Typically, packaging is meant for a single use (SUP) and therefore there is a reckless turnaround for disposal at all places. SUPs are used in many applications such as tires, fabrics, and coatings. Consumers need choices to avoid plastic waste such as legal means to encourage plastic collection through a refundable deposit scheme on SUPs, collection at regular intervals and avoiding plastic waste going as a mixture in municipal solid waste (MSW). The packaging can be dealt with in three different ways including landfill, incineration, or recycling. Waste incineration leads to the largest climate impact of these three options. According to the World Energy Council (WEC), based on the current trend in plastics production and incineration upsurge as anticipated, GHG will rise to 49 MMTA by 2030 and 91 MMTA by 2050. Landfilling has a much lesser impact on climate than incineration. But the landfill sites can be related with similar environmental issues. Recycling is a much better option. With regard to the little costs of virgin plastics, recycled plastics are high cost with low commercial value. It makes recycling lucrative only seldom, and so it calls for substantial subsidies by the government authorities. On the contrary, the chemical recycling of polymers including depolymerization and hydrogenation are excellent choices. Plastics can be categorized broadly into 7 types (See Figure 3).

Chemical or feedstock recycling is being touted as a game changer that can transform recycling. With chemical recycling, innovative technologies such as pyrolysis, gasification, chemical depolymerization, catalytic cracking and reforming, and hydrogenation convert plastic waste into chemicals. These technologies produce feedstocks such as monomers, oligomers, and higher hydrocarbons that can in turn be used to make virgin polymers. Green hydrogen will play an important role (Figure 4).

Use of hydrogen in plastic recycling

Hydrogenation (hydrocracking, hydrotreating, hydrogenolysis) of waste plastic is very useful to convert any plastic waste into hydrocarbons/oils useful

Figure 3

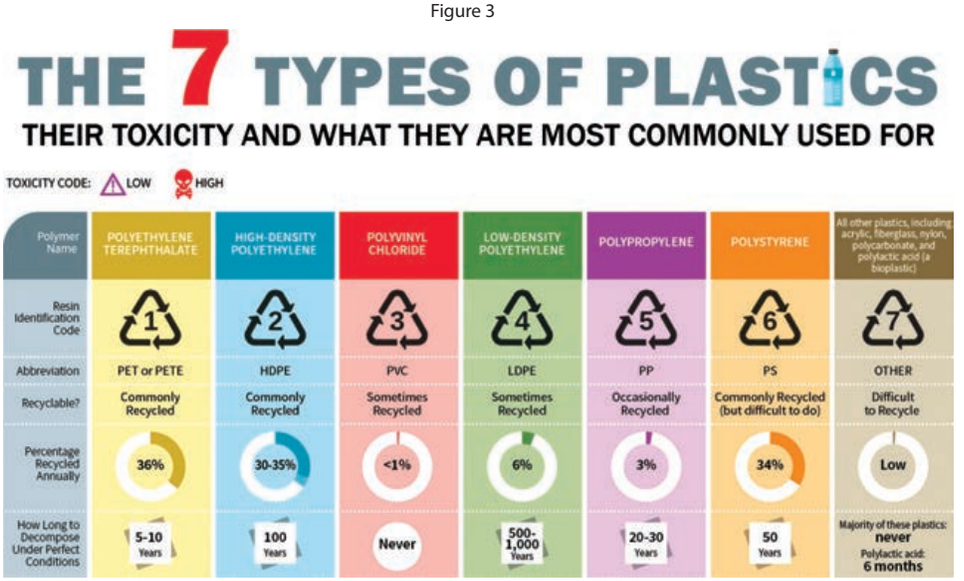
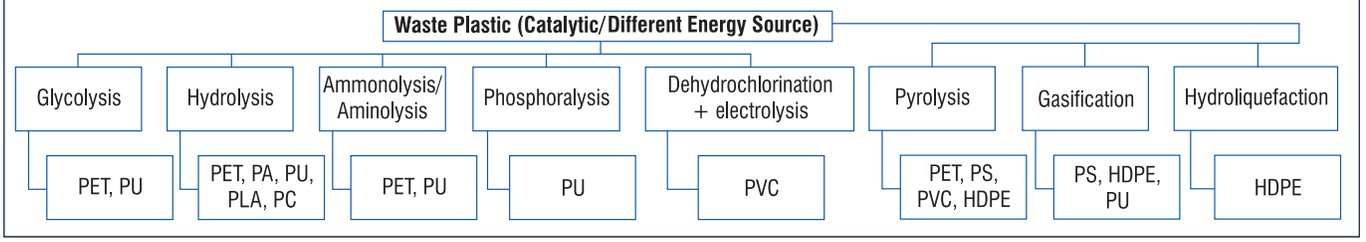


Figure 4: Chemical recycling of waste plastics. Once the segregation is done at source, it becomes easy to chemically react waste plastics into a variety of products



as fuels and chemicals. Tough atoms such as, N, S, and Cl are easily broken and the technologies are well known in refinery and chemical industry (Figure 5). Green hydrogen will be the real saviour. Any mixed plastic can be catalytically converted into hydrocarbons for reuse as fuels or feedstock.

Providing Incentive for Collection of SUPs & Public Participation

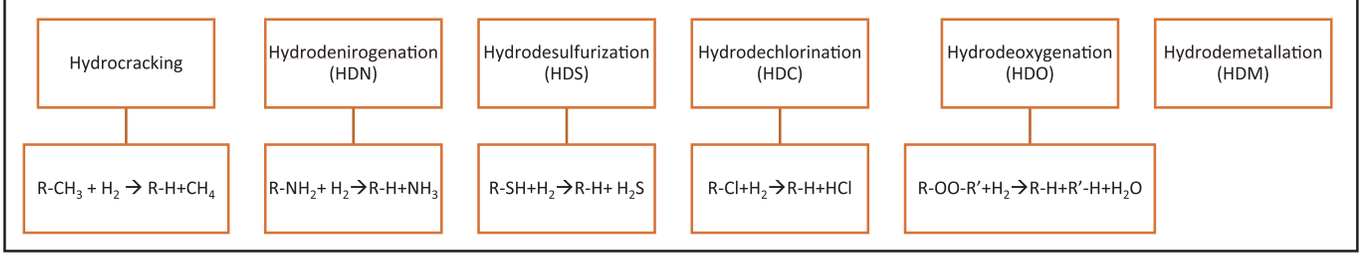
Anything free, irrespective of cost, is not appreciated and thrown out as scrap, garbage or waste. Plastic packaging falls into this category. Collection of SUPs from the consumers can be advanced by levying refundable deposits which should be more than the cost of the article or product, properly labelled without causing additional pollutants; and thus, the consumer is disciplined and encouraged to return the used goods anywhere convenient to them. For instance, if a plastic straw, or PET bottle or milk pouch which may cost a few paise, is given to the customer for a refundable deposit at Rs. 5 per piece irrespective of size or thickness, they will return it to collect their deposit. Or if somebody else (just not rag pickers but others in offices and functions) collects it, they are encouraged to return and collect the deposit. Here to reduce the burden, all articles irrespective of size or weight can be returned. Like the newspaper boy coming to the doorstep, another plastic collector will come to collect the segregated clean plastic from each house, deduce his fee/ commission (e.g. 5%) and refund the remaining deposit. It can be done digitally through bar codes which can be used only once to collect the deposit anywhere in India. It will promote digital economy. Like the education cess, government has already introduced the Swachh Bharat cess which is supposed to be used to deal with all plastic goods lying around in colonies. One of the mistakes done by authorities is that the plastic waste should be collected at a decent price so that rag pickers pick up all plastic bags and 'useless' articles rather than only the PET bottles which they choose from the garbage and are recycled.

Future of Recycled Plastics

The new paradigms are Waste to Wealth, Circular Economy and Renewable Energy, particularly solar, wind and green hydrogen. Recycle Engineering, Process Intensification, Waste Minimization and Green Processes must be practiced for achieving sustainability. There is a big concern that enormous quantities of plastic waste being incinerated and discharged into the landfills and the environment, there is a tremendous scope for further upgrades in the management of waste plastics, especially through chemical recycling which concerned with thermal pyrolysis, solvolysis, in-situ/ ex-situ catalytic pyrolysis, co-pyrolysis, hydroreforming, steam/ CO2 reforming of plastic pyrolysis volatiles and gasification and hydrogenation of waste plastic. When the crude oil resource is depleted and millions of tons of plastic is lying around, it will be prudent to use it as a feedstock. Chemical recycling is an excellent idea whose time has come. Catalytic processes to recycle or upcycle plastics will be hotly pursued. More research is needed on upcycling of thermosets. If government-established recycling targets are to be achieved, the links between consumers, municipalities, and petrochemical production must be improved. The Govt of India should not ban SUP but provide incentive to common citizens to return used articles, it will do wonders. After all, public opinion is moved by media images of a threatened planet and eco system. Only through the collaboration of people, municipalities, and industry - supported by improved technology along the recycled plastics supply chain a solution for this global crisis can be achieved.

The Govt. of India, I believe, ought to use some the ideas presented in my article which I have been talking about since 2018 in newspapers, articles and seminar (see YouTube) and should not ban SUP but incentivize the general public to be responsible. ■

Figure 5: Hydrotreating of waste plastics



DIVERSITY DRIVES PROGRESS

Building a progressive culture is not just about ticking off boxes of diversity and inclusion but it is about creating an environment where everyone feels included and can contribute to the company's growth

CHANDRAKANT NAYAK
CEO & COUNTRY PRESIDENT
DOW CHEMICAL INTERNATIONAL PVT. LTD.

In today's rapidly evolving world, innovation is key to progress. Companies need to keep up with the changing times, and to do that; they need to foster an environment that values diversity and inclusion. Companies need to innovate strategies that not only can contribute to developing but implementing an inclusive culture that attracts diversity and drives lateral thinking. Committing to building an all-inclusive, diverse work culture where everyone feels valued and respected is a path to progress.

Our perspective is more forward looking - Building a progressive culture is not just about ticking off boxes of diversity and inclusion but it is about creating an environment where everyone feels included and can contribute to the company's growth. It's not just essential to have a firm commitment from leadership but it's also critical to align employees and keep them motivated to turn intentions into actions.

Inclusion and Innovation are Intertwined

The more diverse a team, the more ideas and perspectives there will be. This diversity leads to increased creativity and innovation. According to the Bloomberg Gender Equality Index 2023, the communications, financials, and technology sectors led the field on inclusive culture scores with 81%, 76%, and 72% respectively. It is integral to take note of the percentage gap in the manufacturing industry, where women constitute 10-12% of the workforce. Today, as we stand with the data indicating a significant gender gap in the manufacturing industry – the urgency to advocate for inclusion and innovation is high.

Technology is an integral tool that can help bridge the gap in the workplace by providing accessibility, training, and communication that empower employees. As companies strive to create diverse and inclusive workplaces, they must leverage advanced technologies to break down barriers and foster a culture of innovating equity and equality that accommodates the needs of every employee despite their gender or background.

Efforts to Promote Inclusion in Chemical Industry

Manufacturing was initially characterized by manual work, long hours, and assembly line floors. Numerous studies have demonstrated how sectors with a single dominant gender can stifle innovation or, at the very least, limit the expression of distinctive viewpoints. More so in the chemical sector, where the gender gap is skewed. "Unique perspectives" in production could refer to a novel, time-saving method of producing items rather than just the colour of a component.

Today, automation and the efficient operations that IoT (Internet of Things) and AI (Artificial Intelligence) enable can help us build equitable floors of operation for all genders. Having been

Dow India has taken concrete steps towards building an inclusive environment in chemical manufacturing plants by introducing an "All Women Batch" product at our plant in Lote

invested in this concept for several years, Dow India has taken concrete steps towards building an inclusive environment in chemical manufacturing plants by introducing an "All Women Batch" product at our plant in Lote. This intervention came with unique strengths and advantages that women bring to the table.

Some of the benefits we witnessed by building all-women teams are increased innovation, creativity, productivity, and morale. Advanced technologies were introduced, and mechanics were modified to enable an equitable workspace, which led us to attain safety and productivity along with accessibility for women to join traditional male-dominated industries. The experience gained from implementing an all-women batch at Lote extends beyond simply promoting diversity and inclusion. It serves as a credible platform for us to share our learnings and insights with others around the world, fostering the adoption of more holistic approaches to building inclusive workplaces.

A survey in 2020 found that recognition and engagement have increased women participation in the manufacturing industry to 75%. For the most part, women are and can be ready to get into the industry, but we need a fundamental shift in our approach - hiring practices, like introducing inclusivity even in the selection panel and operations to facilitate this growth. This also means shifting from the traditional approach of expecting certain deliverables and actions from employees. Instead, as an industry, we must adopt an approach that caters to the diverse needs and experiences of our workforce, keeping in mind that these can differ for all.

Key Steps to Implement a Culture of Diversity and Inclusion

Urgency to ensure inclusive policies

Commitment from leadership is extremely vital for ensuring inclusivity in a company, as it establishes the foundation for a positive company culture. When leaders prioritize inclusivity and make it a core value, it sends a message to everyone that diversity and inclusion are highly valued within the company, additionally creating a path for others to follow.

Be intentional about building diverse teams

This means actively seeking out candidates from different groups of race, gender, or disabilities and creating a culture where everyone feels included.

Setting up the right environment

Build a level-playing field in the organization for all and resources to help employees overcome any biases and stereotypes. A diverse and inclusive culture can be achieved with multiple Employee Resource Groups (ERGs), for example, that support the diverse groups of second careers and experienced individuals or LQBTQ-aligned groups. It can bring meaningful change by building such peer networks to enhance understanding and develop community programs for better outreach.

Curate mentorship/sponsorship

Additionally, companies can create mentorship or sponsorship programs to help new and old employees advance in their careers.

Practice and preach inclusion

By providing training and promoting awareness by introducing sensitizing sessions, companies like us are ensuring to take holistic steps catering not only to their employees but towards the communities in the areas they operate and engaging in building an inclusive culture – a complete approach, I say.

Moreover, inclusion is also about prioritizing employee needs and wellness. For example, our approach to physical and psychological safety is aligned to the inclusion strategy. All such methods help foster an equitable workspace where everyone belongs and there is an equal contribution.

In conclusion, building a culture of inclusion and diversity is key to fostering innovation and progress. Promoting inclusion and equality is a moral imperative and a smart business decision that can lead to better outcomes for both employees and the company. Diverse teams are more likely to come up with innovative solutions and to better understand the needs of a diverse customer base. By committing to building a culture of diversity and inclusion, companies can not only attract and retain top talent but also outperform their competitors in the long run. ■

SUSTAINABILITY ROADMAP FOR INDIAN CHEMICAL INDUSTRY

Sustainability has become an increasingly important concern for businesses worldwide, as stakeholders demand greater accountability for the environmental, social, and economic impacts of industrial activities. The chemical industry is no exception to this trend, and Indian chemical companies are now taking steps to adopt more sustainable practices

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India's chemical industry has significant importance in the country's economy. It contributes to approximately 3% of India's GDP and is projected to reach $304 billion by 2025. However, the industry also has significant environmental implications due to the use of toxic chemicals, water consumption, and greenhouse gas emissions. Therefore, it is essential to develop a sustainability roadmap for the Indian chemical industry that will enable it to grow while minimizing its environmental impact.

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Currently, the Indian chemical industry faces several sustainability challenges. Firstly, the industry is highly energy-intensive, with around 12-15% of the total energy consumption in the country attributed to the chemical industry. This high energy consumption results in significant greenhouse gas emissions, contributing to climate change.

Secondly, the chemical industry is one of the largest water consumers in India, with around 20% of the total industrial water consumption attributed to the sector. This high water consumption puts pressure on scarce water resources, leading to water scarcity in some regions.

Thirdly, the chemical industry produces large amounts of hazardous waste and emissions, which can cause serious environmental and health problems if not managed properly. The industry is also vulnerable to accidents and incidents, such as leaks, spills, and explosions, which can cause significant damage to the environment and human health.

Finally, the industry faces social sustainability challenges, such as poor working conditions, low wages, and

human rights violations, particularly in the case of contract workers.

Roadmap for Achieving Sustainability in the Indian Chemical Industry

Given the challenges faced by the Indian chemical industry, it is essential to develop a sustainability roadmap that will enable the industry to grow sustainably. The Indian chemical industry needs to adopt a comprehensive sustainability roadmap. This roadmap should include the following key elements:

Energy Efficiency and Renewable Energy

Improving energy efficiency is a key priority for the Indian chemical industry, as it can reduce greenhouse gas emissions and energy costs. The industry can achieve energy efficiency by adopting technologies such as energy-efficient boilers, heat recovery systems, and process optimization. The industry can also shift towards renewable energy sources, such as solar, wind, and biomass, to reduce its reliance on fossil fuels.

Water Conservation and Management

Water conservation and management are critical for the Indian chemical industry, as water scarcity is a major issue in the country. For sustainable wastewater treatment of a complex wastewater inside larger industrial plant, effluent characterization and stream segregation plays a vital role. The wastewater from the manufacturing process is segregated into 3 streams for easier and more efficient ways of achieving sustainable treatment. The 3 streams are:

- Green Stream
- Yellow Stream
- Red Stream

In the green stream, the effluents have a TDS below 5,000 ppm and a COD less than 10,000 ppm, and after this is segregated it is sent for biological treatment, which is either activated sludge process technology (ASP) or the moving bed bioreactor technology (MBBR) for appropriate treatment. Then the treated effluent is sent to the scaleban which can then be a utilized in the cooling towers.

In the yellow stream, the effluents have a TDS below 100,000 ppm, and higher than 5,000 ppm whereas the COD is below 20,000 ppm. This effluent is sent to either forward osmosis or the OH Radical where advanced membrane or advanced oxidation technology is used. Usually, ten percent of the effluent generated is rejected and is sent to the scaleban which can also be utilized in the cooling towers whereas the rest ninety present that is generated is clean water that can be used for other purposes at the plant or can be moved for water recycle or reuse.

In the red stream, the high polluting, high COD, and high TDS effluents get generated, and hence it's low in amounts. This effluent is then channelized for Multi Effect Evaporation (MEE) and then sent for recycling or reuse.

The ETP Sludge and the solid waste produced throughout this process is sent to secured landfills thus making this process sustainable for use.

The sustainable treatment scheme inside large complex is shown in below figure 1.

This form of treatment is very relevant since the effluents are segregated into streams which leads to easier, efficient, and sustainable treatment of effluents. Usually, 60 percent is segregated into the Green Stream, 30 percent into the Yellow Stream, and 10 percent into the Red Stream, but this can vary from one industry to another.

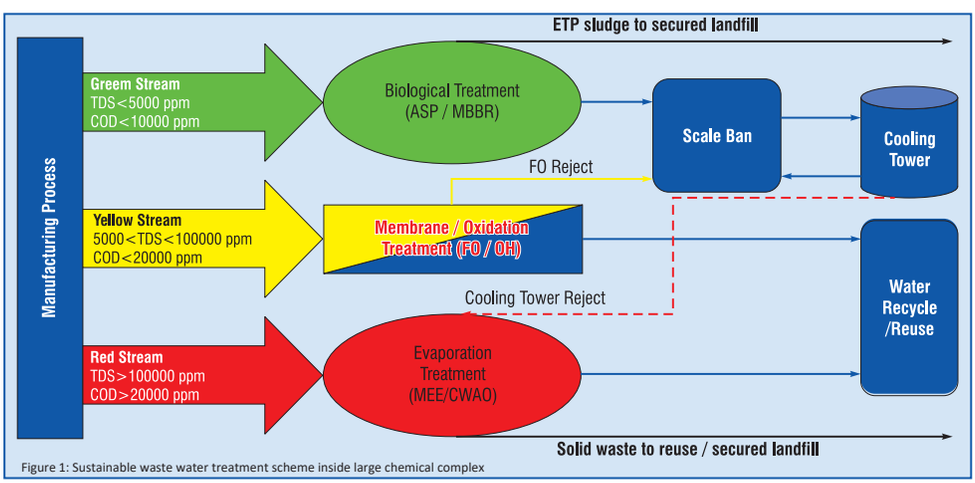


Figure 1: Sustainable waste water treatment scheme inside large chemical complex

The main logic of this form of treatment is that even though the effluents in the Red Stream are very less in amounts yet they are the most polluting and if they are not segregated then they mix with the other effluents causing extreme pollution throughout the system which is not favorable. Hence, segregation is of utmost importance and should always be considered when treating effluents.

The application of relevant technologies is also as important as segregation. As mentioned above, treatments like ASP and MBBR in the Green Stream, Forward Osmosis and OH Radical in the Yellow Stream and Multi Effect Evaporation (MEE) in the Red Stream lead to desirable outcomes.

Thus, this form of technology should be taken into consideration by companies as it's not only efficient but also sustainable in nature.

Sustainability Management Frameworks

The Indian chemical industry needs to adopt a sustainability management framework to transform into 1.5 degree Celsius World. Chemical industries need to adopt structured approach towards sustainability. Following four approach must be adopted to embed sustainability in chemical industries:

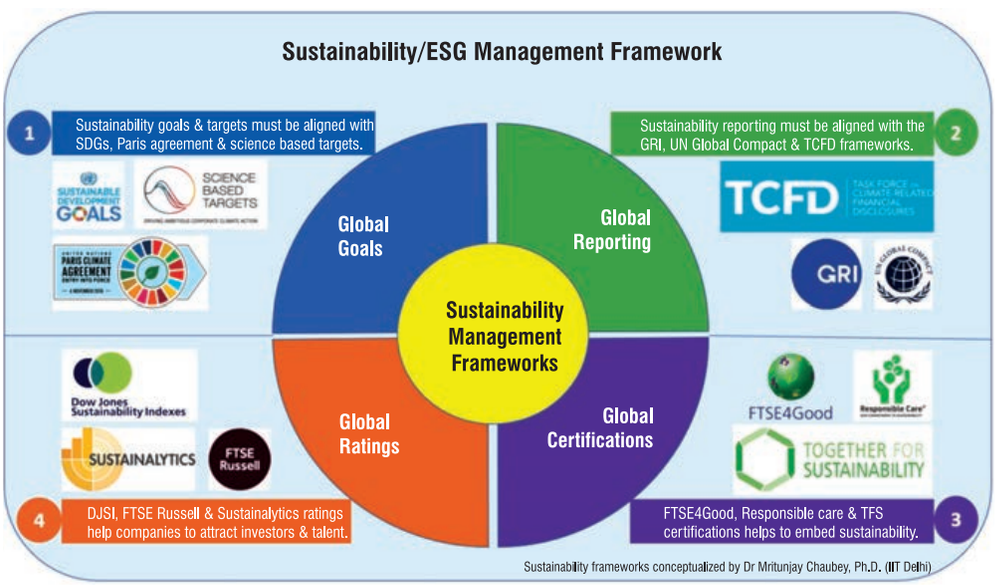
- Sustainability goals & targets must be aligned with sustainable development goals (SDGs), Paris agreement & science based targets.
- Sustainability reporting must be aligned with the Global Reporting Initiatives (GRI), UN Global Compact & Taskforce on Climate Related Financial Disclosures (TCFD) frameworks.
- FTSE4Good, Responsible care & Together For Sustainability (TFS) certifications.
- Dow Jones Sustainability Index (DJSI), FTSE Russell & Sustainalytics ratings.

Conclusions

The sustainability roadmap of Indian Chemical Industries highlights the need for the industry to move towards more sustainable practices in order to reduce its impact on the environment and society. The roadmap provides a framework for the industry to adopt sustainable practices across its value chain, including raw material sourcing, production, transportation, distribution, and disposal.

One of the key conclusions of the sustainability roadmap is the need for Indian Chemical Industries to adopt cleaner production methods and technologies to reduce their greenhouse gas emissions, energy consumption, and waste generation. This can be achieved through the implementation of energy-efficient technologies, the use of renewable energy sources, and the adoption of circular economy practices. Another important conclusion of the sustainability roadmap is the need for Indian Chemical Industries to adopt responsible sourcing practices to ensure that their raw materials are sustainably sourced and do not contribute to deforestation or other environmental degradation. The industry should also work towards reducing its water consumption and improving its water use efficiency.

Overall, the sustainability roadmap provides a comprehensive and actionable framework for Indian Chemical Industries to adopt sustainable practices and contribute to a more sustainable future for India and the world. ■



WATER TREATMENT: SUSTAINABLE SOLUTION FOR GROWING INDIA

Solutions for availability of drinking and potable water for India needs a sustainable approach moving towards total water quality management

MAYANK SHARMA
CHIEF MARKETING OFFICER
CHLOR-ALKALI
ADITYA BIRLA CHEMICALS
ADITYA BIRLA GROUP

Water is an essential resource for life, yet it is a finite one. As the world's population grows, so does the demand for fresh water. In India, where agriculture, industry, and domestic use are the main consumers of fresh water, the need for effective water treatment solutions has become more pressing than ever before. The need of the hour is to offer innovative, sustainable, and affordable water treatment solutions that cater to a diverse range of industries. At Aditya Birla Chemicals, we recognize this need and offer solutions that traverse multiple industries and ensures water treatment from safe drinking water to industrial wastewater treatment.

Water Scenario In India

India is prone to water crisis, with severity increasing in many regions that struggle to meet the demand for fresh water. According to the National Institute for Transforming India (NITI) Aayog, some of the major cities in India are expected to run out of groundwater. This is a serious concern, given that groundwater accounts for 40% of India's water supply. The situation is compounded by the fact that India is home to 17% of the world's population but has only 4% of the world's freshwater resources.

The major consumption of fresh water in India are agriculture, industry, and domestic use. Agriculture alone accounts for 80% of India's water consumption. Industries such as textiles, leather, chemicals, and pharmaceuticals require large quantities of water for their operations. This also makes them significant contributors to water pollution, as used water/ wastewater is let out. Domestic use in urban and rural habitats are also a major contributor to water pollution, with untreated sewage being released into rivers and other water bodies.

To address this problem, the Indian government has implemented various initiatives such as the Swachh Bharat Abhiyan (Clean India Mission), which aims to improve the cleanliness and hygiene of the country, and the National Mission for Clean Ganga, which aims to clean the river Ganges.

In addition to these initiatives, there are about 193 Common Effluent Treatment Plants (CETP) in India, treating a cumulative total of 1474 MLD water. Most CETPs consume

There are about 193 Common Effluent Treatment Plants (CETP) in India, treating a cumulative total of 1,474 MLD water

coagulants in the primary treatment process, making it a critical component of the water treatment process. We have successfully treated five CETPs across India, delivering added benefits to our respective customers.

Our Business

We at the Chlor-Alkali Business of the Aditya Birla Chemicals, a part of the Aditya Birla Group, is committed to address and contribute to the country's water woes through our water treatment solutions.

Aditya Birla Chemicals is a leading player in the Indian chemical industry, with a strong presence in various geographies and sectors. The Chlor-Alkali business is a flagship business with number one position for Caustic Soda in India today, as well as in Polyaluminium Chloride and Stable Bleaching Powder. The above are crucial for water clarification and disinfection. We are also expanding our portfolio of specialty chemicals with applications in water treatment, plastics and polymers, agrochemicals, dyes and pigments, pharmaceuticals, food, cosmetics, and more. With quality systems are approved by BIS, we also have ISO 9001, ISO 14001, OHSAS: 18001 & SA:8000 certifications.

The water application portfolio focuses on coagulation, disinfection, hygiene, sanitization, bio-security, wastewater treatment, and dewatering

The Chlor-Alkali business spans across eight manufacturing units in India with over a 1Mn Ton capacity through 7 states servicing the nation's east-west corridor. The Water Application Centre at Gujarat – Vilayat is designed to develop customized Specialty Chemicals that can add value to our customers in water treatment. We work in collaboration with recognized institutes like DST, NEERI, CIFE, etc. This Water Lab facility received DSIR recognition in 2017. We offer technical support starting from lab trials to plant scale applications and post-sale. The water application portfolio focuses on coagulation, disinfection, hygiene, sanitization, bio-security, wastewater treatment, and dewatering.

We have expertise in treating CETPs connected with the textile industry and tanneries and collaborate with top OEMs.

Water Treatment Solution

Our solutions for water treatment is focused on Coagulation and Disinfection.

In Coagulation, we offer a range of products that help to remove impurities and suspended solids from water. These products include polyaluminium chloride (PAC) and aluminium Chlorohydrate (ACH), which is used in both municipal and industrial water treatment plants. PAC is a highly effective coagulant that can be used to remove turbidity, colour, and organic matter from water.

Our range of VIKRAM PAC products can be used in water and wastewater treatment plants by simply adding prescribed dosage of the undiluted PAC solution to the raw water, followed by immediate high agitation to ensure proper mixing.

VIKRAM PAC offers up to 40% direct cost savings over conventional chemicals like alum. It also helps in reduced supervision charges, savings on maintenance cost of filtration pump system due to reduced operative cycles and reduction in Sludge Disposal cost. It has a greater speed of floc formation than Alum, so it is possible to shorten the slow agitating (or retention time).

For wastewater treatment, the Chlor-Alkali business of the Aditya Birla Chemicals offers a special range of products that help to remove pollutants from wastewater. Our latest series of coagulants is the VYTAL range, which offers a variety of solutions for industrial water treatment and wastewater management. Its applications include oil-water separation, industrial wastewater treatment, colour removal, fluoride removal, specialty chemical formulation, and paper sizing. The products are designed to meet the specific needs of different industries, including textiles, refineries, paper mills, pharmaceuticals, tanneries, and more. With its high efficiency and cost-effectiveness, VYTAL has become a preferred choice for many companies looking for sustainable water management solutions.

For disinfection, we offer a range of products that help to kill bacteria, viruses, and other harmful microorganisms in water. These products include chlorine and its derivatives like sodium hypochlorite and calcium hypochlorite. These disinfectants are used in both municipal and industrial water treatment plants to ensure that the water is safe for consumption.

Our Stable Bleaching Powder brands – VIKRAM, LION & SHAKTIMAAN, comprise of dry free-flowing powder with very high degree of superior stability. It is produced in a modern state-of-art plant using high purity hydrated lime. The outcome is a dry free-flowing bleaching powder with very high degree of fineness and superior stability. It has low bulk density and preferred by all Water Treatment companies due to the salient bleaching characteristics and low sludge when dissolved in water. It is soluble in cold water, has low moisture content and free from any heavy metal impurities.

We also offer RENSA, which is a high strength bleach, available in the form of free flowing white granules with 65-70 % available chlorine. It is used in municipal and industrial sector for effective disinfection of water. It helps to eliminate bacteria, viruses, and waterborne diseases. It is a strong oxidizing agent which acts as bactericide and fungicide to control algae and eliminate odour in water.

Needless to say, and evident is that water quality management is crucial for our health and the environment. Poor water quality can lead to various health issues, and contamination of water sources can also have detrimental effects on ecosystems. While efforts have been made to improve water quality through treatment and regulation, the future lies in Total Quality Management, an essential shift towards a more holistic approach. This approach involves managing water quality at all stages, including its sources, distribution, and disposal. It also requires the cooperation of various stakeholders, including policymakers, water managers, and the public, to achieve sustainable and safe water management practices. Total Water Quality Management will not only improve the quality of life for individuals but also ensure that our water resources are protected for future generations. ■

ROLE OF R&D IN ACHIEVING SUSTAINABLE GOALS

Scientists and engineers working in R&D should also focus on developing new sustainable materials, such as biodegradable plastics, bio-based materials, and recyclable materials to replace traditional materials that are less sustainable

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GODREJ AGROVET LTD.

The chemical industry is a major contributor to the global economy, with a market size of over US $4 trillion in 2021. The industry is also a significant employer, with millions of people working in various roles, including research and development, production, quality, EHS, sales, and logistics.

In India, the chemical industry is extremely diversified and covers more than 80,000 commercial products. This can be broadly classified into bulk chemicals, specialty chemicals, agrochemicals, petrochemicals, polymers, and fertilizers. One of the major challenges the industry faces is changing consumer preferences.

As consumers become more environmentally conscious, there is an increasing demand for products that are made from sustainable and environmentally friendly materials. This trend is driving the development of new products and technologies and therefore, one of the fundamental drivers of growth in the chemical industry continues to be R&D.

The traditional approach of chemical organizations to R&D may not be the best option as the industry is changing fast with development of newer technologies and digitalization across the world. It will be difficult for companies to remain competitive if they do not stay ahead of the technology curve. This is only possible by investing in R&D and developing new products. Therefore, R&D will play an extremely important role in helping organizations achieve sustainable goals.

Sustainable chemistry aims to design and develop chemicals and processes that reduce or eliminate the use and generation of hazardous substances, minimize environmental impacts, and promote economic growth. It is important for R&D to focus on the twelve principles of "Green Chemistry" which include prevention, atom economy, less hazardous chemical syntheses, designing safer chemicals, safer solvents and auxiliaries, design for energy efficiency, use of renewable feedstocks, reduce derivatives, catalysis, design for degradation, real-time analysis for pollution prevention, and inherently safer chemistry for accident prevention.

Scientists and engineers working in R&D should also focus on developing new sustainable materials, such as biodegradable plastics, bio-based materials, and recyclable materials to replace traditional materials that are less sustainable. Newer technologies can also be used to develop new processes for recycling and upcycling materials. Chemists need to develop new methods for breaking down plastics into their component parts, which can then be used to create new products. Additionally, upcycling processes can transform waste materials into new products, reducing

Discovering new modes of actions for insecticides, herbicides, and fungicides has helped farmers to reduce the doses of chemicals from Kg/hectare to few grams/hectare

the need for new raw materials. Coatings play a critical role in many industries, but traditional coatings can be harmful to the environment. Green chemistry can be used to develop sustainable coatings that are less harmful to the environment. For example, researchers can develop coatings that are made from renewable materials or coatings that have lower volatile organic compound (VOC) emissions.

In the agrochemical industry, efforts of scientists over several years have resulted in identification and developing safer chemicals that have lower toxicity and are less harmful to human health and the environment. Discovering new modes of actions for insecticides, herbicides, and fungicides has helped farmers to reduce the doses of chemicals from Kg/hectare to few grams/hectare. Scientists have developed safer raw materials which cause minimum damage to the environment and are less hazardous for farmers. Collaboration among researchers, government agencies, and industry can help identify safer chemicals. By sharing data and knowledge, stakeholders can work together to identify chemicals that are safer and more sustainable.

In the pharmaceutical industry, sustainable manufacturing of Active Pharmaceutical Ingredients (APIs) is important to ensure supply security to manufacture required formulations. This was evident during Covid-19 period as some of the most developed nations were dependent on India to supply life-saving drugs. Recently developed and introduced APIs are highly active but complex in chemistry. Therefore, more sophisticated processes are involved which also poses challenges and opportunities for R&D scientists. Atom economy, waste generation and chemical reaction hazards need to be focused to ensure sustainability of the processes.

In the oil and gas industry, engineers and chemists in the upstream processes need to collaborate to develop greener solutions which are effective as corrosion inhibitors, scale inhibitors, viscosity modifiers, emulsion breakers, reverse emulsion breakers, biocides, hydrate inhibitors among others. These solutions

Over the last few years, commercialization of a few green technologies using ionic liquids and supercritical carbon dioxide as solvent were attempted with limited success

are extremely important for sustainability considering the high-volume requirements. Developing and identification of greener catalysts, fuel additives, H2S scavengers in the downstream process of the oil and gas industry is equally important for sustainability.

Today, the sustainable practices followed by Industries are limited to solvent recoveries and developing safe processes to avoid accidents. Economic and technical challenges often hinder the commercialization of green chemical processes. Over the last few years, commercialization of a few green technologies using ionic liquids and supercritical carbon dioxide as solvent were attempted with limited success.

Microwave chemistry is extremely popular with academia but still not seen as a success in commercial applications. Advantages of microwave chemistry include low energy consumption, homogeneity, speed of heating, faster reaction (minutes instead of hours or days), atom economy (greater yield and lesser wastage), green solvents (including water, ethanol, and methanol) which are strongly responsive to microwave.

Less or no solvent also gives opportunity to perform concentrated reactions and possibility of neat condition or supported reagents. Rapid conditions screening for integrated on-line control guarantees safe operations. R&D scientists need to challenge themselves to commercialize this technology which will contribute significantly to the sustainability cause.

There are also recent reports of commercial applications of surfactant mediated reactions but in limited numbers. Many organic fundamental organic reactions, which otherwise need organic phase and dry conditions, can be carried out in water using surfactant mediated

technology. Advantages of this chemistry is that it brings substrates and reagents in proximity to enhance efficiency and rate of reaction, and it sometimes shows reactivity or selectivity that cannot be attained in organic medium. Considering the potential of this technology, more efforts are needed to popularize green chemistry.

Flow chemistry is getting good traction and over the next few years, it is expected that several batch processes will be converted to continuous using flow chemistry. In flow chemistry, reagents are continuously pumped through the reactor and the product is continuously collected. Key factors for flow chemistry reactions are residence time (flow rates), mixing, pressure and temperature. Some of the highly energetic reactions such as nitration are good candidates for flow chemistry and are being practiced in industry.

Sustainability principles should be considered when we initiate the process development of any molecule. It is important that during the ideation stage, we must thoroughly debate and look for sustainable practices. This includes the use of lower quantities of volatile organic solvents and recyclable catalysts. This also includes focusing on processes which give least minimum products and maximum yields resulting in superior atom economy and selecting processes with least steps resulting in energy efficient synthesis.

During the entire product lifecycle from development to growth and from maturity to decline, processes need changes. In every step, the development team must focus on sustainability which may also be achieved through collaborations with academia or research institutes. Industry and academia must foster a better environment for creativity by jointly building and developing new knowledge and by bringing together multi-talented groups of researchers from both pools to provide solutions to make R&D more sustainable.

To develop a sustainable process for optimum yield (which is also intrinsically safe to manufacture), very often we are required to use solvents in larger quantities and hence it is extremely important to judiciously follow 3R (Reduce, Reuse, and Recycle) principles.

We must try to Reduce as minimum solvent as possible in the process, our next option must be to Reuse it back in the process. However, very often it has challenges of impurities and therefore Recycle after appropriate treatment is key to the success of the process. All efforts should also be made to use solvents with superior EHS profile such as minimum ozone depletion potential and biodegradability. This also has an economic advantage since incineration of waste is not cost effective and will result in expensive product costs.

Green chemistry is probably not a solution to all environmental challenges, but it still remains to be the most fundamental approach in achieving sustainability goals. Green processes will not be successful if not economically viable and therefore Green technology must compete with classical processes with respect to cost of the product. More efforts are required from R&D as well as commercial teams to make our products “Good and Green”.

Globally, there is an increased regulatory focus on ESG and climate risk, and the chemical industry will be the first one to face scrutiny. We need to work towards changing the environmental brand image of the chemical industry by focusing on sustainable and green technologies to deliver better and safer solutions. R&D will play an integral role in fostering economic and viable solutions for future growth. ■

RECYCLAMINE: CONTRIBUTING TO A GREENER PLANET

Breaking free from the linear 'Take-Make-Dispose' model to create a resilient and sustainable future

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Sustainability has emerged from merely a buzz word to a reality that the world is coming to terms with. The climatic changes, consequent socio-economic impact, concern over depletion and limitation of natural resources, our recent volatility during a pandemic have all amplified today's population's consciousness towards contributing for the greener world in future.

Governments and policy maker on one hand and business fraternity globally are all looking to make this a critical part of all planning and execution. From just contributing to raging a war against carbon footprints and waste management is being ingrained from macro to the minutest level. This is defining strategies and actions across nations globally - giving rise to conversations on Circular Economy.

Shift Towards a Circular Economy

As the world faces the environmental, social, and economic challenges, the recognition of the need for a circular economy is becoming increasingly urgent to create a more resilient and sustainable future for us and the planet. The fundamental shift from the traditional linear economic model, which is based on the take-make-dispose approach to the circular business models, based on the principle of keeping resources in use for as long as possible, is gaining momentum around the world to address the challenges of sustainability and resource depletion. The concept that collective action of each person and every industry has the power to create a sustainable world is gaining momentum.

One area where circular economy is emerging significant and much work is being done is in the world of composites.

> We have the world's 1st and only technology to make every Epoxy Composite a potential opportunity for recycling

The Composite Story

The adoption of composites is fast increasing, driven by megatrends and the modern contemporary lifestyles that we are all leading today. From light weight vehicles to our day-to-day gadgets and our preference for construction material, composites are everywhere. Keeping in pace with this rapidly changing world, materials are getting lighter yet stronger. Over the years the industries have moved from legacy materials to light weight composites. One such of the composite family, as we all know, are Epoxy Composites.

Epoxy Composites are high performance polymers and are a preferred choice across industries like aerospace,

automotive, marine and construction due to its light weight, energy efficient and high-performance properties. The epoxy resin provides a strong and durable matrix for the composite materials, while the reinforcing fibres add strength and stiffness to the final product. Epoxy composites have a high strength-to-weight ratio, making them ideal for applications where lightweight materials are required. Some common applications of epoxy composites include aircraft components, wind turbine blades, sporting goods such as surf boards, and structural components in buildings and bridges.

Recycling of composite materials, including epoxy composites, can be challenging due to the nature of the materials and the way they are constructed. Composite materials are typically made up of two or more materials that are bonded together, which makes it difficult to separate and recycle the individual components. At the end of their lifecycle these products end up in debris adding to the ecological degradation of our fragile planet. This is one of the key challenges the world is facing as the disposal of composite materials at the end of life had been a pain point for across user industries. Such widely used epoxy composites do not provide a sustainable solution for the future as they are non-recyclable.

Today, this challenge has a solution in Recyclamine® Technology, the world's first solution to end of life management for epoxy composites - a technology innovation of Advanced Materials Business of Aditya Birla Chemicals, Aditya Birla Group.

Our Business

The Advanced Materials Business of the Aditya Birla Chemicals is a truly global, among the top 3 epoxy players worldwide, with manufacturing across 3 countries. This has a strong portfolio of epoxy products, systems, and solutions with a broad spectrum of properties, behaviours, and performance benefits. With strong customer-orientation and focus on highest fulfilment levels, we enable customers to fulfil assembly-line needs, test new prototypes, enhance technical domains and build innovations. The business is geared to build and curate solutions that help deliver best-in-class deliverables to customers, thereby impelling growth and consolidating a clear edge. We are committed to synthesizing products that optimise safety for formulators and applicators and minimise ecological footprint, thereby vitalising the value chain for a healthier planet.

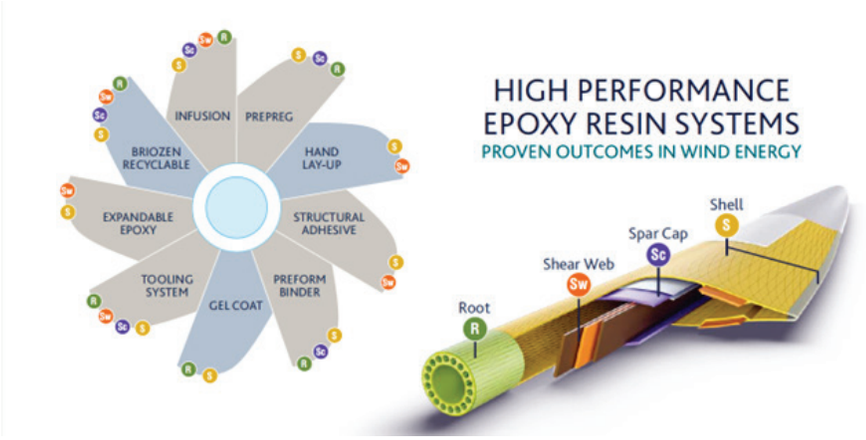
New scientific discoveries in the field of environmentally friendly solutions, new technology innovations in the field of recyclable materials and development of new products from renewable resources is at the fore front of Research & Development for Aditya Birla Group. We are committed to developing and providing solutions that are safer for our customers, healthier for end-users and have a greater positive footprint on the planet. The business has started designing products with the end of life management in mind. The materials are structured based on their ability to be reused and recycled. The use of recycled materials in the manufacturing process reduces the need for virgin resources and creates a closed loop system.

Recyclamine®: A 1st In The World

One of the finest innovations, high on circular economy and sustainability index, is the 'Recyclamine' Technology, which was developed as a solution to a global concern of the end-of-life management for composites. Redefining the very future of applications that use epoxy thermoset, Recyclamine® Technology is a path-breaking innovation by the business, that captures a commitment towards a greener planet. This pioneering, patented technology allows epoxy thermosets which are non-recyclable to be recovered, reused, and repurposed. This facilitates end-of-life recycling and zero-waste manufacturing, thereby plugging into a circular economy. For several industries that use epoxy-based composites as a frontline material, this is a paradigm shift. Ecological, environmental, and societal impacts caused by composite waste are now and can be, a thing of the past.

The multiple award-winning Recyclamine® Technology involves unique Amine-based Curing Agents containing specifically engineered cleavage points at cross-linking sites. Under specific conditions, they convert thermosetting epoxies into thermoplastics enabling recycling. Like for composite components, the reinforcing fibres and plastic material can be recovered and reused. Performance properties of recovered reinforcement fibers are comparable to virgin fibers and can be used in multiple applications, while the recovered epoxy thermoplastic can either be compounded with thermoplastics or used solo to make plastic components.

This portfolio offers two categories - Recyclamine-based Building Blocks



and Recyclamine-based Epoxy Systems, which are suitable for a variety of manufacturing processes. They exhibit a wide spectrum of properties like fast to slow reactivity & latency, low to high thermal and chemical resistance.

Wind Industry Application: Driving the Change

Let us demonstrate the Recyclamine® Technology application in the wind industry for the wind turbine blades. The biggest challenge the wind industry is facing is the end-of-life management of the decommissioned rotor blades. As most of the blades installed earlier this century are getting decommissioned, this poses a significant waste management challenge due to their size, weight, and composition. While we can recycle almost 85% of the wind turbine, 15% of the components which are largely coming from wind blades cannot be recycled due to the non-recyclable thermosets.

Global statistics indicate that the waste anticipated to be generated by 2050 will be to the tune of 43mn tons. It is becoming extremely important for the wind industry to consider using more environmentally friendly and sustainable materials for wind turbine blades.

Over the past two decades, wind companies, worldwide, have trusted the Advanced Materials Business to help achieve transformational advancements in turbine rotor blade technology. The business serves the Wind industry, for onshore & offshore applications, with a robust and ever-evolving portfolio of Composite Systems. At every step, we stay aligned to help fulfil aspirations of load handling, efficiency, compliance & circular economy. Our systems enable optimal aerodynamic rotor blade architecture with greater dimension stability to maximise the energy harnessed from wind. The ability to meet stringent process & application demands, has made epoxy thermoset a material of choice for designers and manufacturers. Wind blade manufacturers, globally, choose from an extensive portfolio of robust systems for Resin Infusion, Prepreg, Tooling, Gel Coat, Hand Lay-up, Preform Binder, Core Material & Structural Adhesives. Suitable for different processes & blade designs, these systems perform excellently under static & dynamic loading.

Through this Recyclamine® Technology, the Aditya Birla Advanced Materials Business manufactured wind turbine blades that can now be recycled and reused while retaining high performance on strength and being economically viable, thus, shifting from Linear to Circular economy, low costs owing to recyclable products and lower carbon footprint for the industry.

We have achieved milestones with this technology and collaborated with world-class organisations to launch the world's first fully recyclable blade based on Recyclamine® Technology ensuring end-of-life management. We are partnering with leading end-use segment companies, recyclers, international labs, and academia to achieve the true potential of this unique technology.

This Recyclamine® Technology has an innovation journey of over 10 years. Recyclamine(s) are a group of several new organic compounds, that have different structure and properties. Synthesis and process parameters are optimised by Research and Development team of the Advanced Materials Business, Aditya Birla Group to allow efficient and economic manufacturing. After the successful operations, demonstrated at the laboratory and scale-up pilot plant trials, it is being successfully commercialized with customers globally. A dedicated plant has been commissioned to produce Recyclamine building blocks and systems. Recyclamine® Technology will serve customers around the world through our global operations network. To enable seamless adoption of this pioneering technology, our technical teams will engage closely with customers to comprehend their specialized requirements. An extensive range of properties combined with superior performance and recyclability, will make Recyclamine-based epoxy systems a clear choice for sustainable products.

While the Recyclamine® Technology is fast garnering traction globally, particularly in the US and EU, India is well poised to integrate this technology in the composite applications and products. One such application is composite cylinders for LPG and CNG applications. As the demand for composite cylinders continue to rise (estimated 15million cylinders/ year), the industry can manage the end of life of the composite cylinders by using Recyclamine based resin systems. Not only the thermoplastic can be recovered and repurposed, but the high value carbon fibre can also be recovered and reused. We have the world's 1st and only technology to make every Epoxy Composite a potential opportunity for recycling.

The versatility of the Recyclamine® Technology stems from the fact that it is applicable to any industry - may it be Wind, Sports, Infrastructure or wherever composites are used. Thus, this amply addresses the circular economy concept to break free from the linear 'Take-Make-Dispose' model to create a step change towards a sustainable future for our planet. ■

Indian CHEMICAL News

ChemConnect

SECOND EDITION

Transforming To A New Better | 2023

September 15, 2023 | Novotel Mumbai International Airport, Mumbai

TRENDS IN INDIAN CHEMICAL SECTOR:

- Digitalization & Industry 4.0 Gaining Momentum
- Innovations to Drive Growth
- India and South East Asian Countries Set to Emerge as Manufacturing Hub
- ESG Becoming Mainstream
- Increase In Mergers, Partnerships, and Acquisitions
- Shift Towards Green And Non-fossil Fuel

WHO SHOULD ATTEND?

- Logistics & Supply Chain
- Supply & Distribution
- Warehousing & Transportation
- Lean & Operational Excellence
- Value & Demand
- Information Technology
- Strategic Sourcing
- Procurement

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Petrochemicals

Setting the Stage
for Growth

INDIAN PETROCHEMICALS INDUSTRY: FIVE WINNING PRINCIPLES FOR 2047

Strategic planning, differentiated GTM strategy, collaborative ecosystem, policy interventions, and sustainability can support the country in leading the petrochemicals revolution

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India's petrochemicals industry is a vital part of the country's ambition of becoming an economic superpower. The industry is expected to continue its healthy growth trajectory, surpassing US $75 billion by 2030 and US $150 billion by 2047. However, it is still lagging global peers in terms of per capita plastic consumption (12 kg versus a global average of more than 35 kg). Tailwinds such as an expanding population, urbanization, and changing demographics, supported by the availability of low-cost skilled manpower and enabling regulations, will drive up demand. To realize its full potential, the industry will need to navigate a variety of headwinds, including the availability of competitive feedstock, access to world-class production technologies, and intense competition from cheap imports.

India's demand for petrochemicals across molecules is expected to grow faster than the global average. With growing domestic demand, there is also an opportunity to capture the global petrochemicals market as the China+1 sentiment is becoming more prevalent across major economies. Net imports are about 10 percent of demand, and the supply–demand gap is even more acute at a product-grade level, with almost 100 percent import dependence in intermediates such as styrene and acrylonitrile.

To cater to the gaping demand for many petrochemicals molecules, India's hydrocarbon industry will need to commission 20 world-scale crackers by 2047. While the industry is poised for robust growth, it uniquely lends itself to two national goals: Atmanirbharta and Sustainability.

Atmanirbharta

In its push toward Atma Nirbhar Bharat, the Indian government has identified the petrochemical industry as high priority because of its strategic relevance. Various favourable policies have been announced and implemented to fuel the industry's growth, including 100 percent FDI allowed through automatic routes, setting up petroleum, chemicals, and petrochemicals investment regions (PCPIR), and lower effective tax rates. While investments worth about US $13 billion are under implementation and more than US $85 billion are under consideration, concerted supply planning at a product-grade level will

be imperative as the industry becomes self-reliant. Supply–demand challenges persist, and a dichotomy of oversupply and undersupply is strangling India's petrochemicals industry. The shift of the fertilizer industry, the major consumer of naphtha, to natural gas resulted in a naphtha surplus, which pushed refiners to integrate petrochemicals complexes for naphtha-based petrochemicals building block production. These expansions have resulted in a surplus of products such as butadiene and benzene, with India being a net exporter of these petrochemicals. On the other hand, downstream petrochemical intermediates lack a domestic supply chain, especially for derivatives such as styrene and acrylonitrile etc. Even though select petrochemicals building blocks are in oversupply, specialized grades of polyethylene such as metallocene, a low-density polyethylene film, continue to be imported due to limited domestic production. Over the next decade, the surplus of petrochemicals building blocks is expected to shrink, and India will become a net importer by 2030 for these petrochemicals.

Sustainability

At the COP26 summit in Glasgow in 2021, Prime Minister Narendra Modi laid down the action plan for India to reach net zero by 2070. The petrochemicals industry is uniquely positioned to support this vision by driving the transition of carbon feedstocks from fuels to petrochemicals. Hence, increasing the Petrochemicals Intensity Index (PII) serves twin goals for industry participants: enhanced profit pools and a reduction in scope 3 emissions. (Using naphtha as the fuel source results in greenhouse gas emissions of more than 3,600 kg of CO2 compared with more than 2,800 kg of CO2 per ton of naphtha when used for petrochemicals production.)

Going forward, crude oil to chemicals (COTC) is emerging as the ultimate level of integrated pet-chem complexes.

> While investments worth about US $13 billion are under implementation and more than US $85 billion are under consideration

The technology is still novel, having reached a maximum 50 percent of COTC conversion. It has the potential to produce chemicals amounting to 70 to 80 percent of the barrel opposed to about 10 percent in a non-integrated refinery complex. The technology advancement in using green feedstocks such as bio-naphtha and bioethanol, green processes such as crackers with CCUS and electric crackers, or combination of both could be crucial in progressing toward sustainability.

Lastly, a circular economy is another important vehicle in the sustainability cause. Plastic polymers can be recycled and reprocessed, thereby reducing the use of virgin fossil fuels. A circular economy can help transitioning a simple linear model into a complex circular model where the molecule life is extended in the value chain. The world has always looked at this industry as a linear model of extract, produce, and waste. A circular economy can address these end-of-life emissions. India has a strong established recycling value chain with most of it still existing as an informal industry and focused mainly on mechanical recycling. Reducing end-of-life emissions will require investing in chemical and biological recycling facilities.

Five Imperatives for Strategic Success in 2047

The next quarter century will be characterized by substantial opportunities, innovations, and disruptions for India's petrochemicals industry. Five strategic imperatives for incumbents, new entrants, policymakers, and other allied stakeholders can support the country in leading the petrochemicals revolution

Strategic Planning

Investing in the right molecule chains and creating a robust product portfolio will differentiate players in the long term. Before making strategic long-term bets, incumbents and new entrants will need to carefully assess the market dynamics, capability requirements, business model fit, competitive landscape, and potential disruptions. R&D investments to develop indigenous technologies—new catalysts, additives, and related technologies—can help in setting up domestic supply chains for petrochemicals and improve production costs. A robust portfolio strategy will need to build flexibility to account for product evolution over time, product switches for netback optimization, and synergistic offerings for high-value propositions. Strategic investments in sustainable technologies such as green crackers and biofuel production will future-proof their portfolios.

Adopt a Differentiated GTM strategy

India's go-to-market (GTM) models have evolved in response to the highly fragmented, credit-starved base of downstream petrochemicals customers. Indian GTM models have seen limited innovation or differentiation, and most

channel partners and other intermediaries add limited value beyond expanding customer reach and extending credit to customers. To counter margin pressure, commodity sales will need to start moving toward low-overhead, no-frills, and digital-first models. To drive differentiation and create customer stickiness in direct sales of specialty products, producers will need to evolve from being product marketers to solution providers. This can help Indian manufacturers capture a larger share of customers' wallets and boost domestic production.

Create a Collaborative Ecosystem

An ecosystem enables stakeholders to contribute and collaborate, enhancing industry wide value creation. India's vision to become atma nirbhar will require a strong infrastructure, such as strengthening of plastic parks, supply chain infrastructure around cryogenic pipelines, and warehouses. In addition, domestic petrochemicals players can partner with other domestic producers of downstream derivatives or global manufacturers to create a long-term strategic advantage. M&A activities among complementary domestic players can help create world-scale businesses and mutual benefits. For sustainable growth particularly, an ecosystem around recycling infrastructure and green feedstocks will be essential.

Push for Policy Interventions

A favorable policy landscape and government interventions will help shape the industry in an Atmanirbhar and sustainable way. Policies that incentivize investments such as tax incentives, rebates to promote capacity expansions, support to adopt non-conventional feedstocks-based technologies such as coal to chemicals, and crude to chemicals could boost the inflow of capital. Given the nascent status of technologies for both circularity and sustainable manufacturing, such a positive governmental push will encourage more R&D investments and help India transition from being a licensee to a licensor. In parallel, stringent norms to discourage low quality can boost domestic producers' competitiveness on the global stage. Intra-government agreements and interactions on technology licensing can also help set up the supply chain for petrochemicals.

Embed Sustainability into Ways of Working

Forward-thinking companies will be stewards of sustainability, and this approach will help avoid business disruptions, such as from a sudden decline in demand because of a plastic ban. Companies can explore multiple routes toward sustainability, including mechanical, chemical, and biological recycling or renewable feedback platforms. An industry consortium can be developed to engage in positive public relations among key stakeholders, defining the industry's value proposition and the intended positioning for sustainability brand equity.

India's petrochemicals industry is poised to continue its transformative growth journey, and it is uniquely positioned to drive two national goals of atma nirbharta and sustainability. While India has come a long way in creating atma nirbharta in the country, there is still headroom for more development. The country's dependence on imports for multiple petrochemicals products makes a strong case for driving the Make in India movement in the industry. The industry is also well-positioned to support the wider petroleum industry in its decarbonization journey. The petrochemicals industry can provide an economic energy transition route for refineries given its smaller carbon footprint. Scope 3 emissions, which form the majority of a refinery's carbon footprint, are well-addressed by the petrochemicals industry while increasing the gross refinery margins. To drive this, stakeholders across India's petrochemicals industry will need to come together and play their respective parts. Unlocking the right mix of strategies will help catalyze the next phase of growth for the industry. ■

INDIA REQUIRES CLUSTERS IN CHEMICALS AND PETROCHEMICALS TO BECOME A PETCHEM HUB

Petroleum, Chemicals and Petrochemicals Investment Region (PCPIR) aims to drive infrastructure, innovation, facilitate knowledge transfer, and promote collaboration among industry players across the entire value chain to make the production of chemicals and petrochemicals more efficient and sustainable

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The purpose of the PCPIR is to create an environmentally sustainable investment region for the development of manufacturing, trading, services and logistics in India, in the field of petroleum, chemicals and petrochemicals. The region focuses on investment and the development of infrastructure, which includes the local supply of raw materials and resources, transportation, storage and logistics, and the social infrastructure required for its operation. Overall, it is intended to create an attractive regional environment to facilitate the development of the petrochemical industry in the region and to promote economic development in the country.

Global Chemicals Market

In 2017, the value of the global chemicals market exceeded US $5 trillion. By 2030, it is anticipated to double. In emerging economies, both output and consumption are rising quickly. Global supply chains, and the trade of chemicals and products, are becoming increasingly complex. Growth in chemical-intensive industry sectors (such as building, agriculture, and electronics), driven by global megatrends, creates risks but also opportunities to improve sustainable production, consumption, and product innovation.

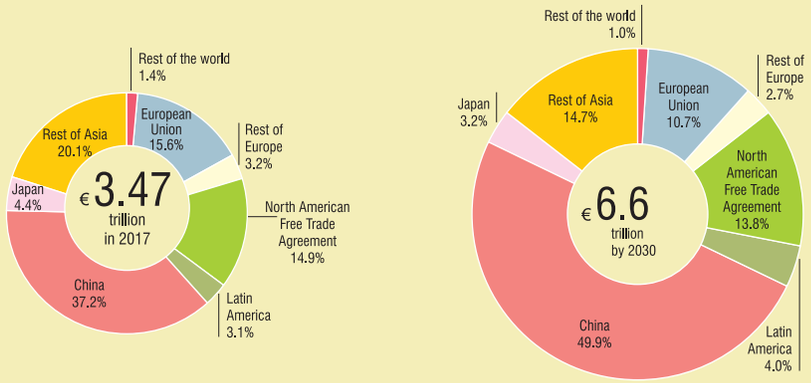
About 62% of the 345 million tonnes of chemicals consumed in the EU in 2016 were hazardous to health, according to statistics from Eurostat, the statistical office of the European Union (EU), collected in 2018 by the European Environment Agency. Leading businesses, from chemical manufacturers to retailers, are implementing human rights-based policies, complete material disclosure, risk reduction beyond compliance, and sustainable supply chain management.

Chemical clusters in India have the potential to become major players in the global chemical industry. However, there is a need to address the challenges faced by these clusters

What Do Clusters Mean?

"Clusters" may be seen on the globe economic map of today. A cluster is a geographic concentration of similar businesses, institutions, and organizations in one industry that might exist in a given area, state, or country. Clusters develop

Projected growth in world chemical sales, 2017-2030 (adapted from Cefic 2018, p. 34)



Global chemical sales (excluding pharmaceuticals) are projected to grow from euros 3.47 trillion in 2017 to euros 6.6 trillion by 2030. Asia is expected to account for almost 70 per cent of sales by then.

Source: Global Chemicals Outlook-II by UNEP

because they increase a company's productivity, which is impacted by regional resources as well as the existence of nearby similar businesses, organizations, and infrastructure. Clusters can improve competitiveness in today's more complex, knowledge-based, and dynamic economy by building on prior accomplishments in macroeconomic stability, privatisation, market openness, and cost reduction.

Cluster in Economies

To increase efficiency, the chemical and petrochemicals sector has a history of significant cluster-like ties amongst businesses. However, as the comparison with clusters in other sectors of the economy demonstrates, this legacy hasn't only been a boon; in some respects, it has also constrained how clusters and cluster projects are handled in the chemical industry.

The Indian petrochemical sector may use clusters as a tool to move to a new stage of successful growth, which is an obvious possibility. Moving away from a concept of internal optimization inside businesses and toward a model of cluster-based optimization across networks of co-located activities is necessary for the Chemicals and Petrochemical industry's competitiveness upgrade.

To increase competitiveness at the level of enterprises, the cluster, and the cluster-specific business environment, cluster initiatives in the Indian petrochemical sector must shift from a focus on supply-chain improvements to a broad-based agenda. The concept of industry-based collaboration in the Indian petrochemical sector has to be replaced with a new structure that involves all tiers of government, academic and research institutions, as well as industrial partners.

Basic Understanding of Regional Chemical Industrial Clusters

Clusters in a sector of the economy depend on technology, government policy, and market circumstances across all locations. In addition, a number of characteristics connected to the development route that produced clusters in a certain geographic area will have left a legacy in their present profile relative to other locations.

Chemical manufacturing requires capital. Investment decisions bind a corporation to a place financially. This fosters cluster collaboration and development. Chemical industry inputs and outputs are large and expensive to transport. Key feedstock inputs, mostly oil and natural gas, are not near chemical product markets. Value chain transportation expenses are considerable. It fosters clusters at transportation hubs. It provides an atmosphere where specialist logistical enterprises and proximity to linked transportation and logistics clusters benefit.

Chemical firms are diverse due to their economic sectors. Due to the commodity character of basic chemicals, huge multinational corporations compete in a worldwide market using economies of scale, learning economies, and highly efficient production systems. Many speciality chemical industries, some worldwide and some national or regional, have led to a system of firms of various sizes addressing specific client demands or geographic areas.

Clusters of Chemicals

Strong chemical clusters usually belong to two or more related cluster groups. There is evidence of super-cluster effects, which enhance the advantages of connected clusters. Clusters (oil and gas, biopharmaceuticals, plastics, and analytical instruments) also have substantial relations to the chemical cluster. Chemical clusters further down the rankings are concentrating on specific phases in the value chain from feedstock inputs (oil & gas) to final outputs that need moderate (plastics) to advanced (biopharmaceuticals) materials. Making the relationship between inputs and the most advanced outputs directly or focusing on the most advanced outputs alone appears too difficult; the requisite capabilities are diverse and may be lured by different geographical features. Agriculture might affect locational trends if the chemical sector uses more agricultural feedstocks. Innovation, productivity, size, and big firms characterise the cluster group.

Role of Government for Cluster Development

Government performs three essential functions in an economy: providing acceptable macroeconomic circumstances, enhancing microeconomic capability, and creating a supportive and progressive regulatory environment. This is the consensus among policymakers, practitioners, academics, and business leaders.

To bring cluster players together, the government's involvement should also include promoting cluster growth, enabling it, and providing chances for fruitful discourse. Some of the most important governmental duties include

acting as a "facilitator," "initiator," "participant," and "listener" to engage partners in fruitful dialogue and foster a sense of urgency that leads to action; conducting ongoing cluster assessments to ascertain their viability and relative strength to ensure global competitiveness; institutionalising cluster upgrading (for example, restructuring government programmes and services, disseminating new knowledge, and collecting and disseminating data). Technical, physical, and intellectual infrastructure should get

direct investment as well as investment incentives. Cluster conferences and forums should also be sponsored to encourage participants' access to "social capital."

Cluster-based Economic Development

Government officials, corporate executives, academics, and practitioners all recognise that cluster-based economic development promotes innovation, productivity growth, and wealth. Intangible assets like social capital drive cluster success, regardless of their origins. Clusters foster knowledge and collaboration. Cluster development provides a new way for governments to arrange their industrial projects and services. Actions include embracing cluster-based economic development as a national strategy, sponsoring cluster evaluation and plans, expanding R&D investment, infusing technology, and demanding clusters. Isolated cluster approach fails. Instead, the question is whether industries succeed owing to solid business strategies, locational advantages, or leveraging on a nation's competitive advantages and strategic planning by governments/states throughout the world.

Understanding of Chemicals Clusters in Different Regions

Europe Europe is a major chemical market. European clusters servicing consumers in this region continue to benefit from the scale of the European market, even as other markets, notably in Asia, rise. Europe's key asset is its highly developed business environment, which allows chemical businesses to attain productivity levels that compensate for high factor prices. Second, access to a highly skilled labour population, especially in places where a long history of chemical industry employment has produced specialised educational institutions. Third, the chemical industry has access to productive general inputs and services from numerous linked and supporting sectors, notably in Europe's industrial heartlands.

Chemical product manufacture and usage in Europe must fulfil rigorous environmental and safety regulations. European chemical clusters may be threatened by some of these requirements, which are costly. However, as these standards foresee worldwide trends and empower enterprises to find new solutions, they may also position European clusters as global industry leaders in innovation. Based on these economic environment characteristics, Europe has built a cadre of powerful chemical enterprises, many with rich historical origins. Many of these firms have global reach and contribute to other clusters. This worldwide reach gives European clusters significant links to foreign markets. European enterprises must continually examine which of their various locales is ideal for a specific activity, which puts European clusters in constant rivalry.

Asia Asia's chemical industry is younger than Europe's. It is still defined by fragmented markets, whereas competitors in North America and China are rising in bigger, more integrated markets. European clusters have issues due to their long history. Europe's capital stock is older, so industrial facilities don't attain the same economies of scale as new investments in Asia.

Jurong Island: Petrochemicals Cluster Case Study

The diamond model is used to analyse the petrochemical cluster. The diamond model suggests four linked facets i.e. factor inputs, demand conditions, connected and supporting industries, and firm strategy and rivalry. Jurong Island's cluster-based growth is crucial to Singapore's petrochemical industry. Feedstock and many upstream and downstream enterprises combined with linkages at one designated location makes this very beneficial for individual companies. Due to rising regional demand for petrochemical and specialised chemicals, multinational corporations from around the world have invested on the island. Over 70 firms operate on the island. With safety in mind, the government have built cutting-edge utility infrastructure. Supporting businesses like logistics, common docks and jetties, waste treatment facilities, and chemical warehouses attract investors.

Factor Input

Political stability, sound macro & fiscal policies, financial incentives, good transportation network, sound legal framework, good telecommunication infrastructure, and pro-business atmosphere are widely understood. Cluster-specific factor inputs are the emphasis here.

Refineries Singapore's third-largest oil refinery is in Singapore. The four major refineries are Shell, Exxon Mobil, SPC, and SRC (SRC). Oil refineries produce naphtha, NGL, and LPG, which are used as feedstock in the petrochemical process. Their presence in Singapore may encourage other firms to build petrochemical plants nearby to decrease transportation costs. Cost is the reason petrochemical factories are located near or integrated into feedstock producing sites. Integrated petrochemical refineries are anticipated to add US$2-$5 per tonne of petroleum to refinery margins.

Shared Facilities Jurong Island was established to provide a cost-effective environment for corporations, notably in capital-intensive industries like petrochemical. Jurong Island was developed by linking seven small islands (Pulau Merlimau, Pulau Ayer Chawan, Pulau Ayer Merbau, Pulau Seraya, Pulau Sakra, Pulau Pesek, and Pulau Pesek Kecil) to cut logistic costs for petrochemical and chemical factories. Marine facilities (jetties and berthing), waste treatment, warehousing, firefighting, medical and emergency response, roads and drain infrastructure, and service pipelines are shared by island companies. Service pipelines provide easy access to Jurong Island's common service corridor for all firms. By "plugging in" to the service pipeline, enterprises can easily transfer raw materials, finished products, and utilities services (SembCorp Utilities Terminals helps to control the flow to companies). The strategic benefit of Jurong Island is "plug and play" capacity. Companies can save 20% on capital costs by sharing facilities, according to Economic Development Board. The "plug and play" capability will allow new businesses to be set up faster and eliminate the need for complicated infrastructure development and hefty expenditures.

Demand Conditions

Sophisticated domestic demand drives innovation and competitive advantage. Therefore, petrochemical industry demand must be domestic. Additionally, plastics, electronics, and pharmaceutical sectors drive demand. India has advantage due to huge local demand of the petrochemicals products.

Related Industries

Logistics, utilities, engineering, and finance help petrochemical companies. They support petrochemical firms in Singapore. These related industries is working in harmony to share the cost of production and bring economics of scale.

Firm Rivalry Context

The number of enterprises in the same industry can indicate the rivalry context's efficacy. 70 enterprises operate on Jurong Island. Not all companies make the same things. Due to its sophisticated concept and high capital intensity, few companies have comparable product lines, limiting competition. Long-term supply agreements and product collaborations are frequent in this business. Thus, this industry's domestic rivalry is limited by low product line duplication and long-term supply agreements. The main integrated petrochemical feedstock suppliers like Shell, Exxon Mobil, and Singapore Refineries Company compete (SRC).

India's Chemicals Cluster

Chemical clusters in India have the potential to become major players in the global chemical industry. However, there is a need to address the challenges faced by these clusters and develop a sustainable and environmentally friendly approach to chemical manufacturing. In India, the Upstream and downstream chemicals product cluster and plastic cluster export potential with respect to other sectors is low (Ref: Fig. 2). However, the demand and prospective for growth is high considering the high consumption potential.

India position for Upstream chemicals products cluster export is comparatively good as compared to downstream chemicals products and plastics clusters in the world. It shows that the India need to improve its position in world for the cluster development in Chemicals and Petrochemicals sector (Refer: Fig. 1).

Downstream and Plastic Clusters Exports for year 2019 in world (Source: ISC International Cluster Competitiveness Project).

It is also observed that the Organic Chemicals has the highest export, thereafter industrial gases from the upstream chemicals products which can be further grow if focuses on the development of cluster in India (Ref: Fig 3). Similarly, India has huge potential for export of plastic material and resins.

From the year 2005 to 2019, the exports from Upstream, Downstream chemicals products and Plastic clusters in India has been increasing from 0.1-

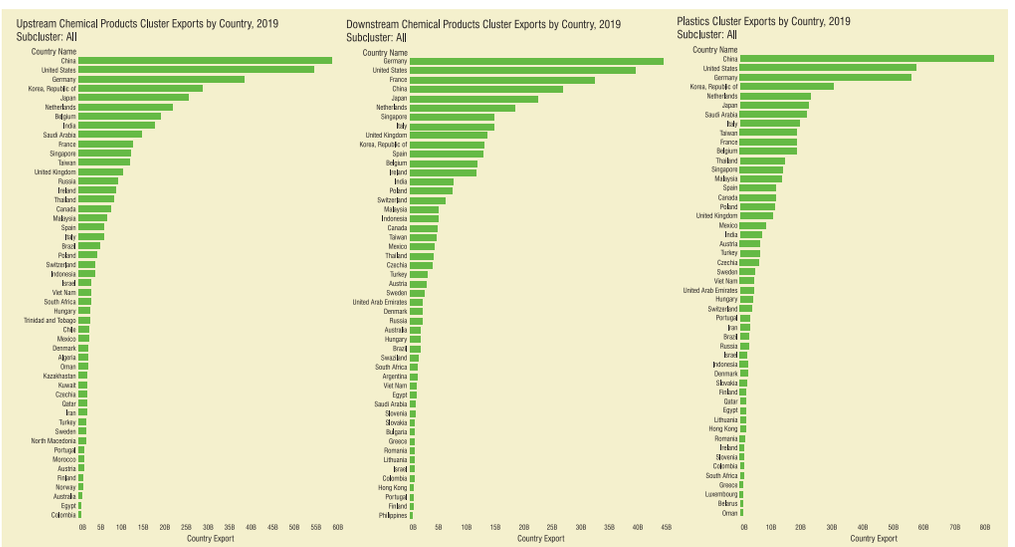


Fig 1: Countries position in Upstream, Downstream and Plastic Clusters Exports for year 2019 in world
Source: ISC International Competitiveness Projects

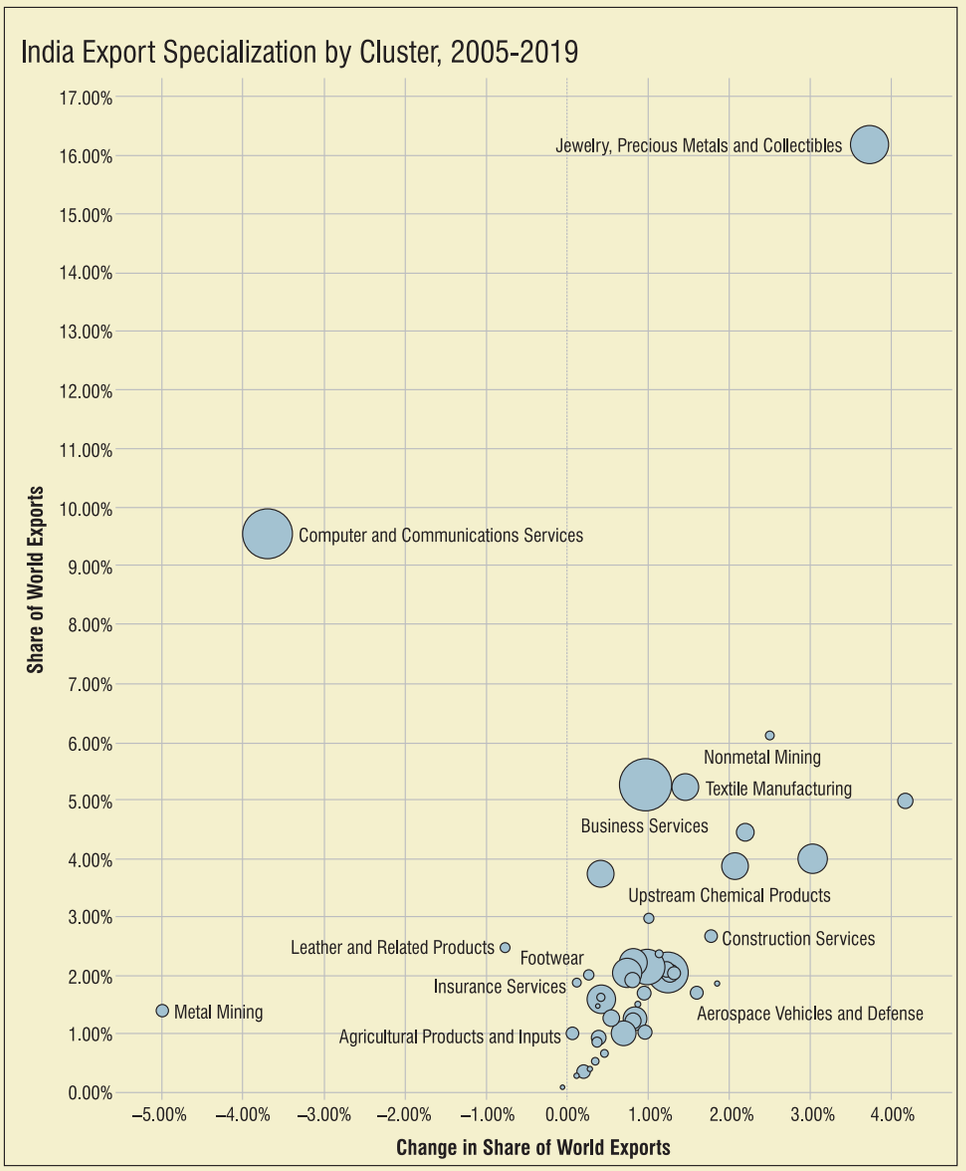


Fig 2: Indian Exports share in world exports and its % change from 2005-2019 across different clusters

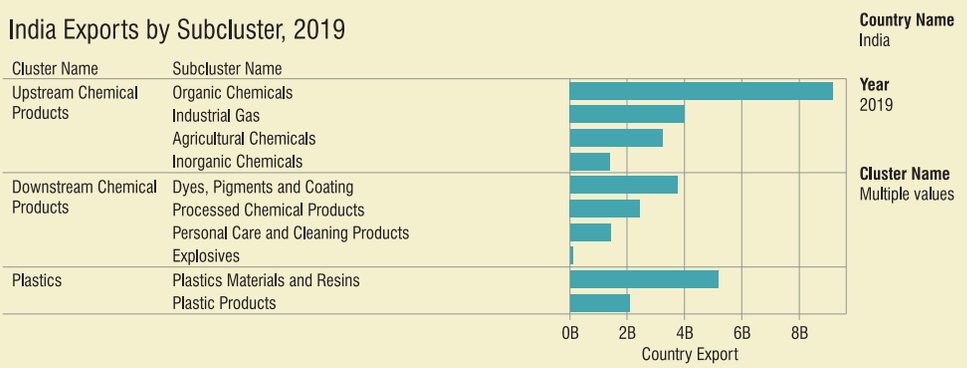


Fig 3: India Export by Subcluster, 2019 in USD Billion and its contributions

0.3% to 1.3- 4% of world share and value of exports. It is observed that chemicals and petrochemicals cluster in India still needs to be more competitive in order to increase our share of the export in world.

For the sustainable development of Chemicals Cluster in India for Make in India and Make for World in chemicals and petrochemicals sector, there is a need to develop the dedicated strategy for manufacturing hub in this industry. We need to work on the following aspects to project ourselves as manufacturing chemicals and petrochemicals hubs and becomes dominant in chemicals and petrochemical supplier.

Regulatory Reforms The Indian government has implemented several regulations to promote the safe, reliable and sustainable production of chemicals and petrochemicals. These include regulations related to human, plant and animal health, safety and environment.

Promotion of Innovation and Technology There is need to take initiatives to promote innovation and the adoption of advanced technologies in the chemicals and petrochemicals industry. India is currently dependent on developed countries like USA, Japan and EU for the advanced technologies used for the manufacturing of chemicals and petrochemicals. These technologies are heavily guarded. It is necessary to provide incentives for the development and application of sustainable technologies for the production of high quality and safe chemicals and petrochemicals in India.

Sharing of Facilities and Infrastructure There is a need to create Integration and cost effective infrastructure in which Companies can share common facilities and infrastructure. Buy

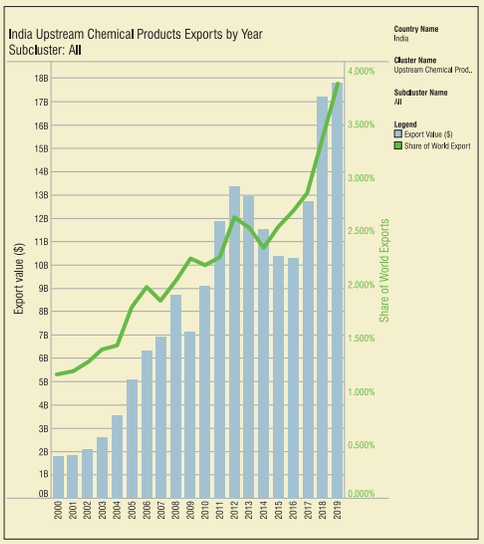


Fig 4: India's Upstream Chemical Products Cluster Exports, from 2000 to 2019 (Source: ISC International Cluster Competitiveness Project)

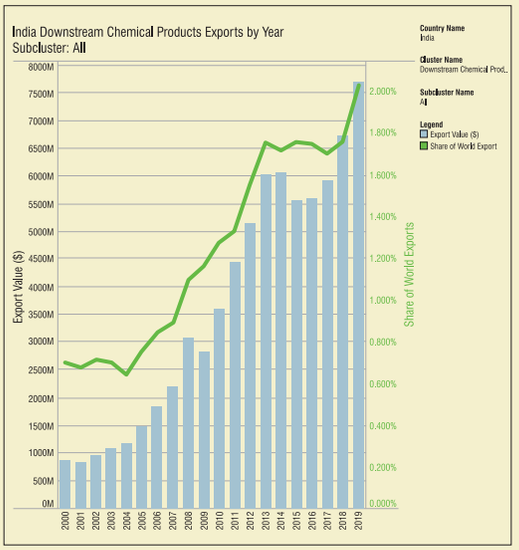


Fig 5: India's Downstream Chemical Products Cluster Exports, from 2000 to 2019 (Source: ISC International Cluster Competitiveness Project)

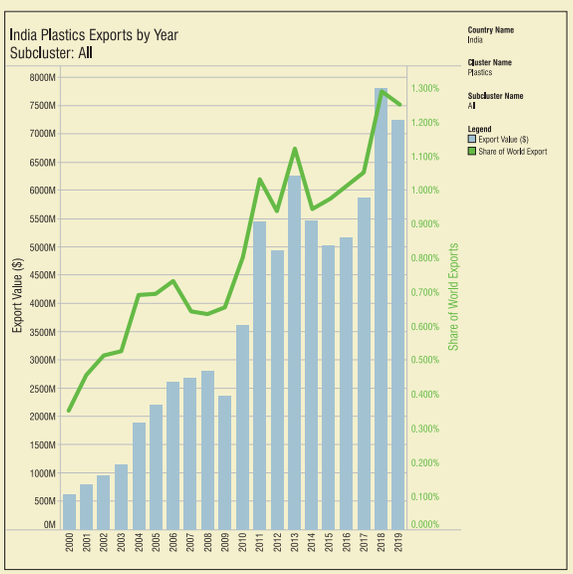


Fig 6: India's Plastics Cluster Exports, from 2000 to 2019 (Source: ISC International Cluster Competitiveness Project)

and sell feedstocks and products "over the fence" by the companies. We need to reduce capital and operating costs by outsourcing their non-manufacturing needs to specialized third-party providers with all parties benefiting from economies of scale like;

- Third-party who supplies utilities and services like steam, hydrogen, cooling water, demineralized water, effluent treatment, industrial gases, storage, port and terminal facilities, and emergency services
- Set up fire stations with capabilities to tackle major fires and hazardous materials incidents
- Construct an underground storage facility to optimize land resources
- Aiming to move to higher-value chemical chains while raising energy efficiency and minimizing environmental impact
- Secure diversified sources of raw materials, such as liquefied natural gas, coal and biomass
- Service pipelines are a form of common service corridor that runs around in region so that companies located in any part of the area can have easy access to the service corridor
- By 'plugging in' to the service pipeline, companies can transfer raw materials, finish products and obtain utilities services seamlessly
- Plan to have the firms being sited close to their buyers
- Low duplication of products lines and plans of long-term supply agreements tend to limit the domestic rivalry in the industry
- Access to skilled labour and suppliers in clusters

Skilling The government is focusing on programs to improve the skill sets of the workers in the chemicals and petrochemicals sector. This includes the availability of skills-based training, knowledge sharing and technical workshops to educate the workers in safe, efficient and sustainable chemical production.

Collaboration The government is also encouraging collaboration between industry, academia and civil society to develop more efficient and sustainable production processes. This collaboration will also help to identify new opportunities and products and promote the uptake of advanced technologies in the industry.

Responsible Business Practices: The government is promoting responsible business practices in the chemicals and petrochemicals industry. This includes promoting adherence to safety, health and environmental standards, and encouraging meaningful engagement between government, industry, academia and civil society to manage risks and build trust.

The Chemicals and Petrochemicals Manufacturing Hub or clusters in the World is a major global initiative in the chemicals and petrochemicals industry. India has taken steps to become a hub in the sector and has an advantage in the cost of production due to local resources and supportive government policies. However, India still has challenges related to the availability of shared facilities, infrastructure planning, regulations, data management, plug & play facility and adequate R&D capabilities in chemicals sector. Improving these capabilities is essential for the Indian chemicals and petrochemicals clusters or hub to be competitive in the global arena. ■

(Disclaimer: The views expressed by the author are strictly personal.)

EPC: ENABLING SUSTAINABLE GROWTH IN CHEMICALS AND PETROCHEMICALS

The vision towards decarbonisation and circular economy will depend largely on the adoption and integration of new developments in hydrogen-based technologies, battery and energy storage, use of electric vehicles, opportunities for rooftop solar PV, etc.

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The chemicals and petrochemicals industry plays a significant role in India's economic growth and development, contributing to the country's GDP, employment, and export earnings. Growth of the Indian petrochemical sector is traditionally dependent on availability of feedstock. With rapid technological advancements and thrust on energy transition, alternate pathways based on biomass, renewables, etc. are now becoming feasible and available indigenously. The growth of the chemical sector is driven by increased domestic consumption as well as strong global demand. With the changing dynamic geopolitics, India is considered as a future manufacturing hub for chemicals and petrochemicals.

Sustainability is no more a buzzword; specially for the chemicals and petrochemicals producers as it is one of the biggest contributors to the GHG emissions. EPC companies are hence required to align their services and solutions that meet the project objectives towards sustenance. To enable and ensure sustainable growth in the EPC sector of the Indian chemicals and petrochemicals industry, several important considerations are required to be earnestly addressed.

The chemicals and petrochemicals sector is largely dependent on feedstock comprising crude oil and natural gas with an embedded carbon footprint of around 65%

EPC's Vision

The chemical and petrochemical sector is at the cusp of a growth revolution fuelled by the call for “Atmanirbhar Bharat” and adoption of production linked incentive (PLI) scheme to boost downstream sector and user demands. Several other recent policies (such as E20 program, National Green Hydrogen Mission, renewable energy transmission, etc. laid by the Government of India provides a strong push and mandate towards sustainable development infrastructure for the chemicals and petrochemicals industry. It is expected that these frameworks will catalyse sustainable growth of the sector. These dynamic and rapid developments in the industry are changing the expectations from EPC players and demanding renewed project KPIs. In order to keep pace with the scenario EPCs to realign their solutions considering sustainability aspects, else they may lose the business continuity. The EPC’s vision towards decarbonisation and circular economy will depend largely on the adoption and integration of new developments in hydrogen-based technologies, battery and energy storage, use of electric vehicles, opportunities for rooftop solar PV, etc.

What sustainability means for EPC?

EPC companies need to incorporate sustainability in its true sense across all plant life cycle stages. Some examples of specific activities related to sustainability in a typical EPC project are given below:

- **Concept:** Support of low-risk financing, pollution reduction and waste management strategies, technology selection with alternate domestically available feedstocks and consumables
- **Design engineering:** Increased use of renewable resources, reduced use of natural resources, optimise energy consumption, minimise waste generation, and maximise recycle
- **Procurement:** Sustainable supply chain management
- **Construction:** Selection of sustainable construction material, minimise fossil fuel usage in construction machinery
- **Operations:** Efficiency improvement measures through digital technologies

EPC companies thus play a pivotal role in boosting sustainable developments towards making our world a better place to live. Sustainable production can lower the cost of setting up and operating plants. Adoption of a circular business model increases growth potential. Environmentally sustainable goals aligned with profit and targets lower business risk.

Environmental Sustainability

Chemical and petrochemical units have more direct emissions and are one of the highest energy consumers amongst the industries. Hence, this sector can have significant environmental impacts, including emissions, waste generation, and resource depletion. Promoting environmental sustainability is of vital importance. Adopting clean technologies, improving energy efficiency, reducing emissions, implementing waste management and resource conservation methods can significantly contribute to a sustainable environment and help in reducing the damages. The designs must not only be compliant with current environmental norms but should consider the most stringent and best possible reduction in emissions beyond the

stipulated limits. Use of digital tools, dashboards, and simulation techniques for dispersion, radiation, and emission parameters should be considered as integral parts of the delivery.

Innovation and Technology

The chemicals and petrochemicals sector is largely dependent on feedstock comprising crude oil and natural gas with an embedded carbon footprint of around 65%. Reducing use of fossil fuel through use of biomass, utilization of CO/CO2 and recycling are possible solutions. Green hydrogen as feedstock for chemicals, green ammonia plants with hybrid renewable energy systems, and battery energy storage systems are technologies with high potential for decarbonization of the sector. These technologies together with carbon capture and conversion of CO2 to useful chemicals.

Embracing innovation and technology can drive sustainable growth. This includes investing in research and development to develop new processes, products, and materials that are more environmentally friendly, energy-efficient, and economically workable. Digitalization, automation, and advanced analytics can optimize operations and help improve the resources utilization. The key success factors for EPCs include adoption of industrial energy transition revolution, thorough understanding of current and upcoming technologies, agility in implementation approach.

Digital Technologies

Digital tools and technologies play an important role in achieving overall sustainability of the project starting from execution to operations till decommissioning. With advancements in digital technological space and rapid implementation of industry 4.0 solutions, it is imperative that the EPCs adopt digital tools for the project execution. Modern tools for digital handover of the project containing all asset information and asset digital twins would be useful not only in operator training but also in maintenance planning, future capacity expansions, and operational troubleshooting. Going beyond the 3D simulation models, use of 4D (Schedule) and 5D (Cost) simulation techniques would help in monitoring project progress in a seamless and effective manner. Integrated smart engineering would help in error free and consistent design databases. Digital tools would help in reducing any potential delays in the project by identifying the bottlenecks/critical paths (supply chains, construction speed, etc) and would proactively drive the schedules. The virtual photo realistic plant models would avoid the last-minute construction related site specific modifications and accelerate the project schedules.

Circular Economy

Transitioning towards a circular economy model can nurture sustainability. This includes designing products for recyclability, promoting recycling and reusing of waste and

by-products, and minimizing resource consumption. Adopting circular economy principles can reduce waste generation, conserve resources, and enhance resource efficiency. The construction and demolition waste can be reused. Alternatives to concrete mix and Portland cement are being explored. Optimization of construction power, water requirements and its recycle, reuse should form an integral part of execution planning by EPCs. Optimization of land development by reusing the topsoil in development of green belts should be encouraged. Scraps generated during construction should be segregated and properly recycled. The packaging materials can be sent for recycling instead of disposing as waste material. Treating and preserving water required for equipment/piping testing would be essential in meeting project objectives.

Skill Development

The shift from traditional carbon rich processes of chemical manufacture to sustainable technologies will require investments on a large scale. The design engineering and procurement of new materials for sustainable production/ operation, reporting and disclosure of scope emission compliances are new and complex tasks that will require new expertise. Developing a skilled workforce is crucial for sustainable growth. Investing in training and ability building, promoting knowledge transfer, and cultivating innovation-oriented culture can enhance the capabilities of the workforce. Collaborating with academic institutions, industry associations, and government agencies can further facilitate skills development and talent retention.

Regulatory Compliance and Risks

Monitoring and reporting of the scope emissions would help EPCs to achieve their part of net zero commitments. With increased scrutiny of environmental norms, the design and plant must adhere to the regulatory compliances. It is expected that the process performance guarantee parameters in future will include the emission norms as well. Adhering to environmental and social regulations is critical for sustainable growth. Compliance with environmental laws, health and safety standards, and corporate governance principles is essential. Proactive engagement with regulators and timely implementation of required measures can help avoid penalties, reputational risks, and business disruptions. EPC contractors also need to effectively handle the risks associated with new technologies, newer supply chains, stakeholder expectations, etc.

Social Responsibility

Ensuring social responsibility is very essential for sustainable growth of the chemicals and petrochemicals industry. This includes prioritizing worker safety and health, implementing fair labour practices, promoting diversity and inclusion, and proactively engaging with local communities. The stakeholder engagement, community outreach, and responsible supply chain management can help create a positive societal impact. With increased industrialisation comes increased job opportunities in the community.

Conclusion

To summarise, enabling sustainable growth for the EPC of Indian chemicals and petrochemicals requires an inclusive approach that integrates environmental, economic, regulatory, and social considerations. Emphasizing environmental sustainability, innovation and technology, circular economy, skills development, regulatory compliance and social responsibility can immensely contribute to the long-term success and sustainable growth of the industry which in turn help the growth of EPCs. Realignment of newer project KPIs, reskilling of the manpower, newer construction techniques and equipment, adoption of digital tools will enable the EPCs to minimise the risks associated with adoption of new technologies and help in growing their business. EPCs may also explore maximising the offsite construction through precast concrete, prefabrication, and modular construction techniques, which will ensure optimum resource usage. ■

O2C: FUTURE OF REFINERIES

Crude Oil-to-Chemicals (COTC) offers a path to greater refining profitability by converting lower value crude oil to higher value chemicals

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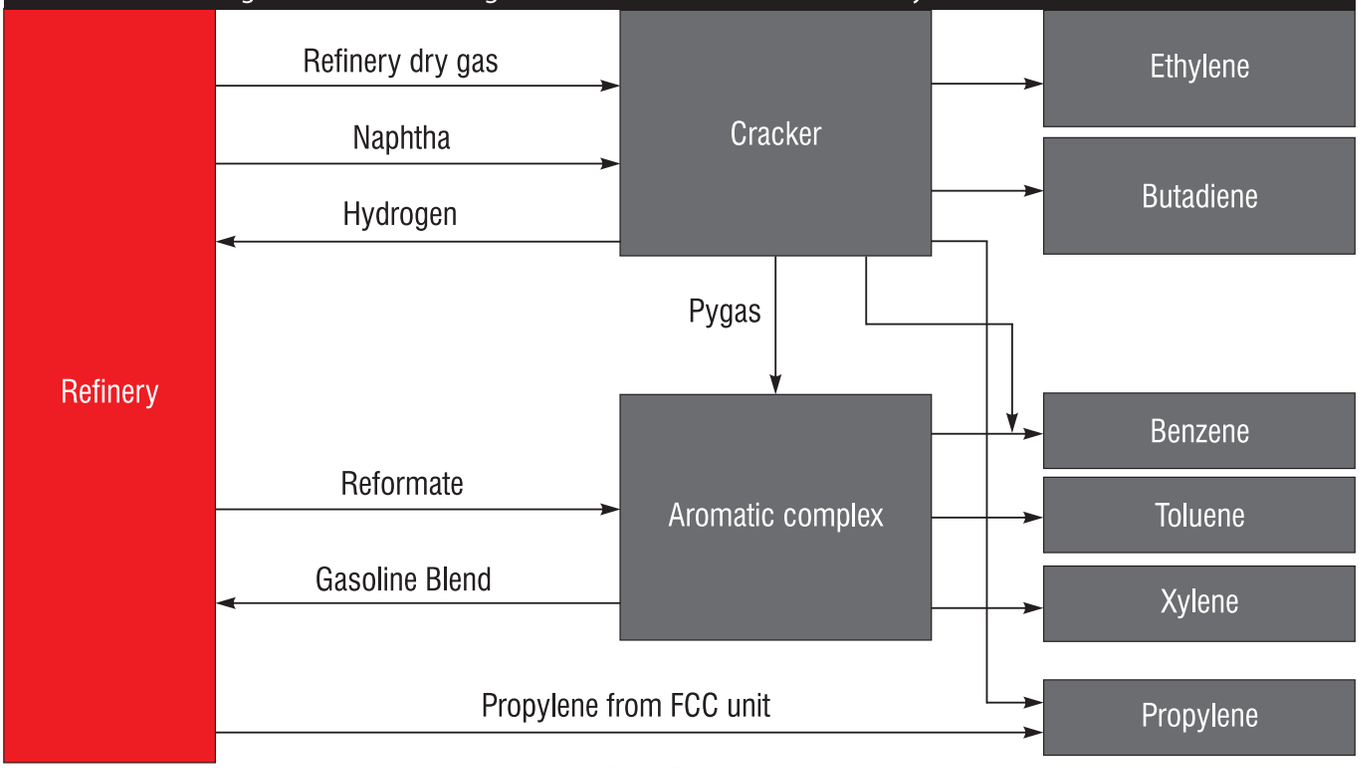
GENERAL MANAGER, TECHNOLOGY
HALDIA PETROCHEMICALS LTD.

A rising call for existence of human civilization and survival of life on earth in general is becoming a concern from onset of global warming, hence COP-26 convention held in Glasgow in November'2021 aimed for renewed commitment has been amplified by adherence of action oriented plans agreed upon unequivocally on global common goal on United Nations Framework Convention on Climate Change (UNFCCC) mission orchestrated through 'The Paris agreement on the global objective of limiting the global temperature rise no more than 2°C above pre-industrial levels and pursue efforts to limit the global temperature increase to 1.5 °C'; an alignment reached by heads of countries were part of the signatories. This has necessitated countries to declare them as Nationally Determined Contributor (NDC), made them compulsory to report national emissions; outline & communicate their climate change actions and submit results to UNFCCC secretariat at every five-year interval. This has mandated the net zero actions more pervasive, proliferating routes of alternative energy sources away from fossil fuel - be it in electricity generation or other forms energy needs e.g. transportation, powering domestic and commercial buildings, fuel for shipping etc. slated to be disrupting the refining business badly with diminishing returns from petroleum products like petrol, diesel, aviation and bunker fuel. This also necessitates repurposing existing refining product slate away from the traditional fuel business into growth oriented high margin petrochemicals product manufacturing business to cash on and by bridging the demand-supply gap likely get widened with increase of wealth, GDP growth leading to change in demography.

Having mandated by UNFCCC and subsequently declared as responsible NDC's, many countries that are starved of crude oil, natural gas are planning to become less dependent on yesteryear's primary source of energy originating from petroleum crudes catering to transportation, power generation etc. Alternatively, they are putting their scare resource on switching into more and more on renewable power generation e.g. solar, wind and host of other things; crafting new legislations to speed up electrification of vehicles and creating more sustainable infrastructure, deploying hydrogen as clean fuel (green, blue) for rail and road transport; legislating mandatory use of biofuel as blend stock in motor spirit etc. Member countries are also putting thrust on energy efficiency measures through new design initiatives leveraging innovative technologies, formulating sector specific norms and rolling out plan of actions to assign targets to designated consumer to incentivise or penalize through market driven instruments fostering competition to bring down the green-house gas emissions, thereby would be importing less and less of crude oil in coming years, shall minimize currency volatility and any betterment in this endeavour will help in improving their balance of payment situation.

COTC enables the process of maximizing production of chemical suites exceeding 70% to 80% of the barrel as opposed to ~10% in earlier non- integrated refinery complex

Exhibit 1: Block diagram of classical Integration of Petrochemical and Refinery



Source: Future Bridge Analysis

Yesteryear's tradition in refinery configuration setting has been focussed more on maximizing production of transportation fuels. A classical refinery-petrochemical integration scheme from open source is in display to visualize and help in analyzing how interchange of streams leverages simplicity out of complexity, bring synergies and helps in optimizing Capex and Opex for any operating plant having scale and scope in simplifying their line of business processes and finally helps in improving margins:

Technology has evolved over time, developments have been attempted successfully to process different feedstock i.e. Naphtha, gas oil and ethane. The direct use of crude oil in steam cracking for production of light olefin has not been successful on as is basis due to higher coke formation and fouling in convection section in cracking heater. However, recently there have been attempts to use light crude oil in steam cracking. This process requires preconditioning of crude oil prior to it being fed into the steam cracker.

On the other hand, Crude oil-to-chemicals (namely COTC) technology has the capacity to create new pathways, allows direct conversion of Crude oil into high-value chemicals instead of traditional transportation fuels designed for automobiles, shipping fleets and heating oils for buildings and commercial establishments. COTC enables the process of maximizing production of chemical suites exceeding 70% to 80% of the barrel as opposed to ~10% in earlier non- integrated refinery complex that we all know.

Crude Oil-to-Chemicals (COTC) is a "Transformative" technology that takes chemical production into refinery scale. It offers a path to greater refining profitability by converting lower value crude oil to higher value chemicals with a scale that would disrupt the global chemical industry, a revolutionary step in technology advancement for refinery and petrochemical integration. It has the potential to carve out more than double the profitability from a barrel of crude oil for any global refiners.

The choice of technology portfolio's for COTC depends on the type of feedstock slated to be tied up for processing, product slates expected from the integrated Refinery-Petrochemicals complex based on their end use keeping longer term business vision with support from domestic unmet demand and keeping regional growth drivers in mind. COTC plants are primarily focused on increasing the yield of light olefins or aromatics building blocks like benzene, toluene, and xylenes. Naturally the solutions space for COTC will vary based on type of crude sourcing planned, flexibility planned to be amortized to accommodate value-addition from outsourced hydrocarbon streams being envisaged for integration and for upgrading the overall value, and for abating ESG goals.

Standalone steam cracker can be designed with multiple feed flexibility options (Mix feed, dual feed, single feed) suiting to the availability of feedstock at competitive rate for a long-term supply commitment and the feed flexibilities are as follows:

- Ethane/Propane
- Full Naphtha
- Naphtha/C3/C4 LPG
- Naphtha/Ethane
- Naphtha/NGL/AGO

Having said above, steam cracker feed flexibility and its design should have a master plan for execution with futuristic product portfolio integration for phasing out investment ideally not to exceed more than 5-7 years into its downstream business keeping a mix of commodity, basic chemicals, specialty for long-term value accruals and best possible returns from the capital employed. It is to be noted that standalone liquid cracker failed to extract value from the bottom of barrel products like carbon black feedstock and Py-Oil and it is a drawback that way which COTC plant will be at an advantage and overcome this limitation easily. In coming years only commodity products manufacturing from cracker complex will find it difficult to stay in competition and with penetration of COTC complexes in coming years likely to make it more difficult and it will face severe margin pressure.

Yield profile of chemicals from COTC project integration depends on crude assay types built into design, usually it is denoted by API gravity. It is also to be mentioned here that API gravity essentially characterises crude assay (Paraffin, Naphthenes, Aromatics and Ashphalt content) and broadly classified into four categories (Light, medium, heavy and extra heavy) Ref. classification is taken from Petroleum, UK.

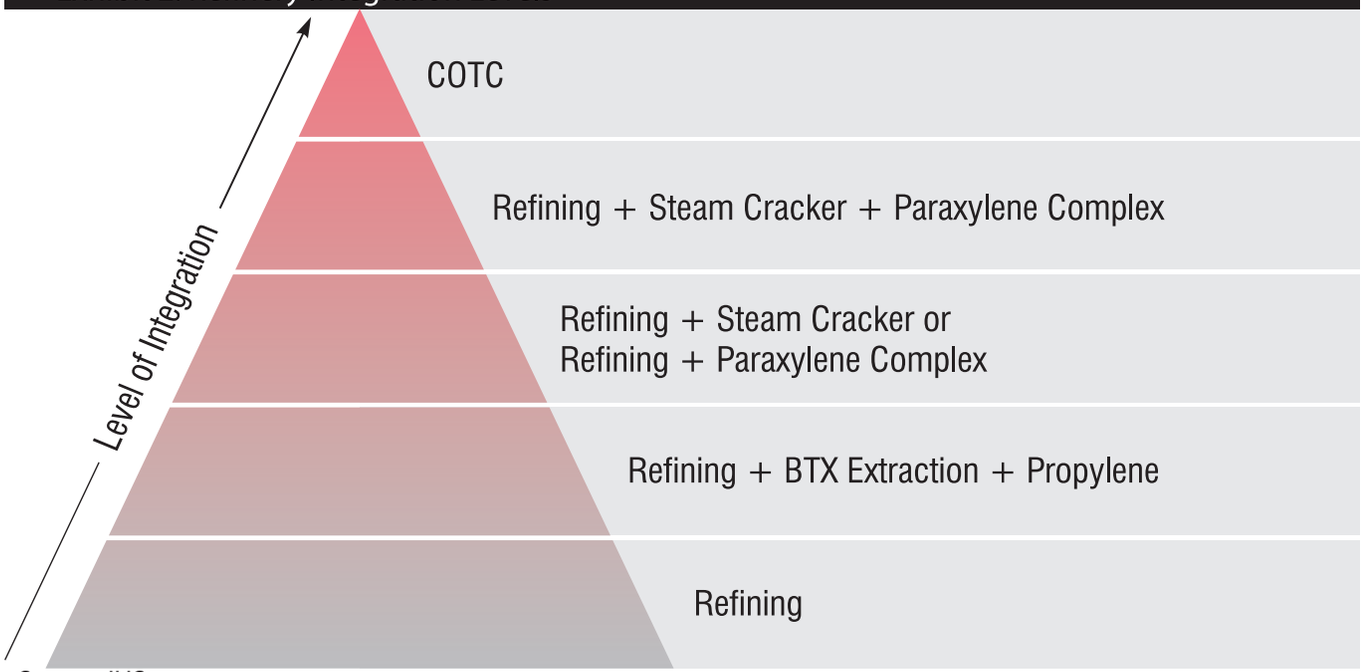
API Gravity	**Crude type**
>31.1	Light
31.1-22.3	Medium
22.3-10.0	Heavy
<10	Extra heavy

When we talk about crude oil characteristics linking API gravity, sulphur content is also gets associated reason being nature does not provide crude oil without sulphur attached to it and varies from 0.3% wt% to 3.0 wt% or even more at times. Therefore, few more types emerge based on the sulpher content- <0.5 wt% termed as sweet crude and >0.5 wt% referred as sour crude. Therefore, going by two broad parameters API gravity and sulphur content we termed them as sweet light, sour light, sweet heavy and sour heavy etc etc. API gravity characterizes crude where in H:C ratio becomes a fundamental parameter - varies from 4 to 1.3, a ratio of 2.0 and greater is a preferred choice for COTC complex integration for maximization of crude to chemicals which includes lighter olefins.

Now it is becoming obvious from the explanation provide above that crude selection is a key and lighter sweet crude with extra light API >31.1 should be the choice of COTC integration to minimize residue handling and its associated cost of technology integration to minimize the Capex and Opex per barrel of crude. COTC eliminates many agencies in between, minimizes the equipment count and gives enormous scope for energy integration, bring down the carbon foot-print as rejection of carbon is minimal. COTC will be a foundational change, a step forward towards the sustainability goal. A schematic representation with hierarchy of portfolio integration is on display (source-HIS) to explain step changes on chemical yield profile that COTC provides:

Now it is becoming very clear that complexity of integration with crude types

Exhibit 2: Refinery Integration Levels



Source: IHS

TABLE 1: COTC Plants

Project	Refinery capacity (MMTPA)	P-Xylene Capacity (MMTPA)	Olefin Capacity (MMTPA)	Estimated Chemical conversion/ bbl of oil (%)	Investment ($ billion)	Start Trial Operation
Hengli Petrochemical	20	4.3	1.5	42	11.4	2018
Zhejiang Petroleum and Chemical (ZPC) Phase 1	20	4	1.4	45	12	Est. Q2 2019
Hengyi (Brunei) PMB Refinery-Petrochem	8	1.5	0.5	>40	3.45	2019
Zhejiang Petroleum and Chemical (ZPC) Phase 21	20	4.8	1.2	50	12	2021
Shenghong refinery and Integrated Petrochem	16	2.8	1.1	60	11	2021
Aramco/SABIC JV	20	–	3	45	20	2025

Source: IHS

and attainment of Chemical yield does not happen automatically, requires lot of unit-operation oriented integration, fewer it is employed to serve the technology needs the better. It is also understood by now that steam cracker yields is a key to improve overall margin from COTC complex, higher it is the better; higher the paraffinic hydrocarbon provides to steam cracker, higher will be the olefinic yields and that is where the technology focus is, for attaining higher yields of light naphtha and less of heavy naphtha; less and less of middle distillates and diesel as fuel out of the entire crude basket is desirable. Upgrading crude into naphtha will require many pieces of technologies and primarily in the area of new age unique hydro-processing technology brings more transformation in molecular structure where more of hydrogen addition (hydrotreating, hydro-visbreaking and hydrocracking) and less and less of carbon rejection techniques are deployed to reduce the complexity and bring down the overall Capex requirement where lot of new age catalyst will come into play.

Lot of resources in the past were deployed on research, significant capital spending done to develop new age catalyst and finally the results are extremely encouraging; commercial installation at large scale planned and it will go onstream within few years from now. Therefore, it is the catalyst core that differentiates the technology, whoever have won it, will dominate the market in coming years.

Hence, COTC requires significant refinery residue upgrading. Hydrogen addition is favored over carbon rejection as has been explained above. Hydrocracking will become one of the most important processes, due to its ability to crack, add hydrogen, removes sulfur, produce more light naphtha and at the same time achieve high conversion rate makes it very attractive.

Hydrocracking for COTC requires catalysts designed to produce more light and heavy naphtha. Targeting chemicals of desired proportion call for changes in crude selection, cheap hydrogen source and hence optimum configuration should be attempted.

Utilities consumption as a whole and its cost structure, product yields, capital investment likely to be the key determining factor for embarking such a capital-intensive project.

Below is the display of COTC project update sort of a ready reckoner to show how they are evolving in different parts of the globe, also taken from the open source, IHS:

Beside the COTC technology that is going to rock the stage in coming years, another ground breaking technologies which will transform the Petrochemical manufacturing from natural gas methane to ethylene and become integral to steam cracker. This technology 'Oxidative decoupling of methane' is showing enormous promise and where surplus natural gas is available they will be able to capitalize it better and dependence on crude will also go down for manufacturing of ethylene which is major building block for birth to many petrochemicals.

Given the range of approaches on emerging retrofit options for operating refineries, a single strategy is unlikely to work for all those who are envisaging to repurpose their product basket. Some refineries may not be candidates for a major shift to petrochemicals by virtue of their scale, specificity to their site constraints, design configuration in place; they will have to consider clubbing with other synergistic strategies for survival or even plan to exit from refining business.

For those that are ready for a crude-to-chemicals shift, number of factors will underpin their decision about the best way forward. ■

(Disclaimer: This article of mine is developed based on my personal capacity of visualization that has come over the years and inputs from open-source literature and broader understanding of mine, Haldia Petrochemicals Ltd. is in no way responsible or tied for any facts, figures etc. and its core understanding. It is primarily intended for knowledge sharing so that others can be benefitted out of it)

RISK ENGINEERING SURVEYS IN MITIGATING HAZARDS AND ENHANCING SAFETY

These surveys are normally conducted on-site, and they involve a comprehensive analysis of the plant's operations, maintenance practices, reliability, safety performance, and other factors that could affect risk of accidents or disasters

DEVENDRA RATHORE
OPERATION ENGINEER
KUWAIT NATIONAL PETROLEUM COMPANY

Industrial facilities like refineries, petrochemicals, and chemical plants due to their sheer size and complexity have inherent risks such as fires, explosions, gas leaks, and spills. Insurance companies that provide coverage for these industrial facilities need to assess the risks associated with these facilities to determine the appropriate premiums and coverage levels. This is where risk engineering surveys come in picture.

Risk engineering surveys are assessments conducted by Risk Engineers (normally representatives of re-insurers & engineering service providers such as broker or third party) to evaluate the risks associated with these facilities. These surveys are normally conducted on-site (or virtually in exceptional circumstances like COVID), and they involve a comprehensive analysis of the plant's operations, maintenance practices, reliability, safety performance, and other factors that could affect risk of accidents or disasters.

Hydrocarbons are naturally flammable substances, and because they are treated under extreme heat and pressure in the presence of hydrogen, they become even more explosive and flammable. As a result, a wide variety of highly skilled and specialized professionals, such as those in operations, process, safety, instrumentation, and electrical, are needed for the safe functioning of refineries.

Turnarounds and regular maintenance activities are important for the integrity of the plant, therefore of particular interest to the insurers

Significance of Risk Engineering Surveys

- It helps insurance companies to understand the risks associated with these inherently hazardous industries and to determine the appropriate level of coverage and premiums.
- For clients, risk engineering surveys can help to identify potential areas of risk and to implement safety measures that can reduce the likelihood of accidents and disasters. Major benefit of a risk engineering survey (of any inherently hazardous industry) is in bringing an experienced 'second pair of eyes' into the facility. (This effect is multiplied if you have a team of experienced insurance engineers with you, but that's not always possible.) Facility owners can, though familiarity, stop seeing hazardous situations or practices. So, this type of third party inspection can be revealing.
- Another major benefit is providing (anonymised) information regarding

losses that other facilities have suffered. As well as sharing good practice, this can help staff of a facility to maintain a constant state of vigilance for unsafe issues or practices among all managers and workers who deal with hazardous systems and materials all day every day.

During risk engineering surveys, both the client and the insurance company need to look at several important factors. These include:

Asset integrity The survey assesses the refinery's inspection philosophy and practices, any overdue inspections and failures reported. Risk engineering surveys normally look at the equipment such as tanks, pipelines, vessels, boilers, etc., to identify any potential weaknesses or failures that could lead to accidents. Corrosion is one of the important factor which affects the life of equipment and mitigation measures employed

Operations The survey analyzes the refinery's operations status, which is the heart of any process plant, checks including its processes, procedures, and safety protocols during steady and transient operations. This also involves figuring out any laggard issues that the operation team is dealing with for continuous and safe operations.

Maintenance Turnarounds and regular maintenance activities are important for the integrity of the plant, therefore of particular interest to the insurers. Proper maintenance can help prevent equipment failures, accidents, and environmental incidents, reducing the overall risk of the refinery. If deficiencies in the refinery's maintenance program are identified during the survey, it could lead to increased insurance premiums or even a denial of coverage. Conversely, a well-maintained refinery may be eligible for more favourable insurance rates.

Emergency response The survey evaluates the refinery's emergency response plans and procedures, including the availability of emergency equipment, impairment of protection systems, training of personnel, and communication systems in place.

Safety performance The survey reviews safety statistics of the facility in terms of numbers of fire & environment incidents reported (referred as Tier-1, Tier-2, and other Process Safety KPIs), potential near misses, incident investigation status, and overdue recommendations.

Regulatory compliance The survey also ensured that these facilities are in compliance with all applicable regulations and standards. Emissions from heaters, flares and other exhaust are in line with regulations.

Risk improvement recommendations Based on the hazard & risk assessment, risk engineers will then develop recommendations to mitigate the identified hazards. This could involve upgrading equipment, implementing new safety procedures, or providing additional training to workers. The recommendations will aim to reduce the likelihood and severity of accidents. These observations & preliminary recommendations are briefly presented to the management at the end of the survey.

Survey report Outcome of the risk engineering survey is the technical report prepared and submitted by the risk engineer (survey team) to re-insurers and to the client (facility owner). The report typically includes an executive summary that outlines the key findings and recommendations of the survey. It also includes a detailed description of the refinery's operations and the associated risks, including fire, explosion, environmental incidents, and worker safety.

Conclusion

Overall, risk engineering surveys are an essential tool for insurance companies and facility owners (client) to identify the hazards present in the facility, help to assess and manage risk, and provide recommendations for mitigating potential accidents. By active participation in risk engineering surveys, refineries can demonstrate their commitment to safety and improve their overall efficiency and productivity. ■

CAPEX PLANNED IN FY 2023-24 IS RS. 12,000 CR

Combined installed capacity of HPCL refineries will be enhanced to 33.5 MMTPA

S. BHARATHAN
DIRECTOR - REFINERIES
HINDUSTAN PETROLEUM CORPORATION LTD. (HPCL)

How would you explain the global trends in petrochemicals, oil, and gas in 2023 and how it will impact India?

Global Oil Outlook: Russian announcement of a production cut of 500 kbpd from March will result in reduced supply whereas refinery capacity additions in later part of this year (Kuwait's 584 Kbpd Al Zour, Oman's 220 Kbpd Duqm, and 400 Kbpd in Shandong, China) will provide support to crude demand. According to IEA's latest projection, average annual growth in oil demand is expected to show robust growth of 2 Mbpd to reach 102 Mbpd as the global economy continues to recover. Recently, OPEC has also affirmed its commitment to extend 2 Mbpd of cuts agreed in October 2022, till the end of 2023, maintaining restricted supplies for crude oil thus, the fundamentals of consistent demand growth and restricted supplies will keep crude price supportive. In the near term, refinery margins are expected to remain at current levels and it is unlikely that we will see a repeat of 2022 (record high margins). Refinery margins will remain supportive due to robust demand growth especially from India and China. Having crude oil prices and refinery margin in a stable price band will help India and HPCL as it will result in stable prices for consumers and sustainable margins for the company.

HPCL along with its JVs have authorization for setting up of CGD network in 23 Geographical Areas (GA's) comprising 48 districts spread across 12 states with planned investment of over Rs. 10,000 Cr during the next few years

Global Gas Outlook: Reason for an all-time high LNG prices were on account of conflict between Russia and Ukraine. Previously dominant, Russian piped gas supply to Europe has been decimated and LNG is the only meaningful supply alternative. Recent corrections in LNG prices are on account of milder winters in Europe. Since European buyers have topped all their storages ahead of winter, the lower demand and high inventories have pushed down the price. Europe's structural pivot away from Russian supply means there will be prolonged and fierce competition, also, for uncommitted cargoes, resulting in sustained elevated price levels in Europe and Asia and however, in case of extreme weather or any unplanned shutdowns, the LNG market will be prone to price spikes.

Global Petchem Outlook: Petrochemical demand is expected to gradually recover specially as domestic consumption in China rises during the year and Incremental cracking capacity coming online during 2023 and high feedstock prices will continue to pressure petrochemical margins.

Key milestones achieved by HPCL in FY 2022-23 and what are the plans for FY 2023-24?

Refining milestones in FY 2022-23 - HPCL refineries have processed more than 19 MMT of crude in FY 2022-23 which is the highest ever yearly crude throughput registered by HPCL refineries. Mumbai Refinery processed 9.8 mmtpa of crude (against an installed capacity of 9.5 mmtpa), in the very first year after revamp and New Crude Distillation Unit with installed capacity of 9 mmtpa has been commissioned at Visakh Refinery towards end of March '23, along with all associated utilities and offsite facilities.

Marketing milestones in FY 2022-23: The LPG infrastructure has been strengthened with the commencement of operation of 120 TMTPA new LPG plant at Barhi in the state of Orissa. Construction of a new LPG plant at Patalganga, Maharashtra has been completed during Q3 of 2022-23. Pipeline network has been expanded with commissioning of 2 major pipelines (Vijayawada-Dharmapuri and Hassan-Cherlapalli LPG pipeline) and the network length has exceeded 5,000 km and capacity crossing 36 MMTPA. Received Letter of Intent (LoI) from Petroleum and Natural Gas Regulatory Board (PNGRB) for Grant of Authorisation of 215 km long for new pipeline, Haldia-Panagarh LPG Pipeline and project execution has been initiated. The alternate fuel option to the customers has been enhanced by commissioning of 1,362 CNG facilities at retail outlets, 1,471 EV charging stations as of February 2023. The customer touch points constitute of 20,979 retail outlets, 1,638 SKO/LDO dealers, 297 Lube distributors,123 Carrying & Forwarding Agents, 736 Door-to-door delivery dispenser, and 6,272 LPG distributorships with a customer base of above 9.35 crore LPG consumers as of February 2023.

Plans for FY 2023-24: Completion of Visakh Refinery Modernization Project (VRMP): The Main unit (CDU-IV) has been commissioned along with all utilities and offsite facilities. Other units will be progressively commissioned in this year. Substantial improvement in refinery complexity index, enhanced distillate yield and improved GRMs are the benefits envisaged from the project.

Completion of LPG cavern, Mangalore. Completion of construction of 80,000 MT LPG Cavern at Mangalore to enhance the LPG store capacities and expanding New LPG bottling plant capacities. A New Bottling plant of 120 TMTPA at Pindwara, Rajasthan is under construction and expected to be completed in 2023.

New verticals where HPCL is focusing and how it will impact the company?

HPCL is focusing to create value and growth by strengthening existing businesses, leveraging new growth engines such as Petrochemicals and Natural Gas and seizing green and emerging opportunities with focus on technology and innovation. Special emphasis on Environment, Social & Governance (ESG) parameters and building strategic partnerships which shall provide competitive edge to the organization in changing business landscape.

In Natural Gas, HPCL is participating in the entire value chain including the LNG import infrastructure, natural gas pipelines, and CGD infrastructure. Construction of 5 MMTPA LNG regasification Terminal at Chhara port by HPLNG, 100% subsidiary of HPCL, is in progress and is expected to be completed in 2023. HPCL along with its JV/subsidiaries have authorization to set up CGD infrastructure in 23 geographical areas in 12 states.

Large-scale investments by HPCL are underway for building the petrochemical manufacturing capacities through joint venture route. For marketing of HPCL's own produced and externally sourced petrochemical products, the 'Route to Market' strategy has been developed and is under implementation. The HP DURAPOL brand of petrochemicals will be further leveraged in expanding presence in Petrochemical marketing.

The organisation is seizing the green and emerging opportunities by expanding footprints in advanced/alternative fuels. The Compressed Bio Gas (CBG) plant and advanced technology solutions are expected to be operational shortly. Expansion in renewables is being done on aggressive scale through solarisation of retail outlets, enhanced usage of renewable power for meeting the operational requirements of refineries, setting up of infrastructure for power import at refineries etc. Green Hydrogen is emerging as a clean fuel of the future.

HPCL is setting up a 370 TPA green hydrogen plant for Visakh refinery to provide green hydrogen to meet partial requirements of the refining process in line with the National Green Hydrogen Mission. With respect to alternate fuels/energy storage new avenues of value creation in the Electric Vehicle (EV) ecosystem including battery swapping and energy storage solutions are being explored in collaboration with various technology start-ups & OEMs etc.

The vast network of over 20,900 retail outlets of HPCL is being leveraged while foraying into emerging opportunities including non-fuel and adjacent business opportunities.

HPCL's refining capacity is 13.97 MMTPA per annum and what's your

share nationally? How are you planning to increase your capacity and market share?

HPCL refineries recorded crude throughput of 13.97 MMT in FY 2021-22, against installed refining capacity of 15.8 MMT during the period. Mumbai Refinery completed its expansion project in FY 2021-22 and enhanced its installed capacity from 7.5 MMTPA to 9.5 MMTPA. As of 1st April 2022, HPCL refineries have a combined installed capacity of 17.8 MMTPA. During March 2023 Visakh Refinery commissioned a new Crude Distillation Unit (CDU-IV) with installed capacity of 9.0 MMTPA, as part of Visakh Refinery Modernization Project (VRMP). Capacity of Visakh Refinery will be enhanced from the current 8.3 MMTPA to 15.0 MMTPA upon completion of the VRMP project.

With this combined installed capacity of HPCL refineries will get enhanced to 24.5 MMTPA. Further, with commissioning of 9 MMTPA greenfield refinery cum petrochemical complex, HPCL Rajasthan Refinery Limited (HRRL), combined installed capacity of HPCL refineries will be enhanced to 33.5 MMTPA.

What is the current status of (9 MMTPA refinery capacity and 2.4 MMTPA of petrochemicals production capacity) greenfield refinery cum petrochemical complex HPCL Rajasthan Refinery Limited (HRRL) at Pachpadra in Barmer District?

The project of setting up a 9 MMTPA Refinery cum Petrochemical complex at Barmer Rajasthan has achieved significant progress with placement of turnkey contracts for major processes and LSTK contract for associated works/utilities etc. Construction work is in progress at the site at full swing.

What was the annual Ethanol production capacity of HPCL Biofuels Ltd. (HBL) in FY 2022-23 and plans for FY 2023-24?

Our Ethanol production capacity is 60 KLPD each of our two plants (Lauriya & Sugauli) i.e., 120 KLPD. The units are run only for four months in a year during the sugarcane harvesting season. Our annual Ethanol production target was 13,800 KL for FY 22-23 however we have so far produced 14,689 KL. The projection for coming FY 23-24 is 15,800 KL together for both the plants.

What is the status of City Gas Distribution (CGD) and plans for FY 2023-24?

HPCL along with its JVs have authorization for setting up of CGD network in 23 Geographical Areas (GA's) comprising 48 districts spread across 12 states with planned investment of over Rs. 10,000 crores during the next few years. CNG Stations have been commissioned in GA's allotted till 10th Round of Bidding and pipeline laying/registration for D-PNG Connections has commenced. In FY 2023-24, City Gas Distribution network will be expanded in 6 GAs.

What are the current and upcoming research initiatives at HPCL's R&D centre? Areas where you are working and how it will benefit the company in the long run?

The key areas of research at HPCL R&D Centre include: Indigenization of Refinery Technologies; Indigenization of Chemicals/ Additives/ Catalysts; Novel catalyst and additives development for key refining operations; Energy efficient process/ technology development; • Widening crude oil basket/opportunity by evaluating new crudes and improving product blends; Residue Upgradation for more valuable products; Exploration of alternative energy sources – Biofuels/Hydrogen/ Solar; Studies in modeling & simulation of various refinery processes; Petrochemicals & Polymers; Process Intensification; Conversion of Biomass to fuels; CO2 to Fuels & Chemicals; Batteries for Energy Storage & Fuel Cells; Providing support to refinery operations, marketing, lubes, and other SBUs of HPCL; Engine research for evaluation of fuel additives, development of clean combustion engine technology, and alternate fuel engine; and Lube formulation development. In the long run, R&D efforts will be helpful in improving refinery margins through development and implementation of indigenous process/ product/catalysts.

HP Green R&D center (HPGRDC) is today focusing on green and alternate energies. The center uses only Green Hydrogen for running all its pilot plants on round the clock basis for more than three years. The main building in the campus is certified as "Net Zero Building". The R&D facility is being expanded by addition of scale-up facilities for products, catalysts and additives. Large pilot plants are built to demonstrate patented technologies. Today HPGRDC has filed 445 patents within the last 7 years and already 160 of them have been granted with 50% of them from different countries.

Is HPCL looking at all aspects of the hydrogen value chain. What are your plans for capturing Hydrogen opportunities in the country?

HPCL-Visakh Refinery is the first

refinery in India to order an industrial scale Electrolyser for Green Hydrogen production. HPCL Green R&D centre has developed technologies for Blue Hydrogen and Turquoise Hydrogen. Pilot plant is running in the R&D center for producing a novel patented process for making H-CNG which does not consume water or generate CO2. A demonstration plant for Blue Hydrogen is being set-up in Visakh Refinery. HPCL will continue to explore all possible opportunities in the hydrogen value chain.

Capex invested in FY 2022-23 and what is the plan for FY 2023-24?

Capex invested in FY 2022-23 is Rs. 11,114 crore (as of February 2023) and Capex planned in FY 2023-24 is Rs. 12,000 crore.

How is the company striking a balance between environment-friendly policies and sustainable growth?

The Government of India has implemented several environmental-friendly policies and schemes in recent years, aimed at promoting sustainable development and reducing the country's carbon footprint. Some of the key examples are:

FAME (Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles) I & II to promote the adoption of electric and hybrid vehicles in the country.

Installation of 500 GW (gigawatt) of renewable energy capacity by 2030 will involve an investment of at least Rs. 2.44 lakh crore.

'Sustainable Alternative towards Affordable Transportation (SATAT)' scheme to promote the use of compressed biogas (CBG) as a clean fuel for transportation. The scheme aims to set up 5,000 CBG plants by 2025 and promote the use of CBG in vehicles.

Biofuel Policy launched with the aim of reducing India's dependence on fossil fuels and promoting the use of biofuels. The policy aims to achieve a 20% blending of ethanol in petrol and 5% blending of biodiesel in diesel by 2025.

Increasing the share of natural gas in its primary energy to 15 per cent by 2030.

The National Green Hydrogen Mission has been launched with the aim of promoting the use of green hydrogen as a fuel. The mission aims to generate hydrogen from renewable energy sources and use it in various sectors such as transportation, industry, and power generation.

India has set a goal to reduce its greenhouse gas emissions intensity of its GDP by 33-35% from 2005 levels by 2030. This goal was announced by Prime Minister Narendra Modi at the 2015 United Nations Climate Change Conference (COP21) in Paris.

The objectives of these policies and schemes are to promote sustainable development, reduce greenhouse gas emissions, promote clean energy, and improve air quality in the country. HPCL is actively participating in all the schemes towards sustainable growth and is striking a balance between environment-friendly policies and sustainable growth with various actions, which are detailed as under:

In Participation in the EV ecosystem, Battery e-Swap Station was launched at Bengaluru under the tie-up with Honda Power Pack Energy India Pvt. Ltd. (Subsidiary of Honda Motor). HPCL also tied up with Hero MotoCorp for setting-up charging infrastructure for two-wheeler electric vehicles (EVs) across the country, thereby providing a fillip to mass mobility's transition towards an electrified future. As of February 2023, 18 battery-swapping stations were installed at various locations along with EV charging stations. The number of EV charging stations has crossed 1470 numbers as of February 2023.

In renewable business, the existing portfolio is being strengthened with the setting up of solar capacities at various locations. Solarisation was completed at 2,860 retail outlets during Apr-Feb'23, taking the total number to 9,271 as of Feb'23. ~44% of HPCL retail outlets operate on renewable energy.

Under the SATAT scheme, HPCL has released 474 LoIs (Letter of Intent) with CBG production capacity of 2,576.2 Tonnes per Day (equivalent to 940.3 TMTPA) for setting up of CBG plants to eligible entrepreneurs.

In Biofuels, HPCL is actively participating in the Ethanol blending programme and has reached to the level of about 11%. HPCL is setting up 100 KLPD 2G ethanol refinery at Bathinda and 14 TPD capacity compressed biogas plant at Budaun in Uttar Pradesh. A cow dung based CBG plant is being set up at Pathmeda in Rajasthan. HPCL is participating in the entire value chain of Natural gas.

HPCL is also setting up a 370 TPA Green Hydrogen infrastructure at Vizag Refinery.

The above actions shall help HPCL achieve sustainable growth.

When are you planning to become Net Carbon Zero and what are the different milestones set by the company?

HPCL declared its plans to reach net-zero in Scope 1&2 by 2040. HPCL have also identified key levers in reaching net-zero such as enhancing energy efficiencies in own operations, fuel switch to bio gas in refineries, usage of 100% renewable power in refineries and replacement of hydrogen requirement by green hydrogen, abatement using CCUS/Offsets etc. In addition, for reduction in Scope 3 emissions, HPCL has plans to transform its product portfolio with low/no carbon fuels and thereby reducing the overall emission intensity of the company.

What are the key CSR initiatives being undertaken by the company in FY 2022-23 and plans for FY 2023-24?

HPCL has undertaken various CSR activities since its incorporation in many parts of the country for the welfare and development of underprivileged communities in order to make them self-dependent. CSR of the Corporation has been in-sync with various prevailing statutes and guidelines. The details of CSR activities undertaken by HPCL are provided below:

Project ADAPT; Children with Special Needs: Project ADAPT aims to

enhance the quality of life of Children with Disabilities (CwD) through provision of online education, individual training and therapeutic treatment. In addition to online educational classes for 'Children with Disabilities (CwD)' uninterrupted therapy services were provided through Tele-Rehab, which emerged as a key vehicle for delivery of services. This new model of providing online services helped the parents and the beneficiaries cope with the pandemic.

Project Nanhi Kali; Girl Child Education: Project Nanhi Kali provides holistic development and support academic pursuit of girl children from tribal and urban slum locations. The project addresses 'challenges and constraints' faced due to gender gap in communities and aims to develop gender equality. During the year, 'Nanhi Kali' girls were provided with online remedial classes, material kits, sports curriculum and other guidance & counselling on personal hygiene and career development.

Project Dhanwantari; Rural Healthcare Program: To provide diagnosis, treatment and health awareness, Mobile Medical Vans (MMV) are operated as 'Reach-In approach' to the people residing in rural and urban slum communities. The MMV offers basic medicines, consultation and referrals. The majority of beneficiaries are women, children and elderly from less-privileged sections of society whose general health is neglected due to poverty and lack of resources, awareness and facilities.

Project Dil without Bill; Heart surgeries of Children: Awareness camps are carried out for identifying patients from lower income groups, especially children with heart ailments and support for conducting heart surgeries is granted.

Project Suraksha; Khushi Clinics: To arrest the spread of HIV / AIDS and STIs amongst truck drivers, Khushi clinics are operative on highways. The project provides AIDS awareness, STI treatment and basic healthcare facilities.

Project Kashmir Super-50 Medical: This project supports the 'Sadhbhavna' (Goodwill) efforts undertaken by the Indian Army in Kashmir valley. This project provides mentoring and coaching to aspiring students from Jammu and Kashmir Region for preparing them for various Medical entrance exams in India. This residential training program gives wings to academic aspirations of youth for their career development.

Project Ladakh Ignited Minds Super-45 'Medical & Engineering': This project supports the Indian Army's initiative in 'Winning Hearts and Minds' of the local population. This project supports the less-privileged yet aspiring students of Ladakh Region in enabling them to compete in various streams like Engineering, Medical and other career-oriented programs.

Project Kargil Ignited Minds - 50 'Medical & Engineering': This project supports the less-privileged yet aspiring girl students of Kargil District in enabling them to compete in various streams like Engineering, Medical and other career-oriented programs (1st batch during 2022-23).

Project White Knight Centre 'Medical & Engineering': This project supports the less-privileged yet aspiring students from Rajouri and Poonch District in enabling them to compete in various streams like Engineering, Medical and other career-oriented programs (1st batch during 2022-23).

Swachhta Pakhwada: 'Swachhta Pakhwada' Campaign by undertaking various initiatives to spread awareness through all HPCL locations and involving more than 20 Lakh stakeholders across the country. For the Swachhta Pakhwada campaign held during the period 1st – 15th July, 2022, HPCL was awarded among top three Oil and Gas CPSEs by the Ministry of Petroleum and Natural Gas.

Community Development: HPCL has conducted various field-level activities with special focus on all round development of society especially women. These projects and field activities undertaken by HPCL aim to provide basic amenities in rural areas. Activities like support to old age homes, orphanages, Anganwadi, providing basic amenities in schools, improvement of rural infrastructure, improvement of basic infrastructure in Government Hospitals have supported the development of local communities. Scholarships for students from weaker sections (SC, ST, OBC and PwD) in schools and colleges were provided amongst which more than 50% beneficiaries are girl students. Contribution made to Armed Forces Flag Day Fund (AFFDF) for the care, support, welfare and rehabilitation schemes for Ex-Servicemen (ESM) and their dependents.

Provisional CSR Action Plan for FY 2023-24: The 'Ongoing Projects' shall be continued and implemented as part of CSR Action Plan for FY 23-24. We shall undertake CSR projects in Corporations' focus areas viz. Education, Healthcare, Sports, Skill Development and Environment & Community Development. Some of the prominent 'Ongoing Projects' are: Support for upgradation and modernization of Gujarat Science City, Ahmedabad; Reconstruction & Restoration of Shri Kedarnath town and surrounding areas; and Construction & redevelopment of Shri Badrinath town as a smart spiritual hill town. ■

EXPANDING CAPACITY WITH AN INVESTMENT OF RS. 8,790 CRORE IN FY 2023-24

Numaligarh Refinery Limited (NRL) plans to implement its first petrochemical project by setting up a Poly Propylene Unit (PPU) of 360 KTPA capacity at a cost of Rs. 7,231 crores. The project is awaiting final investment approval from Government of India and as such no physical progress has taken place so far

BHASKAR JYOTI PHUKAN
MANAGING DIRECTOR
NUMALIGARH REFINERY LTD.

What are the latest trends in the global petrochemicals market and how it will impact India?

The global petrochemicals market, which is expected to grow at a CAGR of 7-8% from 2023 to 2030, is currently seeing several trends that could potentially impact India's petrochemicals industry. The global growth forecast in petrochemicals is largely due to growth in Asia where India plays an important part with a robust GDP growth.

One of the key trends is the shift towards sustainable and renewable feedstocks in the production of petrochemicals. Many petrochemical companies are investing in technologies that can convert renewable feedstocks such as biomass or waste into chemicals.

Although substantial increases in recycling and efforts to curb single-use plastics are expected to take place, especially in Europe, Japan, and Korea, these efforts will be far outweighed by developing economies sharply increasing their shares of plastic consumption (as well as its disposal).

The Indian petrochemical industry is on a steady growth trajectory and is projected to grow to around US $75 billion by the end of this decade, contributing nearly 2% to India's GDP by 2030. The Indian petrochemical industry is expected to contribute nearly 10% to the incremental growth in the global petrochemical demand.

What are the key milestones achieved by Numaligarh Refinery Limited (NRL) in FY 2022-23? What's the forecast for FY 2023-24?

In FY 2022-23, Numaligarh Refinery Limited (NRL) achieved its highest ever crude throughput of 3,091 TMT with a capacity utilization of more than 103%. It also achieved its highest ever Distillate yield of 87.67% and lowest ever Specific Energy Consumption (SEC) of 61.66 MBN. The Capex of the company stood at a towering Rs. 6,615 crores, an all-time high in FY 2022-23. In FY 2023-24, with significant progress of the expansion project, the Capex is expected to increase up to Rs. 8,790 crores.

NRL had announced Rs. 35,000 crore investment plans for the next 5 years for Numaligarh Refinery Expansion Project (NREP), Paradip Numaligarh Crude Oil Pipeline (PNCPL), Crude Oil Import Terminal at Paradip (COIT), 2G Ethanol Project, and India Bangladesh Friendship Pipeline (IBFPL). What is the

NRL has plans to produce a few specialty chemicals like FGH, de-aromatised kerosene, aqueous ammonia, etc.

development on these fronts? How are you going to fund these projects?

IBFPL was completed and was inaugurated by the Prime Ministers of India and Bangladesh on 18th March, 2023.

The Numaligarh Refinery Expansion Project construction activities are progressing in full swing. A physical progress of 31.1% has been achieved and is targeted to be completed by 2025.

Paradip Numaligarh Crude Oil Pipeline and Crude Oil Import Terminal at Paradip have seen a cumulative physical progress of 39.2% as on 31st March, 2023. The pipeline and crude oil terminal is targeted to be completed along with the new refinery units.

The 2G Ethanol Project of 49 TMTPA production capacity is en route to completion this financial year.

As far as funding is concerned, out of the total approved cost of Rs. 28,026 crore for the expansion project, a rupee term loan of Rs. 18,904 crores has been tied up with a consortium of 12 banks led by State Bank of India. Further, Government of India has sanctioned an amount of Rs. 1,020 crores as VGF for the expansion project. Remaining portion of the cost shall be arranged through internal accruals and promoters' contributions.

The company has also got a green signal for the Polypropylene project worth Rs. 6,555 crore last year? What is the latest development?

NRL plans to implement its first petrochemical project by setting up a Poly Propylene Unit (PPU) of 360 KTPA capacity at a cost of Rs. 7,231 crores. The project is awaiting final investment approval from Government of India and as such no physical progress has taken place so far.

With all this diversification, what all products would you be planning as of now? What will be the impact on the financial performance of the NRL?

Once the ongoing projects are completed, NRL will add several new products to its portfolio. Products like ethanol, furfural, and acetic acid will be added from the 2G bio refinery. With an increased focus on petrochemicals, NRL is keen to add Polypropylene (PP) to its portfolio. Going forward, NRL has plans to produce a few specialty chemicals like Food Grade Hexane (FGH), De-aromatised Kerosene, Aqueous Ammonia, etc. These new products are expected to improve refining margin for the company.

Further, aligning with the Net Zero and De-carbonisation goals of the nation, NRL is keen to explore opportunities for production of Sustainable Aviation Fuel, Green Hydrogen, etc.

What is the current market share of NRL in the country and by when are you planning to triple your capacities?

Today, NRL operates a 3 MMTPA refinery which is relevantly insignificant when compared to the overall installed refining capacity of around 250 MMTPA of the country. However, in the context of the Eastern India region, NRL contributes to around 15% of MS-HSD demand of the entire region. Going forward, once the expansion project is completed by 2025, NRL will triple its production capacity and will contribute more to the energy demand of the region and will also be exporting products to neighbouring countries.

What role do you see for NRL for the Hydrocarbon Vision 2030 for North East India?

Out of Rs. 1.30 lakh crore envisaged for Northeast India under the Hydrocarbon Vision 2030, NRL is set to play a significant role by implementing projects to the tune of Rs. 40,000 crores.

Some of the major projects under implementation are - Numaligarh Refinery Expansion Project (NREP), 2G Bio Refinery, and Northeast Gas Grid project. With regard to the NE Gas Grid, besides being a promoter of the JV company, NRL is also the anchor customer for the gas pipeline network. Further, as part of an expansion project, NRL is laying a crude oil pipeline from Paradip to Numaligarh. This pipeline will have surplus capacity to carry crude oil to facilitate capacity augmentation of other refineries in the Northeast.

In 2021, the company signed an agreement with Indradhanush Gas

A Rupee Term Loan of Rs. 18,904 crore has been tied up with a consortium of 12 banks led by State Bank of India

Grid. What is the status of this project?

A Gas Grid connecting all state capitals in the Northeastern region is being constructed to supply PNG and CNG in the region. A trunk gas pipeline from Barauni to Guwahati will connect NE Gas Grid to the National Gas Grid. A JV company has been incorporated as "Indradhanush Gas Grid Limited" with equal equity participation from IOCL, GAIL, ONGC, OIL, and NRL. NRL's refinery expansion has been considered as an anchor customer, constituting around 50% of the total throughput of the pipeline grid. As on 31st March 2023, the overall physical progress was 70%.

How is your biorefinery project progressing?

The project is anticipated to be completed by the end of 2023. As on 31st March 2023, the overall physical progress was 82.1% and financial progress was 72.06%.

What sort of automation and digitization programme NRL is being implemented in FY 2023-24?

NRL has been a pioneer in promoting digital technologies in the oil and gas industry. NRL's digitization initiatives focus on three pillars, namely, asset centric applications, people centric applications, and process centric applications.

Some of the digital initiatives deployed are: Asset centric application for improvement in reliability and maintenance; Asset Integrity Maintenance System from GE Meridium; Condition Monitoring Techniques; People centric applications to improve field operator/technician productivity; Wireless infrastructure; E Logbook; mart maintenance with mobility; VR applications; Process centric applications to bring efficiency in operation and business processes; ASPENTECH for optimisation of refinery material balance; Paperless Office Solution; Suit for Fire & Safety Applications; and GPS enabled smart fleet management system.

What is your plan for Sustainability, Green, and Carbon Neutrality?

NRL wants to position itself as an early mover in India's energy transition to achieve Net zero by 2040 for Scope 1 and Scope 2 emissions. NRL plans to achieve this through several projects ranging from Aqueous Ammonia production from Refinery Sour Gases, CO2 to Methanol & Oxo Alcohol, Enhanced Recovery Oil (EOR), 24,000 TPA of Green Hydrogen production by 2024 using 18 MW of Renewable Power, 60 million litres of 2G Ethanol from Bamboo etc.

What CSR initiatives would you be undertaking this year?

CSR and Sustainability activities of NRL are pursued in line with the activities specified under schedule 8 of the Companies Act 2013 and as per 'CSR and Sustainability Policy' conforming to stipulations under Section 135 of the Companies Act 2013. The annual budget allocation for CSR and Sustainability activities of NRL for a given year is based on minimum 2% of the average profit-before-tax of three preceding financial years. NRL's CSR activities are based on the above policy framework and are approved by the Board of Directors through its sub-committee on CSR and Sustainability. NRL has put special emphasis on: Livelihood Generation; Promotion of Education and Skill Development; Infrastructure Development; Promotion of Health Care; Promotion of Arts, Sports, Literature, and Culture in line with its CSR policy.

Where do you see the Numaligarh refinery by 2030?

By 2030, NRL aims to triple its crude oil refining capacity and set a strong foundation in petrochemicals and increase the Petrochemical Intensity Index (PII) to 11+%. NRL envisions to capture a reasonable market share in specialty chemicals by 2030.

The company is planning to promote startups. Areas/verticals where you are promoting startups?

NRL's startup support program is sector agnostic and supports startups from various areas, both related and unrelated to the petroleum sector. However, NRL's startup program is geographically focused on the Northeast region of the country. So far, NRL has supported a total of 46 startups from NER with a fund commitment of Rs. 10.55 crores in various sectors like Agri & allied, Bio-ethanol, Health Tech, Fintech, Software, Manufacturing, Tea, etc. ■

SETTING UP BUTENE-1 AND HPG-2 PLANTS AT A COST OF RS. 386.75 CR

Brahmaputra Cracker and Polymer Limited (BCPL) is planning to increase its market share by a new capacity addition of 1,200 KTPA in the coming years. The company has embarked upon its way forward to increase its capacity by 140% from existing 280 KTPA in the first phase while further capacity addition will be carried out in the next phase

REEP HAZARIKA
MANAGING DIRECTOR
BRAHMAPUTRA CRACKER AND POLYMER LTD.

BCPL recently celebrated its 16th anniversary. What are the key milestones achieved by the company in the last 16 years?

BCPL celebrated its 16th Foundation Day on 8th January 2023 at BCPL Petrochemical Complex, Dibrugarh. It has been a very successful journey for this mega petrochemical plant in the NER (North Eastern Region) till date and it is contributing nearly around 3% of the total national polymer production. First and most important milestone achieved by BPCL was its commissioning on 2nd January, 2016 and the subsequent dedication to the nation by Prime Minister Narendra Modi on 5th February, 2016.

From the operation point of view, BCPL achieved 100% production capacity in the 3rd year of operation and thereafter achieved its maiden profit. BCPL has always been in the forefront of digitisation by implementing SAP SE and allied digital machine tools for critical monitoring of systems in its operation to transform and take the company to newer heights.

The many awards and recognitions have been bagged by BCPL like ISO 15001, ISO 14001, ISO 45001, NABL accreditation, FICCI Chemicals and Petrochemicals Award, Annual Greentech Environment/Safety/Energy award, Best Company award from Berkshire Media, Safety Award from National Safety Council of India, and many more. Whatever we have achieved so far is the outcome of the inspiration, efforts, and contributions of everyone associated directly or indirectly with the company.

How did BCPL perform in FY 2022-23 and what is the expectation from FY 2023-24?

The last financial year was a mixed bag for BCPL in terms of polymer production and profitability. During FY 2022-23, the spiraling domestic gas prices in India along with lower polymer prices in the market had impacted the company financials. However, due to the various proactive actions taken by BCPL, the performance is expected to end on a positive note, although with reduced profits.

BCPL has a positive outlook in the current polymer market in India for the FY 2023-24. It is estimated that India's polymer demand will rise to 14.53 million

India's petrochemical demand increases by 2-3 times every decade and demand is expected to grow to 30 million tonnes by 2030 and 60 million tonnes by 2040

tonnes in FY 2023-24 which is nearly 7% increase over previous year.

It is also supported by Government of India initiatives like the Make in India, Atmanirbhar Bharat, Jal Jeevan Mission, etc. All these Govt. schemes will boost domestic production and reduce import of polymers and thereby ensure overall growth and development of the entire polymer industry from raw materials to consumption. It is seen that from 1960 onwards, India's petrochemical demand increased by 2-3 times every decade and demand is expected to grow to 30 million tonnes by 2030 and 60 million tonnes by 2040.

What is the BCPL's group refining/ processing capacity per annum and what is your share nationally? How do you plan to increase your market share?

The nameplate production capacity of BCPL is 280 KTPA of Linear Low-Density Polyethylene, High-Density Polyethylene and Polypropylene with a market share of nearly around 3% of total national polymer production.

BCPL is planning to increase its market share by a new capacity addition of 1,200 KTPA in the coming years. BCPL is in active discussion with process licensors and EPC contractors along with feedstock suppliers like OIL and ONGC and others for additional natural gas supply. Also, BCPL is looking at various options for the additional Naphtha requirement. To achieve the set target within the timeline, BCPL has embarked upon its way forward to increase its capacity by 140% from existing 280 KTPA in the first phase while further capacity addition will be carried out in the next phase.

How is the performance of BCPL's Petrochemical complex at Lepetkata in Assam and what are your expansion plans?

BCPL's performance has been excellent in terms of polymer production and profitability, and it has a market share of over 90% in the NER. BCPL is well positioned to export polymers to the neighbouring ASEAN and BBN countries. Free trade agreements (FTAs)

of the SAARC (SAFTA) and Govt of India Initiative for water transport and Economic Cooperation (BIMSTEC) is boosting economic integration not only in Southeast Asia but also between India and Bangladesh. Being amongst the largest importer of polymer, Bangladesh is giving a viable opportunity for BCPL to establish its footprint in the international polymer market.

The Northeast of India is endowed with huge untapped natural resources and is acknowledged as the eastern gateway of India's Look-East Policy. In this context, BCPL has set up its top priority to utilize more natural gas available in the region to produce additional polymers by increasing its capacity.

What role BCPL sees for itself in the Hydrocarbon Vision 2030 for North East India?

BCPL is downstream of the hydrocarbon sector as an end user of natural gas as well as the marketing and distribution of products derived from natural gas. It is expected that there will be surplus natural gas for the petrochemical industry in the NER once the natural gas production touches around 15.3 MMSCMD by 2029-30 as envisaged in the HC vision 2030 along with the commissioning of the natural gas grid of IGGL. With increasing natural gas availability in the region, BCPL has prepared a road map for its expansion in the near future to align with HC vision 2030.

What is the scope of downstream plastic industries in North East India?

Presently BCPL is selling approximately 38 KT per annum of polymer in the Northeast and the figure is expected to increase with the setting up of more downstream industries. BCPL is offering special incentives to the downstream industries of North East (NE) and promoting the Tinsukia Plastic Park by offering special incentives to the units being set up in the park. Brands like Milton, Supreme, and HUL are using BCPL polymers and have large set-ups in the North East. Overall the polymer scenario of NE looks very promising.

Capex investment made in FY 2022-23 and projects where investment was made? What is the plan for FY 2023-24?

At present BCPL is setting up two value addition plants viz. Butene-1 and HPG-2 at a cost of Rs. 386.75 crore. During the year, the company incurred Capex of approximately Rs. 60 crore for the same. In addition, BCPL is incurring

SAJJAN INDIA LIMITED

Capex for upgradation/modernization of various capital equipment of the existing petrochemical complex.

The Capex for 2023-24 will be incurred for balance work of the ongoing Butene-1 and HPG-2 project, construction of a multi-product storage facility at Haldia and procurement of other capital equipment.

What is your plan for the development of alternate technologies for the production of biodegradable plastics?

Biodegradable polymers (BDPs) or biodegradable plastics refer to polymeric materials that are 'capable of undergoing decomposition into carbon dioxide, methane, water, inorganic compounds or biomass in which the predominant mechanism is the enzymatic action of microorganisms that can be measured by standardized tests, in a specified period, reflecting available disposal condition. Recently, significant progress has been made in the development of biodegradable plastics, largely from renewable natural resources to produce biodegradable materials with similar functionality to that of oil-based polymers.

Biodegradable polymers will play a greater role in the packaging sector in the future. However, cost of production and raw materials availability is one of the major concerns. Also, disposal issues also exist since it is unsuitable for landfill due to their potential to release methane under anaerobic conditions. BCPL is closely watching the progress of biodegradable polymers technologies and allied support systems and is hopeful to get suitable solutions soon to address the current concerns.

It is expected that there will be surplus natural gas for the petrochemical industry in the North East Region once the natural gas production touches around 15.3 MMSCMD by 2029-30

What are your plans for automation and digitalization at BCPL?

Digital transformation is one of the core initiatives being undertaken by BCPL to increase asset utilization through higher manufacturing efficiency, including the efficiencies of all sites and integrated value chains. It is only possible by using advanced digital methods to create our own brand in the market and transform operations faster than the competitor.

BCPL is a digitally driven company with all operations covered through DCS to meet the present requirement as well as the future needs and thereby ensuring the safety of people and the environment. BCPL is considering advanced control algorithms in DCS in order to further improve productivity with minimum human interface in all the complex operations in near future.

Management Information System is another area BCPL is focusing to integrate all processes for better decision-making and ease of access to all information. BCPL has identified the next level of automation in its bagging unit for better customer management with proper planning and timely execution to save time and increase work effectiveness considerably. This technological transformation will also entail creation of a new work culture in the organisation.

How is BCPL striking a balance between environment-friendly policies and sustainable growth?

While focusing on growth, BCPL is simultaneously considering various Clean Technology Scenarios (CTS) to curb air and water pollution and at the same time reduce CO2 emission. To reduce CO2 emission, BCPL is in active discussion with OIL for CCS of pure CO2. BCPL is also reprocessing high calorific value waste in cement industries to take care of the environment under guidance from the central and state pollution control board. BCPL is also exploring diversification into green energy sectors as a future progress engine as part of sustainable growth and retrofitting existing plants with latest

technologies for lower CO2 emissions.

What is your marketing strategy for Petrochemicals?

Marketing of BCPL polymers is being done by GAIL through a marketing agreement. However, BCPL has ensured that the prices of BCPL polymer in NE has been kept competitive vis a vis competitors and other locations. In this regard, BCPL is offering special incentives to the downstream industries of NE and promoting the Tinsukia plastic park by offering special discounts to the units being set up in the park.

CSR initiatives to be undertaken by the company in FY 2023-24?

BCPL entered the CSR regime from FY 2020-21 and continues its endeavor to contribute to the well-being of the communities and society through various environmental and social measures to promote inclusive growth. The CSR projects are being implemented around Health & Nutrition, Promotion of Education, Swachhata and Sanitization Projects, Projects on Skill Enhancement and Alternative Livelihood Promotion & Sustainable Development and Rural Development, etc. However, a major part of the funds is being allocated to Health & Nutrition considering the recent global pandemic situation.

Where do you see BCPL in the next 5 years?

The plastic industry is one of the fastest growing industries in India. It has expanded at around 8% CAGR over the last five years and is expected to grow at around 5-7.5% in the next 5 years owing to increased demand of polymers backed by high population growth, increasing disposable income and lack of better substitutes for such products. With increasing per capita consumption of polymers in NER, there is a tremendous scope for the growth of the polymer industry.

Considering the last 5 years' performance, BCPL has made significant contributions to the national economy and has been able to achieve its mission by establishing a remarkable presence in the north-east region in the petrochemical sector with a market share of over 90%.

With the completion of the envisaged capacity expansion projects along with diversification and digitalization, BCPL is confident of soaring to newer heights in terms of customer satisfaction, visibility, profitability, safety, sustainability, etc. in the next 5 years.

When are you planning to achieve Net Carbon Zero and how are you planning to achieve it?

Prime Minister Narendra Modi has set India's long-term goal of reaching net-zero by 2070 at the Glasgow summit. India is the world's fourth biggest emitter of carbon dioxide after China, the US, and the EU. In line with our promoter GAIL's target, BCPL has also set 2045 as the timeline for achieving net zero carbon emission. India emitted 1.9 tonnes of CO2 per head of population in 2019, compared with 15.5 tonnes for the US and 12.5 tonnes for Russia in the same period.

To achieve net zero, BCPL has identified three main areas which will help to build long term resilience, greater trust and a better tomorrow. First and foremost, improvement in process operations to the next level by adding new climate reliant technologies which will not only reduce carbon footprint but also make us align with the best national and international benchmark index. Energy mix is a part of net neutrality for BCPL where more and more energy will be utilized from non-fossil sources like green hydrogen, green methanol and solar energy etc. in a requisite proposition in the future to reduce carbon footprint.

Secondly, BCPL is in active consideration of Carbon Capture & Sequestration (CCS) which is a proven emissions reduction solution, permanently removing CO2 from the atmosphere. In this direction, BCPL and OIL are joining hands and are in discussion to utilize CO2 in Enhanced Oil Recovery (EOR) in the oil fields in the coming days.

Thirdly, BCPL is also embarking upon nature-based offsetting of carbon as a part of de-carbonization with mass greenbelt development. Even though it is a time consuming process and a large area is required for plantation, it is a grassroot level visible program for achieving net zero.

BCPL is also proactively looking at all other feasible options available to achieve the same with the targeted time. ■

INDIA IS STRATEGICALLY AN IMPORTANT MARKET

In the long run, we do believe that the Indian market will open upstream to international players and open up opportunities and access to new technologies

EDDIE WANG
SENIOR VICE PRESIDENT
ASIA SOUTH
BOROUGE PTE LTD.

What new products you are launching in the Indian market?

Our products are focused on several segments, mainly packaging, sustainability, and circularity. For example, we have a mono-material solution for packaging that enhances recyclability. The other part of our business is mainly focused on infrastructure, including pipelines and NEG which is the cable transporting the electricity. We have a lot of products to support the water safety programme, automotive, medical, and agriculture. We built 900 greenhouses in Jaipur, Rajasthan to help farmers enjoy better crop efficiency, water conservation, and farming efficiency.

You look after the South Asian market. What are your India plans for 2023?

India is clearly one of the most strategic markets for us. We are a Middle-East and Asia Pacific market company and we are currently among top five Polyolefins providers in the market.

The South Asian market is leading the growth engine of the world Polyolefins market and within this market, India is the hottest spot. After meeting all sets of people including our customers, we have seen a lot of positive outlook. Our customers and stakeholders in the recycling industry are positive about the growth story. These include a few key drivers of growth among which the number one is headroom of the consumer.

India over the last several years accumulated the growing consumption power of the middle class. This can grow only further. Another factor is the huge focus by the government on infrastructure, as witnessed in the recent budget. In this category, we have quality product offerings in gas, water, and energy projects. In downstream sub-segments, we have found whether it is consumer or B2B industry customer perspective, the requirement for premium grade is growing strongly. Going by our innovation capacity and commitment to sustainability, this will be our strength to serve the Indian market better.

There are a lot of manufacturers in India which focus on Polypropylene and Polyethylene. How are you cooperating or competing with them considering there is a shortage?

Rightly so, India is a net import market for Polyolefins. This requires joint growth from both domestic and international suppliers for the market to grow and support 'Make In India' vision for downstream segments. We as a company have a unique geographical advantage as our location in UAE is relatively not a long supply line. We can quickly address the customer needs due to a robust supply chain.

The Indian government's ongoing efforts on transparency and reducing tariffs are helping in not only opening up opportunities for us but also increasing

The Indian government's ongoing efforts on transparency and reducing tariffs are helping in not only opening up opportunities for us but also increasing trade opportunities for both countries

trade opportunities for both countries. In the longer run, the Indian market must open up more for the international upstream players. It will help in opening the access to upstream technologies, not only for the polyolefin industry but also the downstream segments to be more robust.

The company's fourth plant is coming up in Ruwais which will add a cumulative capacity of 6.4 million tonnes per year by 2025? How do you see the new facility helping India?

Growth is the key story of Borouge in investment terms. In the past 21 years, we have been revamping our capacity from Borouge 1, Borouge 2, Borouge 3, and potentially Borouge 4. Last year with the successful launch of PP5, we boosted the capacity by 5 million tonnes and on top of that, it will be Borouge 4, going forward. This has supported our ambitions in the Indian market and also because of the proximity of the supply chain and also because of both the quality and volume requirements in the Indian market. This market will, therefore, be a highly strategically important market for us.

Will you be setting up your 5th factory in India?

Currently, our capacity will have very good agility and a robust supply chain to service. In the longer run, we do believe that the Indian market will open upstream to international players and open up opportunities and access to new technologies. This can also be very much in line with Prime Minister Narendra Modi's vision of 'Make in India'. If you have higher technological access to differentiated products, it will help the downstream industry regardless whether it is for domestic utilization or exports.

You talked about infra, energy, and agriculture but not about mobility and pharma. Aren't you interested in these two segments?

Yes, we are very much into mobility and pharma. Our PPE product range is very much focused on syringes, and pouches for medical packaging needs. For mobility, we don't have a local manufacturing facility

but we do have OEMs to supply specifically the bumpers, interior design panels, etc.

You talked about sustainability and circularity. What's Borouge focus?

The circularity and sustainability form the core part of our strategy. This lies in two parts: innovation and recycling. If we look at the enabler of the circular economy on the plastic side, we talk about reducing, re-use, and recycling. On the product design side, it requires a lot of investment and innovation to provide recyclable products.

We spend a lot of our innovation pipeline into design for recyclability. It is not only about the product itself but also the process. Then, the second part is the recycling. When the material is recyclable, we need to find ways to not allow the materials to leak into the environment but to create a full circle. We are polyolefin experts but don't have expertise in waste management. We need to sit with the waste management experts. In the last couple of years, we have already signed twelve agreements including two in India. The collaboration with brand owners and machine equipment for packaging designs or the other applications.

This year you are completing 20 years of India presence. Any major plans this year?

We have a very strong team in our headquarters in Mumbai and also the Sales & Marketing teams are developing business across India. At the same time, we are not only taking care of the business development side but we are also gearing up for developing deep innovation capacities that fit the Indian market. We have a long way ahead here in India.

Apart from the business development office in India are you looking at setting up an R&D centre?

Over the longer run, it could be an option but in the short term we have an innovation centre in UAE that is in close proximity to our production side. We believe that this centre can serve all the needs of the Indian market.

What is the contribution of South Asia to the overall revenue of the company? Is this the biggest region in terms of revenue?

We are very strong in all the regions we are present currently. If one looks at the growth potential, we can clearly see a few mega trends for South East Asia, South Asia regions. Given the potential, many experts have migrated from other parts of the world into South East Asia and also India. The domestic demand is early in India and there is a rising infrastructure demand not only in quantity but also quality, making it one of the fastest growing in the entire region. We are very excited to be a part of this growth. ■

Energy

Leading towards
Decarbonised Economy

INDIA CHARTS A NEW PATH TO ADDRESS RISING ENERGY DEMAND

Overcoming complexities in its energy ecosystem, India could pioneer a new model for low-carbon and inclusive growth TEAM ICN

The country's energy and electricity demand is likely to grow at a CAGR of 3.7-4.5% and 5.4-5.7% respectively till 2047, the pressure on natural resources to fuel the demand would only rise in the future.

India continues to be a major force in the global energy economy scenario. Thanks to rising incomes and improving standards of living, it is the world's third-largest energy consuming country. Since the year 2000, India's energy use has almost doubled, with 80% of demand still being met by coal, oil and solid biomass. On a per capita basis, a country's energy use and emissions are less than half the world average, as are other key indicators such as vehicle ownership, steel and cement output.

Over 80% of India's energy needs are met by three fuels - Coal, oil, and solid biomass. Coal has underpinned the expansion of electricity generation and industry, and remains the largest single fuel in the energy mix. Oil consumption and imports have grown rapidly on account of rising vehicle ownership and road transport use. Biomass, primarily fuelwood, makes up a declining share of the energy mix, but is still widely used as a cooking fuel. Despite recent success in expanding coverage of LPG in rural areas, millions of Indians have still not fully switched to modern, clean cooking fuels or technologies.

As the country's energy and electricity demand is likely to grow at a CAGR of 3.7-4.5% and 5.4-5.7% respectively till 2047, the pressure on natural resources to fuel the demand would only rise in the future. Over the coming years, millions of Indian households are set to buy new appliances, air conditioning units, and vehicles. India will soon become the world's most populous country, adding the equivalent of a city the size of Los Angeles to its urban population each year. To meet growth in electricity demand over the next twenty years, India will need to add a power system the size of the European Union to what it has now.

The country's energy and electricity demand is likely to grow at a CAGR of 3.7-4.5% and 5.4-5.7% respectively till 2047, the pressure on natural resources to fuel the demand would only rise in the future

Thrust on Gas based Economy

The market for natural gas is growing fast in India, but its role varies by sector, by scenario and over time. The 6% share of natural gas in India's current energy mix is among the lowest in the world. However, affordability is a sensitive issue for consumers, especially given the

complex patchwork of additional charges and tariffs that, on average, doubled the cost of wholesale gas by the time it reached end-users in 2019. As India builds out its gas infrastructure, natural gas can find multiple uses in India's energy system, including to help meet air quality and near-term emissions goals if supply chains are managed responsibly. But the sustainable development scenario also underlines that a long-term vision for gas needs to incorporate a growing role for biogases and low-carbon hydrogen, for which India has large potential.

UNFULFILLED DEMAND FOR ENERGY

With a share of 18% in the world population, India consumes only 6% of the world's primary energy. This is evident from the low per capita energy consumption of India (521 kgoe in 2014) which is one-third of the world's average. Moreover, India houses nearly 304 million people without access to electricity and 800 million people without access to clean cooking fuels.

Sustainability: A Top Priority

India's energy future depends on buildings and factories yet to be built, and vehicles and appliances yet to be bought. Within 20 years, the majority of India's emissions in the STEPS come from power plants, industrial facilities, buildings, and vehicles that do not exist today. This represents a huge opening for policies to steer India onto a more secure and sustainable course. India's ambitious renewable targets are already acting as a catalyst for the transformation of its power sector. Natural gas and modern renewable sources of energy have started to gain ground. The rise of solar PV in particular has been spectacular; the resource potential is huge, ambitions are high, and policy support and technology cost reductions have quickly made it the cheapest option for new power generation.

A crucial and even more challenging task ahead is to put the industrial sector on a similarly new path through more widespread electrification, material and energy efficiency, technologies such as CCUS, and a switch to progressively lower-carbon fuels. Electrification, efficiency, and fuel switching are also the main tools for the transport sector, alongside a determined move to build more sustainable transport infrastructure and shift more freight onto India's soon-to-be-electrified railways. These transformations require innovation, partnerships and capital. The additional capital required for clean energy technologies to 2040 in the Sustainable Development Scenario is $1.4 trillion above the level in the Stated Policies Scenario (STEPS). But the benefits are huge, including savings of the same magnitude on oil import bills. Government

policies to accelerate India's clean energy transition can lay the foundation for lasting prosperity and greater energy security.

Challenges Galore

India's combined import bill for fossil fuels tripled over the next two decades in the STEPS, with oil by far the largest component, pointing to continued risks to India's energy security. Domestic production of oil and gas continues to fall behind consumption trends and net dependence on imported oil rises above 90% by 2040, up from 75% today. This continued reliance on imported fuels creates vulnerabilities to price cycles and volatility as well as possible disruptions to supply.

Among other key challenges that continue to bother the policymakers are unhindered carbon emission and constraints within the energy supply chain. India is the third-largest global emitter of CO2, despite low per capita CO2 emissions. The carbon intensity of its power sector in particular is well above the global average. Additionally, particulate matter emissions are a major factor in air pollution, which has emerged as one of India's most sensitive social and environmental issues. Again, the energy use on a per capita basis in India is well under half the global average, and there are widespread differences in energy use and the quality of service across states and between rural and urban areas. The affordability and reliability of energy supply are key concerns for consumers.

SET FOR A GLOBAL ROLE

India's energy sector is set for a sea change with recent developmental ambitions of the Government of India - 175 GW of installed capacity of renewable energy, 24X7 power for all, housing for all, 100 smart cities mission, 10% reduction of oil and gas import dependence, and provision of clean cooking fuels. Envisaged to play a key role in the global energy scenario, India is likely to account for 25% of the rise in demand by 2040 says, International Energy Agency.

Way Forward

As per the International Energy Agency (IEA), India is likely to see the world's biggest rise in energy demand this decade, with demand climbing 3% annually due to urbanization and industrialization. Taking this an opportunity, India must uniquely position itself to pioneer a new model for low-carbon, inclusive growth. Many aspects of such a model are already evident in India's policy vision, and many more are highlighted in the Sustainable Development Scenario that points the way for India towards net-zero emissions. The success of such a model will demonstrate that robust economic expansion is fully compatible with an increasing pace of emissions reductions and the achievement of other development goals.

India is already a global leader in solar power and solar combined with batteries will play a massive part in the future. To chart this new path, India will need a whole host of technologies and policies. As new industrial sectors emerge and clean energy jobs grow, India will also need to ensure that no one is left behind, including in those regions that are heavily dependent on coal today. ■

INDIAN GAS SCENARIO @2047

ICRA projects domestic consumption to increase to around 270 mmscmd in 2047 from 163 mmscmd in FY2022

PRASHANT VASISHT
VICE PRESIDENT & CO-HEAD
ICRA LTD.

The domestic consumption of gas grew at a CAGR of 3.8% from 130.7 mmscmd in FY2016 to 163.1 mmscmd in FY2022. However, dependence on imported LNG remains high at more than 40% currently. Gas production is expected to increase substantially over the next few years from 79 mmscmd in FY2021 and 93 mmscmd in FY2022 to 123 mmscmd in FY2024, primarily due to the ramp up in the production from the KG Basin blocks of RIL-BP and ONGC. Domestic gas consumption is expected to grow by 6% in FY2024 to 168 mmscmd. The share of LNG in the total gas consumption would remain high as the prospectivity of the Indian sub-continent remains poor vis-à-vis oil and gas production.

However, over the longer term the following factors would impact the demand and consumption of gas:

Declining cost of renewable power: Declining cost of renewable energy has already tilted the production of power in its favour. Additionally, India is geographically suited for renewable power generation and the cost of renewable power is among the lowest in the world. Additionally, costs are declining for batteries and green hydrogen, and these are expected to reduce substantially by the end of the current decade, with increasing adoption.

Costlier gas: Historically, gas has traded at a discount to crude on an energy equivalent basis globally. However, since the middle of 2021, gas prices have traded at a premium to crude in most parts of the world. With higher gas consumption there could be a structural shortage of gas and accordingly, gas may continue to trade at a premium to crude, going forward.

ESG goals and climate commitments: Globally there is an increasing focus on the need to slow global warming and accordingly, while several countries are moving from dirtier fuels like coal and fuel oil to gas, the goal is to cut down all fossil fuel consumption drastically. The share of fossil fuels as a primary energy source may fall from 80% in 2019 to about half that proportion by 2050.

Energy security: Most countries want to bolster their energy security by reducing their dependency on imported energy. Accordingly, countries are increasingly focusing on more domestically-produced energy – much of which is likely to come from renewables and other non-fossil energy sources.

Declining investment in the upstream sector: The capital spending by oil majors declined and is likely to remain muted owing to: Increased focus on strengthening balance sheets and increasing shareholder returns; Uncertainty of oil prices in the long term; Transition towards lower carbon emissions; and ESG goals.

Green hydrogen: The cost of green hydrogen is likely to decline to that of grey hydrogen i.e. $1- 2.5/kg by 2030. As costs of green hydrogen decline, natural gas will be increasingly replaced by green hydrogen to cut greenhouse gas emissions.

Considering the above, the gas sector in the country is set to evolve with some of the key trends as below:

Growth in gas consumption would slow down from early and mid-2030s onwards as batteries become cheaper and use of EV increases

Growth in consumption: Gas consumption in the country is set to increase owing to the expanding city gas distribution network and growth in industrial demand. ICRA projects domestic consumption to increase to ~270 mmscmd in 2047. Growth in gas consumption would slow down from early and mid-2030s onwards as batteries become cheaper and the on-road population of electric vehicles increases.

Among the dominant consuming sectors, the trends are expected to be as follows:

Fertiliser: In the past years several new plants for urea production have been set up. Apart from these the government of India is pushing the use of nano urea, which has the potential of reducing the consumption of conventional urea. Accordingly, the demand for incremental gas for fertiliser production would be low till the end of 2030. Beyond 2030 any new fertiliser plants are likely to be based on green hydrogen/ammonia.

Power: Owing to low and declining cost of renewables, natural gas-based power generation has been declining for several years, so incremental demand would be nil. However, post 2030 green hydrogen-based power generation may be incentivised by the government for round-the-clock demand for renewable power and would be used for power storage.

City Gas Distribution: Expansion in pipeline and city gas distribution network throughout the country and healthy conversion economics would lead to growth in gas demand. However, as batteries become cheaper by the end of this decade, growth of electric vehicles is expected to pick up, leading to demand for transportation slowing down. Additionally, natural gas spiked with green hydrogen is likely to be increasingly adopted by various entities as green hydrogen becomes cheaper.

Green Hydrogen Consumption: Green hydrogen consumption is expected to increase with declining costs and to help reduce greenhouse gas emissions. For transmission of hydrogen the existing natural gas pipeline network may be repurposed, and a new dedicated pipeline network would be planned. Green hydrogen is likely to be used to decarbonise sectors such as steel, shipping, and aviation. Hydrogen consumption is expected to increase to about 25 MT per annum by 2050 from about 6 MT per annum currently. The National Green Hydrogen mission of the GoI with an outlay of Rs. 19,744 crore, aims to make India a global hub for production, usage and export of Green Hydrogen and its derivatives. This will lead to significant decarbonisation of the economy, reduce dependence on fossil fuel imports, provide greater energy security, and enable India to assume technology and market leadership in Green Hydrogen.

Increasing Consumption of Bio-gas: The SATAT initiative was launched on October 1, 2018 with the target of developing 5000 Compressed Bio Gas (CBG) plants in India at a cost of Rs. 1.75 lakh crore by 2023-24, thereby producing 15 MMTPA of CBG. However, as of now, less than 1% of that target has been achieved. However, the GoI announced several measures, including setting up of 500 new 'waste-to-wealth' plants to be set up under the GOBARdhan scheme at a total investment of Rs 10,000 crore and 5% CBG mandate will be introduced for all organisations marketing natural and bio-gas. Accordingly, production and consumption of CBG is likely to increase over the next decade.

The domestic gas market remains price sensitive and consumption of alternate fuels viz hydrogen etc will remain a function of the relative economics. Gas consumption in the country will be enabled by setting up of new LNG terminals and expanding the pipeline network. The GoI pushed for setting up of trunk pipelines connecting the East and the North-east through budgetary support in the form of viability gap funding for Urja Ganga and Indradhanush pipelines and the pipeline network is likely to increase from ~21000 km at present to ~33,000 km over the next few years.

While the Dhamra LNG terminal is to be commissioned soon there are several other terminals being set up in Jaigarh, Charra etc. The LNG terminal capacity would increase from 37.5 MMTPA as of now to 66.5 MMTPA as on FY2025-end. To incentivise higher production of domestic gas the GoI has provided marketing and pricing freedom for coal bed methane producers, discovered small fields and HPHT fields (subject to a price ceiling). Accordingly, most new gas fields getting into production have marketing and pricing freedom.

However, some of the key issues hindering the development of the gas sector in the country include lack of pipeline connectivity across the country especially in the eastern and southern parts, regulated realisations/product prices of natural gas consuming industries, absence of uniform taxation with various states having different VAT rates, separation of pipeline ownership and marketing, the slow pace of approvals, etc. ■

BIOENERGY SCENARIO IN INDIA @2047

Bioenergy triggers carbon neutral cycles, as carbon absorbed by the plants from the atmosphere during photosynthesis is released during combustion of biofuels

SHISHIR JOSHIPURA
MANAGING DIRECTOR & CEO
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Year 2047 will mark the centenary of India's independence from British colonial rule. This momentous occasion provides us an opportunity to reflect upon some daunting challenges and glorious achievements over the past 100 years. As a nation, we are striving hard to realize the Prime Minister's vision of becoming the 3rd largest economy in the world and a developed nation by 2047.

Energy is the growth engine for the economy and India has set a target to be energy self-sufficient by 2047. India's energy demand is expected to increase on the back of growth in infrastructure, industry, and transportation. With a population of over 1.4 billion and growing, India is the world's third-largest energy consumer as well as greenhouse gases (GHG) emitter, after China and the United States.

During the COP26 climate change summit in Glasgow, India announced a net zero target of 2070. India is perhaps the only nation in the G20 group on course with its nationally determined contributions (NDCs), as committed in COP21 Paris climate change summit. Energy transition has emerged as the most promising pathway in the race to zero campaign. India's energy mix, dominated by imported fossil fuels, is undergoing change with renewable energy sources making strong in roads. Bioenergy with its positive social, environmental, and economic impact on a nation's growth, is playing an important role in the energy transition.

Bioeconomy is knowledge-based production and use of biological resources to provide products, processes, services & energy in all economic sectors within the frame of a sustainable economic system. As reported by BIRAC's (Biotechnology Industry Research Assistance Council) Bioeconomy Report 2022, bioeconomy in India has grown to the size of more than US $100 billion with bioenergy as one of the budding areas. Bioenergy is the mainstay of bioeconomy.

Bioenergy is a sustainable source of energy that can be produced using natural resources such as agri-based biomass. Bioenergy utilizes biological resources, available in abundance to generate wealth in the form of biofuels and bio-chemicals from what otherwise would have been agricultural waste. Bioenergy triggers carbon neutral cycles, as carbon absorbed by the plants from the atmosphere during photosynthesis is released during combustion of biofuels. Besides helping conserve the environment, Bioenergy positively impacts society and economy. While helping curb GHG emissions, it helps create jobs in rural areas.

Any nation's growth strategy is built on the strength of the resources they possess. India is blessed with ample sunshine, huge agricultural land and abundant bio-based feedstock that it must leverage. India has a distinct advantage of plentiful sugary, starchy, and lignocellulosic feedstock. Deploying these biobased feedstocks

Technology plays a critical role as a game changer by facilitating commercial viability of biofuel plants on a continuous basis

for production of biofuels is helping mainstream Bioenergy in India's energy portfolio. The unique aspect of bioenergy is it offers farmers an additional revenue stream by selling agricultural waste as feedstock for the bioenergy plants. These include among others rice straw, wheat straw, cotton straw, bagasse, etc.

Flourishing biofuels industry has developed a resilient ecosystem across the value chain; from backward integration of the feedstock supply chain to forward integration of biofuel take-off and dispensing to end users. Robust industry ecosystem comprises developers, technology providers, financers, government bodies, industry associations, and academic Institutions.

One of the unique aspects of India's growth story in biofuels is its strong capability in developing and deploying home-grown innovative technology. India has a network of state of the art R&D facilities in industrial biotechnology and a pool of highly qualified technologists. Scientists work on cross functional technology advancements to develop innovative solutions that are capable of processing a diverse variety of feedstock efficiently. Technology plays a critical role as a game changer by facilitating commercial viability of biofuel plants on a continuous basis. The captive technology solutions comprise of well-proven traditional biofuels using 1G technology, rapid commercialization of advanced biofuels such as 2G ethanol, CBG, etc. and development of future fuels like Sustainable Aviation fuel (SAF), Marine biofuels and Bio-hydrogen, etc. Technology is helping optimize energy, utility, and carbon footprint of biofuel plants thus making them competitive.

Undoubtedly, the government's progressive strategic interventions from time to time have played a key role in helping grow the biofuels industry. India's spectacular achievements in the Ethanol Blending Programme (EBP) are attributable to a number of strategic policy interventions, starting with the inception of 5% Ethanol blending in 2003. Major breakthrough came in the form of introduction of the National Biofuels Policy in 2018. Expanded

range of feedstock, upward revision of pricing of biofuels, financial support for setting up production capacities have helped leapfrog industry. Inclusion of starchy feedstock for Ethanol production in 2020 has helped ethanol production across the country giving a fillip to EBP. Further induction of progressive policy namely, Sustainable Alternative Towards Affordable Transportation (SATAT), for propagating use of Compressed Bio Gas (CBG) in transportation sector, has fortified the future of biofuels in India.

Transportation sector is the second largest consumer of energy and emitter of GHGs after industry. Decarbonization of the sector as climate action, is not a matter of choice but an imperative and EBP has emerged as a very promising pathway. India achieved E10 blending mandate five months ahead of its target last year. India is progressing well as per NITI Aayog's five-year roadmap for E20 and in fact the target has been advanced by 5 years to 2025 from 2030. In yet another significant move, the Government of India has launched E20 blended petrol in major cities starting February 2023. This is a clear indication of growing propagation of ethanol blending programs. Automakers are also ready with their E20 material compliant cars which are to be delivered from April 2023.

Success of EBP has made a multifaceted socio-economic impact for India. India is heavily dependent on imported crude oil and has a huge forex outgo that contributes to current account deficit. According to the statements issued by the finance ministry, ethanol blending of 10% has resulted in reduction of crude oil import and corresponding foreign exchange savings of Rs. 41,000 crore. It has also facilitated India's energy security besides helping increase the farmers' income.

The Union Budget 2023 has laid a strong emphasis on green growth during the Amrutkaal. Green growth encompasses energy transition, environmentally friendly agriculture, and sustainable energy in the country. GOBARdhan scheme envisaged for promoting circular economy has provision for setting up 200 'waste to wealth' compressed biogas plants and 300 community biogas plants at the outlay of Rs. 10,000 crore. One of the main highlights of the budget was the 'Green Hydrogen Mission'. Rs. 19,744 crore of total outlay was approved for National Green Hydrogen mission over the period which will be beneficial for development of bio-hydrogen technologies.

As per Biotechnology Industry Research Assistance Council (BIRAC)'s Bioeconomy report 2022, bioeconomy in India is projected to grow upto US

$300 billion by 2030. On the back of a progressive policy framework, innovative home-grown technology, robust industry ecosystem and abundant bio-based feedstock, India's bioenergy sector is poised for a very promising future. During COP27 climate change summit in Egypt, while reiterating commitment to honouring GHG reduction as per Panchamrit agenda, India has reaffirmed the important role of biofuels.

Bio-Mobility platform denotes technology solutions for production of low carbon renewable transportation fuel from biobased feedstock for all modes of transportation namely surface, air and marine.

Bio-Mobility works in tandem with electric mobility in the form of hybrid vehicles that can run on Internal Combustion Engine (ICE) as well as electricity. During India Auto Expo held at Delhi in January 2023, leading auto OEMs i.e. Toyota, Maruti Suzuki, etc. launched flex fuel hybrid vehicles. Flex fuel hybrid vehicles can run on the ethanol blend varying from 20% up to 85%. Flex fuel policy is in offing and major OEMs are working to introduce new models. This is expected to augment demand for ethanol beyond E20. Diesel consumption in India is over three times that of gasoline. Technology is being developed for blending ethanol in diesel, which would increase demand further with huge savings in crude oil import.

While mitigating GHG emissions from road transport, there is also a need to decarbonize the aviation sector. Globally the civil aviation industry generates around 2 to 3% of total global emissions. To limit global warming to 2 degree centigrade, it is imperative to decarbonize this 'hard to abate' aviation sector. The International Civil Aviation Organization (ICAO) adopted the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) to address CO2 emissions from international aviation. Under CORSIA guidelines, airlines and other aircraft operators will offset any growth in CO2 emissions above 2020 levels. CORSIA mandatory stage begins in 2027, where SAF is considered a priority solution to decarbonize aviation. Similar guidelines are expected to regulate the emissions in marine transportation, where marine biofuels will play a major role.

Circular economy has emerged as a very promising pathway for energy transition. A circular economy is a model of production and consumption, which involves reusing, repairing, refurbishing and recycling existing materials and products for as long as possible. This calls for the use of sustainable materials and chemicals that operate on a shorter carbon cycle. Renewable chemicals and materials derived from biological resources provide a very promising solution in this regard. For instance, the world is struggling with plastic menace as it is non-biodegradable and adversely impacts biodiversity. Bioplastics that are made from agricultural resources are low carbon in nature and therefore seen as alternatives for single use plastic.

Bioenergy is an important element in addressing climate change, securing energy supply, and providing inclusive growth. Bio-economy encompasses 11 of 17 SDGs defined by UNFCCC in 2016 and bioenergy as the mainstay of bio-economy has a pivotal role to play. With growing adoption of biofuels like ethanol, CBG and inclusion of SAF and marine biofuels, India can certainly achieve energy independence by 2047. By focusing on technology innovation, policy support, infrastructure development and public awareness, India can become a leader in the bioenergy sector and contribute significantly to the global transition towards a low-carbon economy by 2047. ■

Bioplastics that are made from agricultural resources are low carbon in nature and therefore seen as alternatives for single use plastic

HARNESS THE POTENTIAL OF HYDROGEN IN REBALANCING ENERGY PORTFOLIO

This impetus for India's hydrogen transition initiatives must be viewed from the perspective of the country's larger goals for economic development, energy security, and a low-carbon economy

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Hydrogen in India has been used for decades in significant consumption sectors like refining, ammonia, and methanol. It is not a new entity that has suddenly boomed. However, geopolitical perspectives and technological upgradation has placed hydrogen as the next generation fuel for the future. Traditionally, hydrogen has been used mainly as a feedstock in India and globally and is produced through fossil fuels. It is called grey hydrogen.

With growing concern for climate change and increased focus on renewable energy generation, electrolyser technologies have gained the attraction to produce hydrogen using renewable electricity and water. This hydrogen produced is called Green Hydrogen.

Besides being traditionally used as a feedstock, hydrogen has emerged as a clean energy vector to support India's deep decarbonization strategy. It finds its application in decarbonizing hard-to-abate sectors, such as steel, chemicals, long-haul transport, shipping, and aviation. It also enables direct electrification at places where it is most challenging.

India's hydrogen demand might increase more than fourfold by 2050, accounting for close to 10% of the world's hydrogen needs

Hydrogen Demand in India

In 2020, the hydrogen demand in India was ~ 6MMT which was ~8% of the global hydrogen demand. According to current predictions, India's hydrogen demand might increase more than fourfold by 2050, accounting for close to 10% of the world's hydrogen needs. Understanding the decarbonizing potential of green hydrogen, its share in total hydrogen demand can increase significantly. Ease of Adoption and Cost of Adoption will dominate the pace of transition to a green hydrogen-based economy.

Currently, the demand for hydrogen in India is mainly from fertilizers, chemicals, and refineries. However, this demand is expected to expand with potential sectors, including power generation,

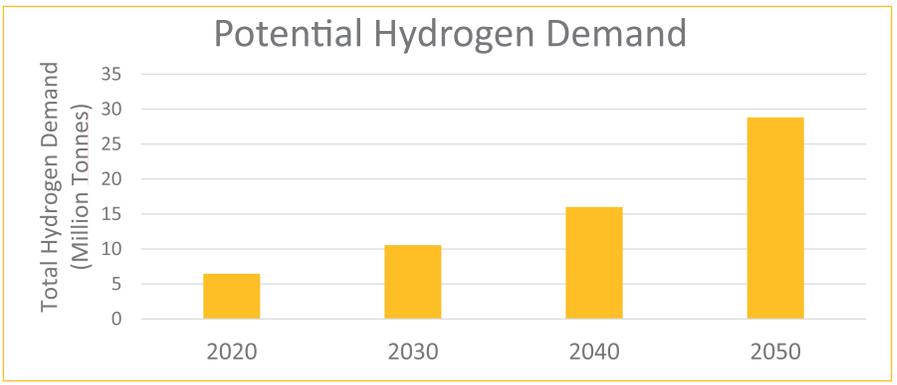


Figure 1: Projected Hydrogen demand in India by 2050

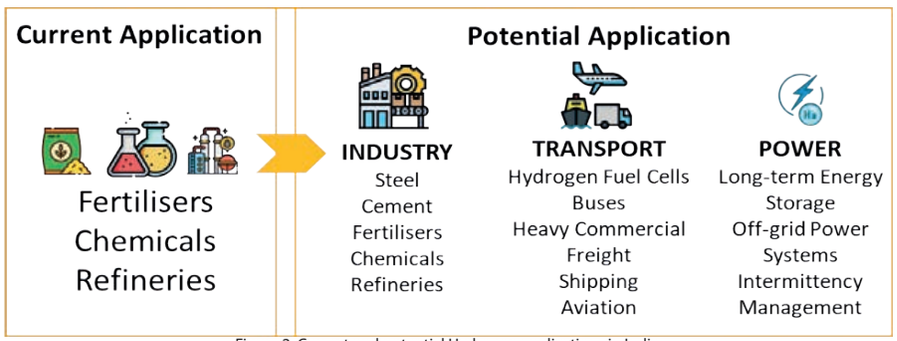


Figure 2: Current and potential Hydrogen applications in India

energy storage, grid stability, heavy-duty transport, steel, and cement industries. A significant portion of this escalating hydrogen demand should be fed by green hydrogen. As per India's national green hydrogen mission, it is expected to produce 5 MMT per annum of green hydrogen. Depending upon the export market condition, it will expand to even 10 MMT per annum by 2030. On a base level of green hydrogen production scenario of 5 MMT in India, about 50 MMT of annual CO2¬ will be able to get abated.

Strategic Importance of Green Hydrogen in India

This impetus for India's hydrogen transition initiatives must be viewed from the perspective of the country's larger goals for economic development, energy security, and a low-carbon economy. The rapid adoption of a higher percentage of renewable energy sources in the electrical grid and the electrification of end users like transport are essential to India's efforts to transition to a low-carbon economy.

However, it is implicitly acknowledged that certain substances, such as steel, ammonia, cement, and plastic, essential to industrialization and urbanization and cannot be decarbonized by electricity alone, have no replacements. The key to achieving a real low-carbon economy is green hydrogen. In the figure below, Power, Industry, and Transport sectors contribute to the highest levels of CO2 emissions. The introduction of green hydrogen in these sectors will help in decarbonization.

This transformation may benefit India, given its renewable energy sector's size, scope, and economic competitiveness. In contrast to fossil fuels, green hydrogen may be created anywhere there is a large amount of renewable potential. India is fortunate in that regard. This will enable a domestically produced energy carrier to emerge, eliminating reliance on imports for vital energy inputs like natural gas and petroleum.

Potential Domains for Development in the Green Hydrogen Value Chain

The complete value chain for the green hydrogen economy includes production, storage, supply, research and development, export, component manufacturing, and domestic application. For India to leverage the existing renewable energy potential and evolve as a global leader in green hydrogen, focus on production and export will be crucial. Research and development will be the key to reducing the current cost of green hydrogen and making green hydrogen prices competitive with grey hydrogen. The supply/transportation of green hydrogen is another critical issue where a lot of focus is needed.

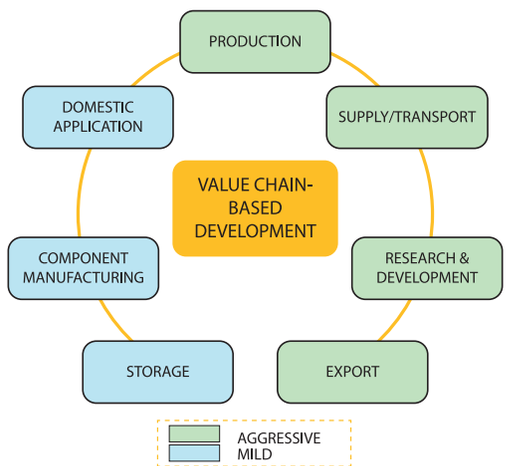


Figure 4: Potential domains for development in Green Hydrogen value chain in India

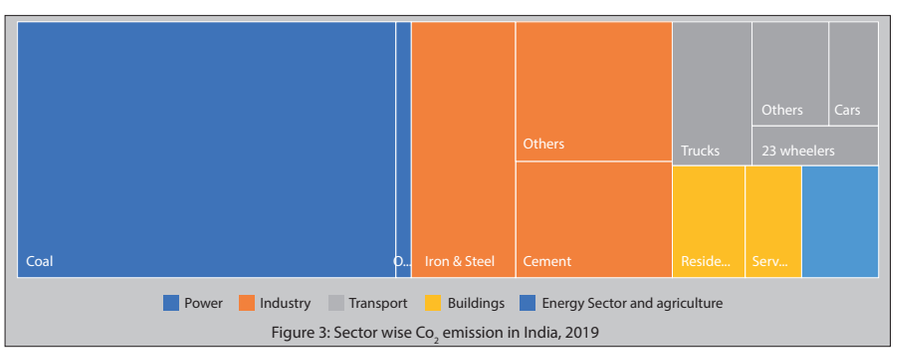
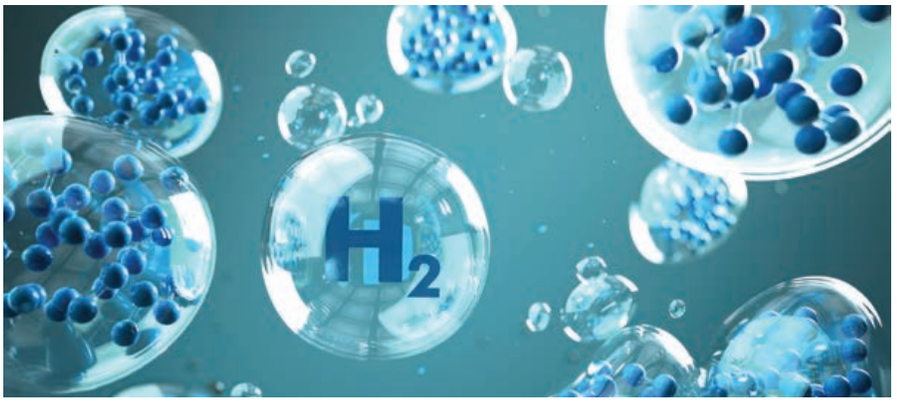


Figure 3: Sector wise Co_2 emission in India, 2019



The figure below details how India is leading forward with the strategies for developing a green hydrogen value chain. The areas of component manufacturing, storage, and domestic application are kept under mild level strategy as the Indian markets for the uptake of green hydrogen are growing slowly, and there is an immediate need to introduce the right policies and mandates.

Role of Policy Making to Boost Green Hydrogen Development

Over the past few years, the role of hydrogen as a new energy vector for hard-to-decarbonize sectors has significantly been recognized. This, however, depends entirely on sustainable hydrogen production while ensuring safety, affordability, and availability. Globally, Green and low-carbon hydrogen has been strategically added to their hydrogen policies, roadmaps, and strategies.

Polices can be the backbone of the growing hydrogen economy. Governments and diverse stakeholders are already working to find effective policies to include the role of hydrogen in the clean energy transition. These policies should be designed exclusively oriented toward the priorities and constraints of the country. This provides resource availability, infrastructure requirements, and expected investment and growth. This article has identified major six areas for consideration by policymakers.

- Demand creation: The demand creation for green or low-carbon hydrogen is crucial. Policies favoring demand creation can be a major push to encourage its early adoption as a clean energy vector.
- Financial support: Policy framework based on Risk share model is required to mitigate investment risks across the complete hydrogen value chain and to support public-private partnerships for fast roll out of green or low-carbon hydrogen. It will reduce the pressure on the government and mitigate risks for public and private sectors participating in this nascent industry.
- Technology and scale of manufacturing: Policy steps like promotion of R&D, knowledge sharing, technology transfer, international collaborations, joint demonstration projects, innovation, and scale of manufacturing are the key drivers that essentially lead to drive down the levelized cost of hydrogen and promoting the competitiveness amongst various hydrogen technologies.
- International trade: Policies are required to support international trade that can ease the risk related to uncertainty in domestic demand. It will further boost investors' confidence and ensure that the demand for green or low-carbon hydrogen at the global level can be met. International partnerships, harmonization of standards and certification, and development of hydrogen hubs /valleys near to the ports can be some of the initial steps to boost international trade.
- Harmonization of global standards and certification: To ensure clean practices, promote international trade, and boost confidence among consumers, developers, and investors in green or low-carbon hydrogen markets, it is required at policy making level to establish globally accepted standards, regulatory framework, and hydrogen certification system.
- Skill development: New skilled and unskilled workforce is required in big numbers during this Energy Transitioning to green or low-carbon hydrogen. It is perceived that this can be achieved by leveraging existing skills and developing new skills among the workforce across the hydrogen ecosystem, including industries, academia, and government. Training, apprenticeship programs, workshops, and the introduction of new educational courses can be some major steps that can be taken to support skill development at the public and private level.

Latest Development across Green Hydrogen Economy

India has recognized the critical role of Green Hydrogen in its energy transition mission and set its sight on becoming energy independent by 2047 and achieving Net Zero by 2070.

India sets its National Green Hydrogen mission to provide a comprehensive action plan for establishing a Green Hydrogen ecosystem and catalyzing a systematic response to the opportunities and challenges of this sunrise energy sector.

An initial financial outlay for the Green Hydrogen Mission will be Rs. 19,744 crore, including an outlay of Rs. 17,490 crore for the SIGHT program, Rs. 1,466 crore for pilot projects, Rs. 400 crore for R&D, and Rs. 388 crore towards other Mission components. The Ministry of New and Renewable Energy will formulate definitive schemes and guidelines for the directional implementation of the respective components of financial outlay.

This will help in creating over six lakh jobs across the sector and cumulative reduction in energy import bill by over one lakh crore.

At the conclusion, the author believes that future of India's New Energy sector is promising in all aspects that it will provide India a robust platform to excel in latest advancements of the technologies, catering to good and healthy life for the generations to come. ■

GREEN HYDROGEN ECONOMY: ADDRESSING FINANCIAL & PROJECT VIABILITY

India can start with a few large green hydrogen hubs that could in future interconnect rather than think of an expensive and premature national hydrogen backbone, but a similar policy framework would work well in hydrogen, as it did in payments

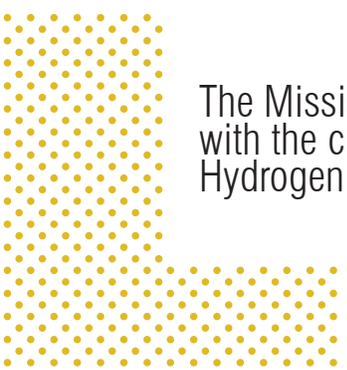
AMRIT SINGH DEO
SENIOR MANAGING DIRECTOR
FTI CONSULTING

India is on the cusp of a green hydrogen development journey. The National Green Hydrogen Mission indicates India's seriousness in pursuing green hydrogen for its net zero pathway in the long run, but making it successful requires a strong focus on building financially viable green hydrogen projects. Here are some of the key imperatives that India should get right as we create the green hydrogen economy in India.

Demand Aggregation

The first step has been taken with public finance allocation towards green hydrogen development, with budget allocation for the US $2.3 billion for National Green Hydrogen Mission and should be followed up quickly with creation of a demand aggregating agency, in the form of a National Green Hydrogen Development Corporation, working independently but under supervision of the proposed Green Hydrogen Secretariat. Such a corporation-structure is important for housing large-scale green hydrogen projects and acts as a clearing house for green hydrogen demand from different sectors – matching demand and supply in specific industrial clusters. This project development enablement should be the key priority of all hydrogen players – industry, government, and funding agencies. Without a strong pipeline of large, financially viable green hydrogen projects, there will be no green hydrogen production and so no consumption or a hydrogen market creation.

There is precedent from the financial services sector – the National Payments Corporation of India (NPCI) was created as a consortia of banks and related payment enabling entities to run India's national financial switch, scaling rapidly beyond its original mandate to run the domestic RuPay card network and now the UPI payment platform. There are parallels here in building of underlying infrastructure – both payment and energy networks are critical infrastructure – pipes that need to be built before usage platforms can be built on them. Hydrogen commercialisation being at an early stage of development is at the pipe-building stage. Due to the stage of commercialization and India's own maturity, India can start with a few large green hydrogen hubs that could in the future interconnect rather than think of an expensive and premature national hydrogen backbone, but a similar policy framework would work well in hydrogen, as it did in payments.



The Mission should be followed up quickly with the creation of a National Green Hydrogen Development Corporation

Demand-side Offtake Price Support

The next priority is to address demand-side support for green hydrogen offtake. Contracts for Difference (CfD) and carbon prices for volume-defined offtake in large-scale projects or hubs offer one way to address the issue of offtake incentives to induce demand. This is a cautious approach – limiting the financial exposure of the state to specific projects of scale (say more than 100 MW electrolyser capacity) – and well suited for the level of market maturity. The use of shadow carbon prices, in the absence of an existing market, in large hydrogen projects and allowing for carbon credits as revenue is one way to increase the financial viability of such projects, till a national carbon market emerges in the long run.

The issue of volume and price risk is a key concern for large-scale green hydrogen project development, particularly in the early stages. Sufficient offtake volumes are important but early-stage commercialization entails high levels of incentives – which can turn prohibitive at high volumes, those posing a dilemma for policy makers and public finance experts. It can be resolved by designing graded offtake incentives structures, first in specific sectors and then capping incentives to defined volumes. This requires strong evidence-based economic modelling so that both volume and price risks can be adequately mitigated for projects in an optimal manner, without putting undue pressure on public finance. If the hydrogen eco-system and players operating in it are able to address this issue, it will address a fundamental issue in building project viability and the hydrogen economy in India. If they are unable to do so, project developers and the government will continue to negotiate with an air of mistrust on incentives, with the possible result being that projects don't see financial closure and then aren't built as a result. This would leave everyone worse off.

Technology Choices

Manufacturing of electrolyser and Balance of Plant (BoP) equipment in India will take at least 2-3 years to be ready for large-scale project deployment. We need a combination of different electrolysers – Alkaline, AEM, PEM, Solid-Oxide – for project developers to choose from, as each will have a different optimal solution depending on the plant design and use case. A large-scale electrolysis plant catering to a single industrial offtaker may choose an electrolysis technology (and the electrolyzer) that is different from a multi-offtake, public-private consortium structure.

Design of the electrolysis plant is an infrastructure design question, as it must be good for the next 15-20 years i.e. the full life of the electrolyser. Scaling up the plant will be efficient using the same electrolysis technology so developers should factor in the costs of technology lock-ins when designing their projects.

Project Development and Skilling

India critically needs project development expertise in building multiple commercial-scale hydrogen electrolysis plants, across different technologies and use-cases. This will require new technical and managerial expertise that will have to be acquired organically and only through an active-learning route. National project development learning can only happen through jointly owned projects where expertise is pooled in, and learning is openly shared with all participants. The Hydrogen Valleys in Europe and some of the proposed Green Hydrogen Hubs in India, such as the Green Kochi Hydrogen Hub (GKH2) are examples of such an approach. India needs more such examples of innovation at scale and national learning in the still-nascent hydrogen market.

In conclusion, there are multiple hydrogen commercialisation hurdles to be crossed before we see a green hydrogen economy in India. These hurdles need to be addressed on priority. Our work through the India Hydrogen Alliance (IH2A), has been to bring players across the value-chain together and work with the government to build a commercialisation pathway for large-scale green hydrogen hubs. This is an exciting time for collaboration across all players and we hope to see more public-private partnerships in this area. ■

GREEN HYDROGEN: ENABLER TO ACHIEVE NET ZERO GOAL

India has the potential to become a low-cost, zero-carbon manufacturing hub by implementing appropriate policies, encouraging industry action, generating and promoting markets, and increasing investor interest

MUKUL GUPTA
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GAIL (INDIA) LTD.

Hydrogen is not only the most abundant element in the universe, it could also play an essential role in tomorrow's energy mix - from fuelling cars, trains, trucks and ships to generating electricity and heating buildings. Green hydrogen has emerged as a promising solution for achieving the net-zero emissions target set by several countries worldwide.

Ministry of New and Renewable Energy launched the National Green Hydrogen Mission in January 2023 with an aim of making India a hub for the production and export of green hydrogen. This is geared to make India energy independent before the country completes 100 years of its independence in 2047. Currently, India spends over $160 billion of foreign exchange every year for energy imports (Source: Niti Aayog). These imports are likely to double in the next 15 years without remedial action. India has vast renewable energy potential. The Institute for Energy Economics and Financial Analysis (IEEFA) and Climate Energy Finance (CEF) estimated that India, the third largest energy-consuming country in the world, will reach 405 GW of renewable energy capacity by 2030. The country has made significant progress towards achieving this target, with renewable energy accounting for over 42.5% of its total installed power capacity as of February 2023 (Source: Invest India). This puts India in a strong position to produce green hydrogen using renewable energy sources.

Emerging Importance of Hydrogen

Hydrogen (H) is the very first element on the periodic table. It is both the lightest and the most common substance in the universe. It is almost always found as part of another compound, such as water (H2O) or methane (CH4), and therefore needs to be separated into pure hydrogen (H2) before it can be fully utilized in its pure form. How well hydrogen contributes decarbonization, depends on how clean and green the method of production is. It is the specifics of the production process, and the energy source utilized, that determine whether the hydrogen will be labelled Green, Blue, Grey, or another colour.

The biggest value proposition of hydrogen is in decarbonizing the hard-to-abate sectors such as iron ore and steel, fertilizers, refining, methanol, and maritime shipping which emit major amounts of CO2. Historically, these sectors have been difficult to address

Alkaline and PEM electrolysers are two commercially available technologies for green hydrogen production today

because of a lack of technically and economically feasible technologies. Hydrogen can address many of these challenges and play a complementary role to effectively decarbonize these sectors. For other high-emitting sectors, such as heavy-duty trucking and aviation, hydrogen is among the main options being explored.

Hydrogen's specific energy (i.e., energy content per unit of mass) is higher than most hydrocarbon fuels. But its volumetric energy density is the lowest. That means pressurization or liquefaction is required for hydrogen to be useful as a fuel. These two properties drive the value as well as the applicability of hydrogen for the various possible end-use cases.

What is Green Hydrogen

Hydrogen is a clean and versatile energy carrier that can be produced from a variety of renewable energy sources such as solar, wind, and hydroelectric power. Green hydrogen is produced through the electrolysis of water using renewable electricity. The process involves splitting water molecules into their constituent elements, hydrogen and oxygen, using an electrolyser powered by renewable electricity. Green hydrogen has the potential to play a critical role in achieving a net-zero emissions economy. As countries transition to renewable energy sources such as solar and wind, green hydrogen can serve as a clean and flexible energy carrier. It can be used to store excess renewable energy generated during periods of low demand and supply the grid during times of high demand. This can help to balance the intermittency of renewable energy sources and ensure a steady and reliable supply of electricity. Central to the Green hydrogen production process is the electrolyser technology. Alkaline and polymer electrolyte membrane (PEM) electrolysers are two commercially available technologies for green hydrogen production today. Advanced electrolyser technologies like solid oxide and anion exchange membrane are nearing commercial deployment as well.

Future of Green Hydrogen in India

India's efforts to move towards a low-carbon economy rely heavily on increasing the proportion of renewables in the electricity grid and electrifying end-use sectors such as transportation. Green hydrogen is crucial for achieving a truly low-carbon economy, as it can be produced anywhere with abundant renewable energy resources. This will reduce the country's dependence on imported energy commodities like natural gas and petroleum. To make hydrogen cost-competitive, the cost of electrolysers must decline. India can benefit from domestic electrolyser manufacturing, improving its technical capabilities, and participating in an emerging global market while capturing more of the economic gains. Although the cost of hydrogen from electrolysis is currently high, India has one of the most competitive Levelized Costs of Electricity (LCOE) from solar and wind. Therefore, expanding green hydrogen production in India is more beneficial than increasing grey or blue hydrogen production. Companies like GAIL (India) Limited and Indian Oil Corporation (IOC) have already announced plans to set up a green hydrogen production facility in the country. These facilities will use renewable energy sources like wind and solar power to produce green hydrogen.

Challenges and Opportunities

Despite its potential benefits, the widespread adoption of green hydrogen faces several challenges. One of the main challenges is the cost of production, which is currently higher than that of fossil fuels. However, as the demand for green hydrogen increases, economies of scale and technological advancements are expected to drive down the cost of production, making it more competitive with fossil fuels. Another challenge is the lack of infrastructure for the production, storage, and transport of green hydrogen. To enable the widespread adoption of green hydrogen, significant investments in infrastructure are needed to build a comprehensive supply chain. This presents an opportunity to invest in the development of green hydrogen infrastructure, creating new jobs and driving economic growth. In addition, while hydrogen fuel cell technology has advanced significantly in recent years, there are still technological challenges associated with the adoption of green hydrogen. For example, the durability and reliability of fuel cells need to be improved to ensure their widespread adoption. There are also issues regarding safety concerns related to hydrogen since it is highly flammable and requires special handling and safety precautions. Moreover, there is currently no comprehensive regulatory framework for the production, transportation, and storage of green hydrogen. The development of a regulatory framework is essential to ensure the safety and reliability of green hydrogen infrastructure. Overcoming these challenges will require a concerted effort from governments, private sector companies, and research institutions.

Results and Conclusions

Major countries around the world are placing big bets and investing in hydrogen-based technologies, and India can play a leadership role at the global level in moving forward the hydrogen economy. Apart from fulfilling national goals around reducing emissions and enhancing domestic manufacturing, hydrogen paves a way for India to become a global power house of zero-carbon embedded export products. Products such as green steel and green ammonia present an early mover opportunity for India, given India's capability and resources to produce them at a cheaper rate than peer nations such as China and Australia. Significant challenges need to be addressed to enable this hydrogen transition. India can also leverage its partnerships with international players to advance the development and adoption of green hydrogen. In addition, India can collaborate with other countries in the region, such as Japan and South Korea, who are already investing heavily in green hydrogen technologies. These partnerships can help to establish supply chains for green hydrogen and create new markets for renewable energy sources.

Increased funding for research and development (R&D) focused on hydrogen production and its various applications can lead to technological advancements and cost reductions. To drive the adoption of hydrogen technology, policies are needed to encourage both demand and supply. Incentives for demand can help overcome the initial high cost barriers and stimulate market growth. As the market matures, these incentives can be gradually phased out. On the supply side, there should be a concerted effort to develop infrastructure and ensure the availability of green hydrogen on a large scale.

India has the potential to become a low-cost, zero-carbon manufacturing hub by implementing appropriate policies, encouraging industry action, generating and promoting markets, and increasing investor interest. We should aim for the 1-1-1 vision, that is, to bring down the cost of hydrogen to under 1 USD per 1 kg in 1 decade. Achieving this would not only fulfil India's goals of economic development, job creation, and public health improvement but also contribute towards its recently announced climate targets and net-zero vision. The time is ripe for India to explore hydrogen's potential to create a clean, secure, and affordable energy future. Through collaborative efforts between innovators, entrepreneurs, and the government, the use of green hydrogen could significantly reduce CO2 emissions, combat climate change, and lead India towards achieving net-zero energy imports. ■

Digitalization

Accelerating Industry Transformation

INDUSTRY BULLISH ABOUT DIGITAL TRANSFORMATION 4.0

Moving on from initial reluctance, the Indian chemical players are now highly prudent about adopting digital technologies into their operating models TEAM ICN

The digital wave is beginning to significantly impact the chemicals industry which in turn is very much poised to embrace this transformation. Disrupting the status quo are also the advancements in technology and instrumentation besides rapidly evolving customer needs. As market demands continue to shift, chemical players that want to remain nimble are incorporating digital tools to develop products that fulfil the requirements.

With digital technology and digital storage options becoming less expensive, the question of affordability is no longer relevant now. Over the past decade, these tools, such as cloud-based electronic lab notebooks and data analysis software, have become more accessible thanks to technology improvements. Chemical organizations can harness lower data storage costs, increased computing power, and advanced analytics to minimize the time needed to discover and implement new products. Throughout the product development cycle, companies can make research and development more efficient and spur innovation.

Chemical companies can address sustainability, supply chain, and price volatility challenges with digital solutions

Currently, a huge gap exists between the degree of digitalization in large and global companies and SME companies. While larger corporations are expected to heavily invest in a more holistic digitalization of various working domains, including R&D, supply chain, and manufacturing operations, the smaller companies are likely to take more time to evaluate the most important areas of their operations that need digitalization and find the optimum service partners to get the technologies and systems implemented.

What has changed in the last one decade?

In 2016, a PwC study found that among chemical industry respondents only 32% reported they are advanced in digital solutions and horizontal value chain integration. The same set of people expected to invest 5% of annual revenue in digital solutions to advance these solutions. Compared to that a recent KPMG survey found that 96% of industry CEOs saw digital transformation accelerate in their organizations, with 48 percent saying it advanced by a few years.

Having been a little slower in implementing digital transformation, the chemical industry has now fully awakened to the emerging trends. The momentum of digitization among chemical plants has gained pace, especially in the post covid-19 pandemic scenario. From novel process technologies to sustainable plastics, the chemical industry is scaling up its digital initiatives. This has opened new doors for organizations to explore opportunities to increase efficiency and

streamline the process.

The overall chemical industry has come a long way from being a laggard in terms of digital transformation and will continue to strengthen its position in this regard over the coming years. Chemical players across regions and segments need to be more explicit in their digitalization strategies considering the end-customer, available infrastructure, and talent pool amid the evolving sustainability needs.

Unlocking Vast Potential

The chemical industry has become increasingly complex as the variety of products and processes expand and competitive intensity has grown. Chemical manufacturers must navigate a fast-changing consumer marketplace and regulatory environment. Increasing competition is reducing margins while consumer focus on healthy living and sustainability makes it essential for manufacturers to understand their facilities' environmental impacts.

This is where digitalization comes into the picture. Digital tools address these challenges well. Digital projects have delivered tens of millions of dollars in savings by optimizing production and business processes. By using data to drive business and operational decisions, many companies are progressing with their own transformation to the next level of performance and operational excellence.

Chemical and other manufacturing players are already leveraging technologies

KEY DIGITAL DRIVERS FOR FUTURE GROWTH OF CHEMICAL INDUSTRY

DIGITALIZATION FOR SUSTAINABILITY

The focus on sustainability in the chemical industry will intensify over the coming five to seven years, and digitalization has an important role to play. The major applications where it will be used include reducing resource use, pollution, energy consumption and wastage. It will also create demand for a circular economy enabled by digital technologies such as AI, BDA, and IoT.

DIGITALIZATION OF INNOVATION

Over the coming years, the major focus in the research and development (R&D) side of operations in the industry will be whole lab automation and the use of technologies that enhance the level of communication and collaboration between teams and organizations. Lab automation will have to be more integrated than the earlier standalone deployment for individual processes.

DIGITAL TRANSFORMATION OF SUPPLY CHAIN

The global chemical industry has been greatly impacted by the disruption in its supply chain over the past two years. Most companies continue to grapple with the inadequate supply of key raw materials in various parts of the world; further streamlining and optimizing the supply chain has never been more important for the industry.

IMPACT OF 5G ON DIGITALIZATION OF INDUSTRY

5G is anticipated to enable the implementation of augmented reality, automation of material handling and remote operation of plants (edge computing) in the industry. Leading chemical companies have already started investments to tap the advantages offered by the 5G network.

such as digital twin, Internet of Things (IoT), and automation to reduce resource and energy consumption. Supply chain constraints and rising inflation have accelerated the adoption of digitalization by chemical businesses. Digitalization is not only helping the chemical industry avail benefits, such as cost reduction, e-networking and customer-centricity, but it can also prove instrumental in achieving long-term sustainability goals.

With a framework to help present a clear vision for how digital and exponential technologies can impact business strategy, chemical companies can achieve aspirations for the five key dimensions—user experience, talent enablement, asset reliability and performance, material system innovation, and ecosystems—and be well prepared for the next frontier in chemicals.

Overcoming challenges

To set off on the journey of digitalization, the chemical companies will need to have a clear picture of readiness, particularly the steps required to establish an accommodating culture that promotes flexibility and learning. As a first step, they will need to make sense out of an enormous bunch of data that remains underutilized. Another important aspect is the necessity of aligning different departments and business functions by using Internet of Things (IoT) based platforms which must not be only about capturing process data but improving the quality of analytics. Bringing more data scientists on board could help boost the quality of analysis drastically. The kind of issues such as changes in coal prices and availability can be dealt with through predictions so that companies can optimize their use.

Way Forward

Digital implementation is changing the decision-making landscape of chemical producers. However, the near-term focus will be on stabilizing current platforms and capabilities, with the intent to monetize the current investment pool before expanding to newer areas. Producers may increasingly use digital technologies to empower materials innovation and expedite low-cost formulations by evaluating, optimizing, and assimilating ingredient recipes and domain knowledge.

The adoption and integration of digital tools across an organization's operation can push the chemical industry into the future. Environmental and safety regulations are forcing chemical industries to improve their products to reduce their carbon footprint and develop new recyclable products. Digitization allows chemical industries to address regulatory restrictions and incorporate recyclable materials in their production processes and invest in recycling technologies. The growing demand for sustainability and recycling in the chemical industry is expected to further enhance the demand for digitization among petrochemicals and polymer chemical industries.

While mega trends such as global supply chain disruption, the drive for sustainability and the anticipated 5G revolution are going to be the key drivers for this growth, the overall industry's awareness and realization that digital transformation will be one of the primary strategies that drive future growth will have a significant bearing on this progression. ■

AN INTELLIGENT DIGITAL ASSIST SOLUTION FOR PROCESS MANUFACTURING

Ingenero's Software Solution for Process Decision Excellence (I-SSPDE)

DR. PRATAP NAIR
PRESIDENT & CEO
INGENERO TECHNOLOGIES PVT. LTD.

The world has gone through three Industrial Revolutions over the past three centuries with the advent of steam driven machines to mass production lines and automation and is now going through a fourth with Digitalization. Applying Digitalization technologies is increasing collaboration among global teams, augmenting the intelligence of users, converting large volumes of data into insightful information and enabling optimized just-in-time time decisions. Digital transformation is rapidly becoming the standard required for success.

I-SSPDE is an Applied AI-based solution that is deployed by Ingenero for process manufacturing applications. I-SSPDE serves as an intelligent assistant to process manufacturing users (i.e. operators, engineers, operating executives and management) by providing:

- A clear view of current status of operations and how the operation stacks up against benchmarks (historical best, design, and theoretical optimal)
- Predictions of expectations going forward
- Prescriptions on actions to be taken to prevent impending anomalies or adverse situations
- Virtual operations engineering capability, by answering to what-if queries for specified scenarios, which are useful to:
  - Troubleshoot

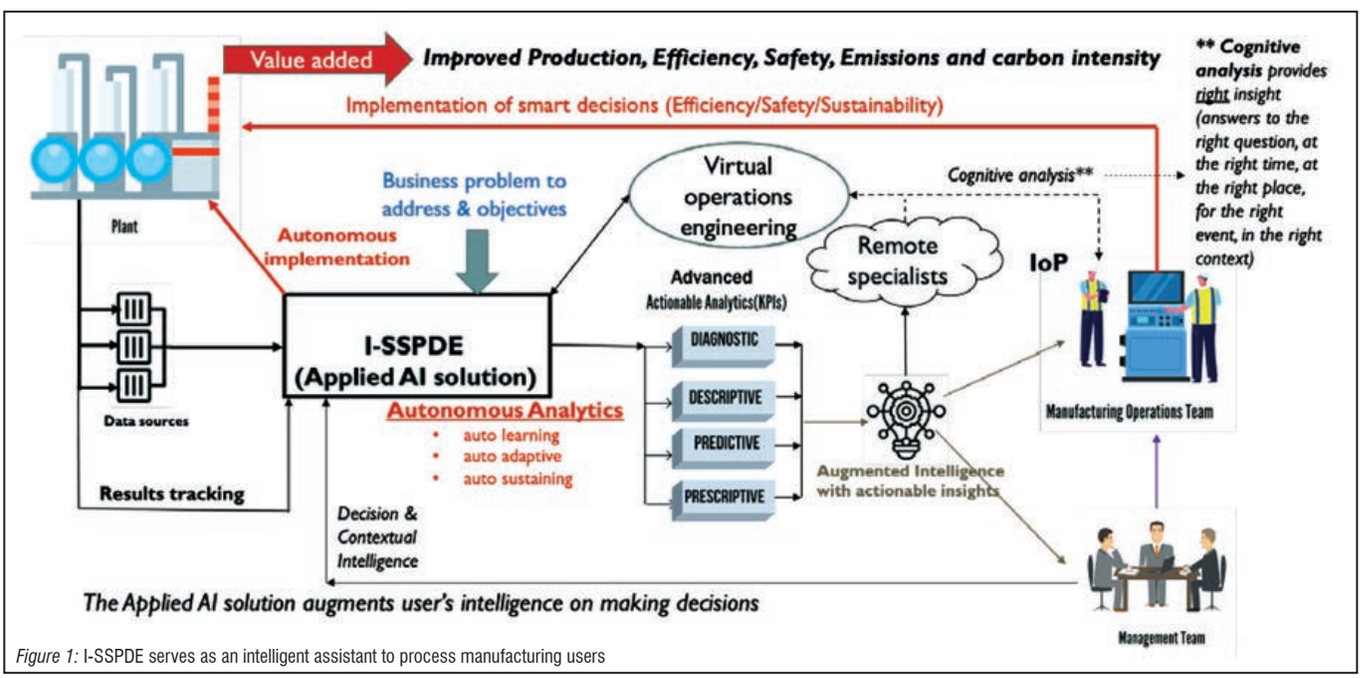


Figure 1: I-SSPDE serves as an intelligent assistant to process manufacturing users

  - Diagnose root causes
  - View operation responses to specified changes
  - Optimize operations
- Augmented intelligence to the engineers, speeding up on-the-job training for new process engineers and also improving skills of experienced engineers, helping speed up the internal workforce upskilling

Just as ChatGPT and other equivalent chatbot apps can be used to draft essays, in response to various prompts and used as a digital assist when drafting reports, I-SSPDE can be used to answer queries related to process manufacturing when making decisions. I-SSPDE serves as an intelligent assistant that enables more timely and higher quality decisions for improved:

- Production
- Efficiency
- Safety
- Scope 1 emissions & carbon intensity reduction

The process of transforming data to actionable information that drives decision excellence requires technologies developed as part of the digital revolution:

a) Data platforms to handle, process and store data in a conveneint way for easy use
b) Machine Learning algorithms to convert data to relational models
c) Fundamental models to augment and provide scientific guidance for these models
d) Visualization and interactive technology including BI dashboards (static or interactive), Augmented Reality, Virtual Reality, and Interactive voice response to interface between the human user and the intelligent assistant
e) Workflow processes/software for implementation and automation tools (e.g. robots, drones or advanced control system)
f) Remote user connection (Internet of People (IoP))

These technologies are integral pieces of an Applied AI solution and specialized Applied AI engineering is needed to:

- Define the use case
- Select the appropriate technology product from the plethora of technologies available in each of the technology categories (a - f), listed above
- Synthesize and configure these technology products to address the defined use case optimally, using an architecture that meets IT specifications, if any
- Fill gaps, if any, with customized programming, when required
- Use the appropriate algorithms to address the problem to be solved
- ML model development: Select the relevant data and features and its

Figure 2: Multiple technology tools required for an end to end Applied AI solution deployment

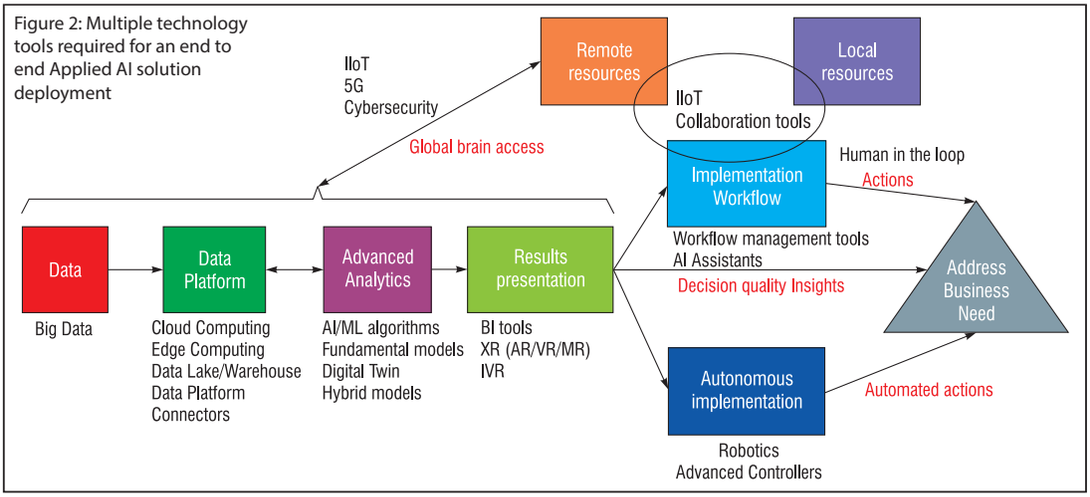
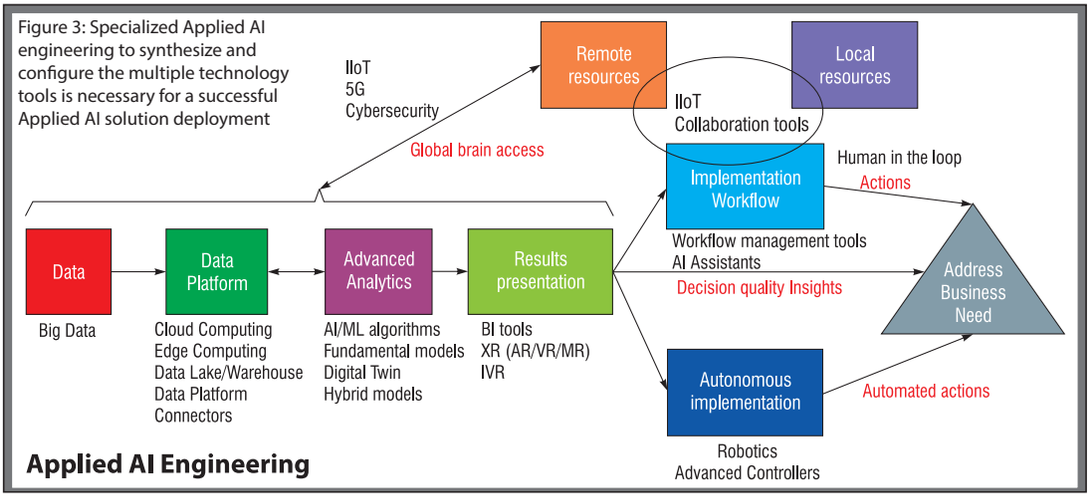


Figure 3: Specialized Applied AI engineering to synthesize and configure the multiple technology tools is necessary for a successful Applied AI solution deployment



transformation, as required, to train the models (using auto features in platforms, where available, along with domain knowledge fine tuning), fill in the gaps with synthetic data generated by fundamental models, iterate and test extensively

- Design and configure the interface with the user to deliver the user experience desired
- Contextualize the output, develop the narrative around the computed outputs to facilitate understanding and implementation to ensure value capture
- Integrate with an existing or modified work flow or with an automatic implementor (Robotics, APC, etc.)
- Provide initial AIOps support and user training on utilization and AIOps handover

Applied AI engineering is critical for successful solution deployment. A specialized multi- disciplinary team is required. Significant coordinated effort by this specialized team is required to end up with a robust solution. The ML model development step is a highly iterative process, which cannot be bypassed, despite having a platform with several data and model building automation features. This is necessary to end up with a robust and reliable solution, that is essential for the building of trust and credibility of the solution. An ML model can be trained and built in a week, but this will very likely not be a robust and reliable model. Building trust on the model is essential for sustained use and incorporation of the solution as part of the standard working process.

Over time the I-SSPDE tool kit has incorporated Auto ML features particularly relevant for process manufacturing applications, for upfront data handling, data preparation, feature selection and relevance, facilitating the model development process, albeit still requiring the iterative process of testing and validation.

While the ML models trained by data and fundamental models are more adaptive to minor changes and reflective of process behavior, it still needs to be retrained from time to time, when there are changes to process operating conditions, like significantly changed feed conditions, conditions post a turnaround, changes to the process, to name a few. I-SSPDE has an automatic rule based incremental model training/retraining feature that was developed and incorporated based on experience with several Applied AI solution implementations in process manufacturing, that keeps the model updated, more relevant over a wider operating envelope and thereby more sustainable and adaptive to operational changes.

An outside vendor with significant experience will ensure speed of implementation and ability to navigate the hurdles that can stop the best of internal efforts. Ingenero has this extensive Applied AI engineering experience, and can use other independent vendors' technology products or their own to deliver a solution on a Build-Operate-Transfer basis.

Applied AI solutions need the user's trust and credibility to be effectively utilized to capture value. Having the solution serve as an intelligent assistant for some time with support of the Applied AI Engineering team is needed. During this time reliability issues, if any, can be ironed out and model results explained to build the confidence levels. The implementation can then be automated by connecting directly to an advanced control system or other automation.

Involvement and buy-in within the organization where these solutions are being implemented, from management to the shop floor level, facilitates the utilization and sustenance of such applications. These applications may require a change in the way certain business or work processes are conducted, to be able to extract value from its application. Encouraging active use beyond just buy-in always facilitates the speed with which such applications are incorporated into the routine operations.

Ingenero has successfully deployed Digital solutions at over 70 manufacturing sites in the past 8 years. These applications typically deliver millions of dollars in added value on average per use case. ■

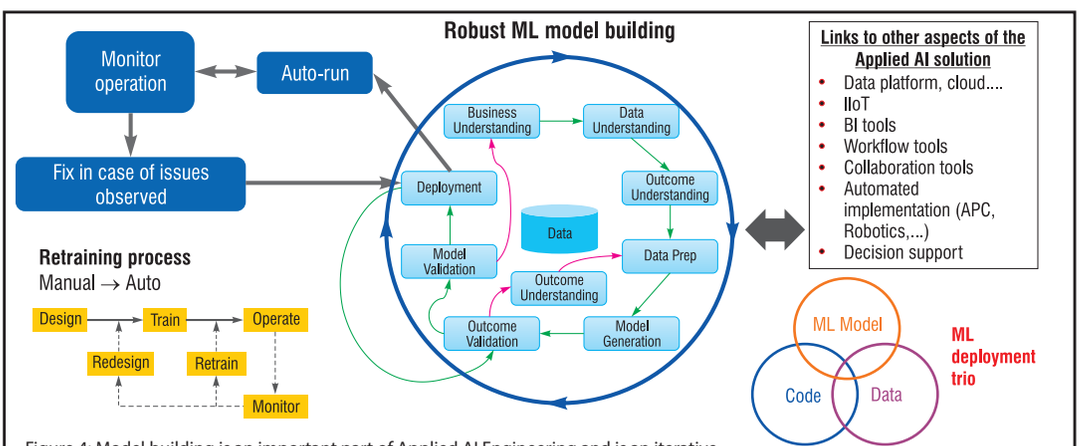


Figure 4: Model building is an important part of Applied AI Engineering and is an iterative process to ensure robustness and reliability of the solution and enabling subsequent automation of the model upkeep process

DIGITAL TRANSFORMATION AND INDUSTRY 4.0

Productivity of chemical plants can be improved by various smart manufacturing techniques: predictive asset management, process control, and production simulations

BIMAL PURI
SENIOR VICE PRESIDENT & CIO (FLUORO CHEMICALS & TECHNICAL TEXTILE BUSINESS) SRF LTD.

Industry 4.0 brings together several digital and physical advanced technologies to form a greater physical-to-digital to-physical connection—and it can potentially transform the chemicals industry by promoting strategic growth and streamlining operations. Broadly speaking, we identify two business imperatives: operating the business and growing the business. The focus on operations and growth can serve as a guide on which areas of the value chain merit greatest attention. Some areas can be readily addressed through Industry 4.0 applications. With the two imperatives of business operations and growth, organizations focused on the former can use Industry 4.0 technologies primarily to improve productivity and reduce risk while those focused on growth can apply Industry 4.0 to build incremental revenue or generate wholly new income streams.

The initial momentum of Industry 4.0 in the chemicals industry is primarily at the level of business operations, mainly due to the abundance of historical sensor data collected by chemical companies over the years. The long-term potential for business growth applications promises to be equally, if not more, transformational, but those applications take time to develop.

The productivity of chemical plants can be improved by various smart manufacturing techniques: predictive asset management, process control, and production simulations, among others.

Digitization is only the first step, however. Industry 4.0 technologies such as real time analytics and automated control actions bring together the digital and physical realms—supporting prediction, alerts, and prescriptive responses.

Predicting changes to reduce operational risk, Industry 4.0 helps chemical companies plan their supply chains in two ways. First, sensors and connected systems can help to improve visibility into the supply chain, reducing risks. Second, advanced analytics tools can help chemical companies predict demand patterns and accordingly align their supply chain and manufacturing operations.

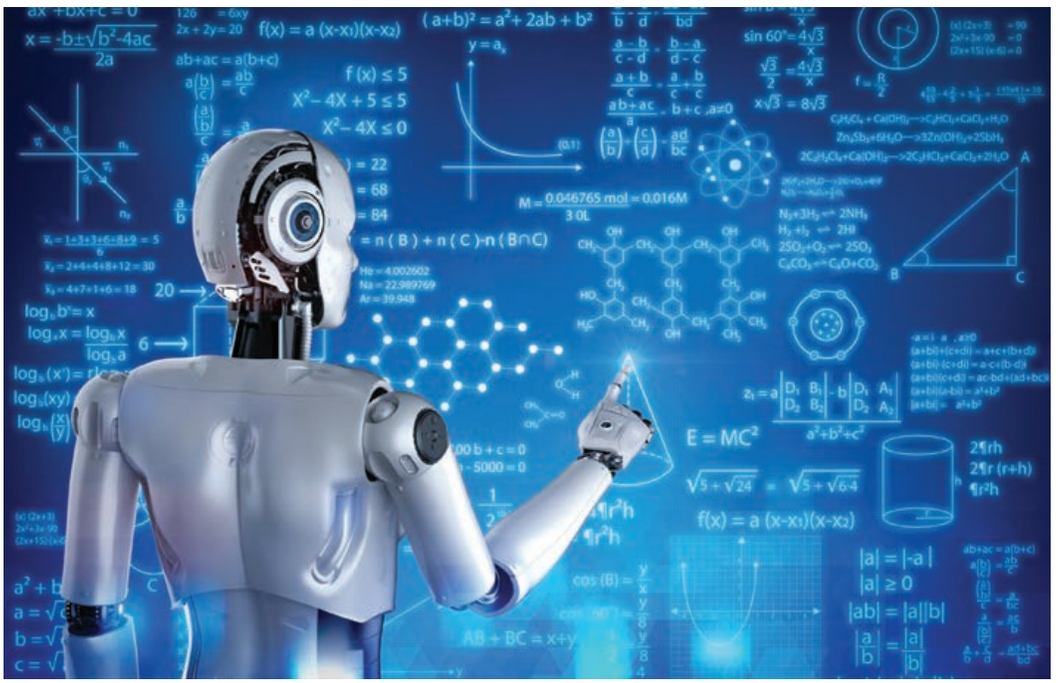
Industry 4.0 will likely impact the way chemical companies operate and grow their businesses, as they shift away from the pay-by-the-ton revenue model to provide value-added products and services to their customers. How fast and well companies perform will depend on the decisions they take today and the initiatives they commit for the coming years.

With changing customer preferences and increasingly stringent regulations, the move to a more sustainable business is crucial for chemical players. More than 80% of chemical players are placing as much importance on environmental,

To get the full advantage of digital transformation, an enterprise-wide digital strategy is often needed

social and governance (ESG) and sustainability as on revenue growth. At such a time, digitalization can be a huge boon and help expedite the pursuit of sustainability.

Integrated digital transformation is needed to fully take advantage of digital systems across the organization. Smart software will help researchers find existing data, unify it, and thus can give them smarter recommendations and visualizations before they even start doing an experiment. Digital tools can help give the human brain that additional help to think about what the data really means.



The chemical industry is poised to embrace digital transformation by incorporating digital tools throughout the product development cycle, companies can make research and development more efficient and spur innovation.

Two dimensions of smart transformations - External and internal. External, that is linked with needs from related industries for new smart materials and technological solutions for digital innovations. Internal is associated with smart modernization of the chemical industry value chain. Analyse data on the business and R&D activities of the leading diversified chemical companies and focus on their successful innovative cases.

The chemical industry's digital transformation will assist extend equipment life and reduce downtime. The financial incentive for digitalization varies according to the nature of the business. Large petrochemical companies prize speed, more rapid throughput that allows them to increase production. Specialty chemicals, which operate on smaller quantities but higher margins, prize quality of output. Digitalization also allows companies to reduce energy consumption and wastage, yielding cost reductions. Through multivariate analysis, specialty chemical companies can better understand what causes quality to change from one batch of product to another and reduce the variability. They can also accelerate the development of new products to better respond to customers' needs. Digital technologies allow them to perform modelling simulations of chemical reactions and of the performance of the final product. These simulations can cut the development time for a new product from 2-3 years down to 4-6 months.

Way forward

To get the full advantage of digital transformation, an enterprise-wide digital strategy is often needed, which percolates down to customizable parts suiting the needs of individual business units. This digital strategy should also tie into the digital maturity model—where the organization is right now and where it aspires to be once the digital transformation is done.

The holistic adoption of digitalization by the chemicals industry will support the transformation of the existing business to absorb newer capabilities, platforms, gain insights using data analytics and make timely changes in business decisions to optimize the existing operating model and maximize efficiency and profits. New development processes, including rapid prototyping and parallel experimentation supported by data analytics, can help companies respond. Organizational complexity, integration and process re-engineering are the most prevalent challenges for executing smart manufacturing initiatives even in chemical industries. Combined, these challenges reflect the largest change management obstacles. However, just introducing new technologies is not enough and the factory workers must evolve alongside the technology and be on board for the changes to come. The roadmap to digitalization lies through an accommodating culture that promotes flexibility and learning, coupled with a complete ecosystem for accelerating its adoption. ■

DIGITALIZATION FOR OPERATIONAL EXCELLENCE

Digitalization may have several positives, but it serves as a catalyst for most companies to help create an agile and sustainable environment

DEEPAK RASTOGI
PRESIDENT - STRATEGY & TRANSFORMATION
DFPCL

Digitalization may have become a buzzword over the last decade, but the COVID-19 pandemic has fast-tracked its adoption. Today, technology-intensive operations are not just revolutionizing new-age industries but are also giving a new lease of life to traditional domains like chemicals and fertilizers, particularly when it comes to operational excellence.

According to the Ernst and Young CEO Outlook Survey 2022, digital transformation is the second most prominent capital issue for chemical players across the globe. Elaborating further, the survey also brings forth how chemical players are now ready to "expedite digitalization", with over 40% of chemical players having been positively impacted by digitalization in the past three years.

With increasing market competi-tiveness, leading Indian chemical and fertilizer companies are pushing for digital transformation, driving a mindset change from 'good to have' to a 'must have'. After all, upgrading to state-of-the-art technologies doesn't just enhance productivity, in units; it also ensures energy efficiency, reliability, and safety for operational excellence.

Automation and Workforce Effectiveness

With the disruption of technology in the chemical and fertilizer industry, the workforce can ensure greater efficiency across business functions, vendors, and customers to deliver superior performance. Over the last decade, automation has been a prominent theme, pushing companies in this space to make technological changes from time to time.

For the process industry, it was all about implementing distributed control systems and incorporating programmable logic controllers for the peripheral islands of automation. The best-in-class equipment is largely being installed to increase human productivity and at the same time, enhance machine efficiency. With hardware design remaining almost a constant across continuous and manufacturing automation, software implementation got associated with industry domain knowledge.

Digitalization may have several positives, but it serves as a catalyst for most companies to help create an agile and sustainable environment. Not only does it take care of operational efficiency across the value chain, it also brings to the fore various stakeholders. With this step, a company is much closer to building a well-networked and connected organisation.

In manufacturing facilities that have complex supply chains, there is immense potential to leverage digital technologies to address the biggest of challenges

Digital Transformation to Drive Change

At a time when digital transformation was still new, chemical and fertilizer industries focused their energies on developing a strong foundation. This meant building a robust transactional support system to an ERP platform across all business units, enabling seamless and integrated flow of business processes and transactions.

Several companies also went ahead and implemented SAP S4/HANA, which is a ready-to-run cloud ERP that delivers the latest industry best practices and is big on innovation. With this move, it was much simpler to integrate all the

core businesses in the organisation, eliminating silos in a large way.

Incorporating industry best practices is the best way to bring about any change. It also helps to create a single source of truth for every business with seamless information flow. One of the most effective interventions adopted by several companies has been the creation of dashboards that serve as a window to access critical business metrics. This is a sure shot strategy to ensure efficiency and drive success.

Most of us are already aware of how supply change is a critical piece of the puzzle to business success. It also became a constant subject of discussion during the pandemic. During this time, realisation dawned upon the industry that there is no bigger capability than planning to ensure critical organizational readiness to fulfil market needs.

In the VUCA world that we live in, we have witnessed several global crises that have imparted one critical lesson – that volatility at both demand and supply sides warrants improved decision-making. In manufacturing facilities that have complex supply chains and cater to different business units, product segments, and geographies, there is immense potential to leverage digital technologies to address the biggest of challenges. This step can also help create a more agile and resilient supply chain.

The use of Integrated Business Planning (IBP) solutions can fast-track the digitalization of the end-to-end supply chain planning process, covering sales planning, production planning, procurement planning and logistics planning. By bringing different functions in supply chain planning onto a single integrated platform, chemical and fertilizer companies can attempt to have better collaboration with their stakeholders and other decision-makers. Such moves can also help with optimisation of working capital, capacity utilisation, and reducing costs.

The Next Leg

For most companies, the next obvious move is to plan and execute solutions that shall be integrated to enable seamless visibility, control and course correct capabilities. These steps can also have better and positive outcomes, including enhanced decision support and most importantly an improved customer orientation.

By connecting the supply chain and financial plan, it becomes a little smoother to deliver targets and at the same time, ensure timely root cause analysis of the deviations, thereby helping companies take corrective actions.

This conversation is incomplete without the mention of transaction systems that are critical to meet customer needs in time. It is also important to consider efficient logistics execution, keeping in mind volume growth, geographical expansion, space constraints, while considering customers' demands as a priority. In this scenario, the measure of success is to maintain dispatch targets on a day-to-day basis, ensuring the delivery of products to customers at their destinations without any delay.

For any chemical and fertilizer unit, manufacturing operations feature at the top of the list. That's why their focus revolves around enabling improved safety, reliability, productivity, and control in the last two to three years. The good news is that there are several new-age technologies that can speed up these tasks through automation, creating a digital operational infrastructure (DOI).

Older plants need to be transformed to keep up with their newer counterparts to maintain productivity, and thus profitability. Companies aiming for top-quartile performance are searching for answers to put together a digital transformation roadmap that will take them from their current stage of plant automation to DOI and autonomous systems.

The Future Roadmap

Digitalization has a huge potential to not just increase efficiencies, but also offer capacity utilization and reduce costs. The journey has already begun and it's only time until things fast track. The Industry 4.0 roadmap is exciting and brings in sustainability as a key objective.

When it comes to enterprise class systems, progressively organisations are taking future ready steps. At the same time, there are organisation-specific needs that cannot be addressed through a standard enterprise system. There is a need for digital enablement of processes or automation through collaboration. With investment into Low Code – No Code platforms, information technology functions in chemical and fertilizer companies can become more agile, in turn speeding up the digitalization journey of the organisation.

Today, the industry is increasingly embracing new-age technologies like Artificial Intelligence (AI) and Machine Learning (ML) to address non-linear challenges across a range of functions like manufacturing, sales, consumer insight, procurement planning, etc.

Last but not the least, it is the end consumer who is the king. With the adoption of digital technologies in a big way, chemical and fertilizer companies are engaging better with their customers, understanding their needs and offering them relevant information on their product and solution offerings.

While digitalization comes with a whole set of positives, companies must take into account safety and privacy issues to ensure increased security. As they say, a stitch in time saves nine!

All in all, the journey to digital transformation has been an exciting one. This isn't the end of the road – there's a future that awaits us with more possibilities! ■

DIGITAL TRANSFORMATION HELPING IN MEETING ESG GOALS

ESG solutions serve to collect the relevant data, calculate key metrics, set and track ESG KPIs, and preview data in interactive dashboards from across all entities within a company

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Digital transformation (DT) and ESG are two highly talked & high priority topics in the business community globally. While first one focuses on technology right from shop floor to smarter business outcomes, the other one Environmental, Social and Governance (ESG) refers to a collection of corporate performance evaluation criteria that assess the robustness of a company's governance mechanisms and its ability to effectively manage its environmental and social impacts.

With digitization, companies can clearly define key metrics in ESG reporting, including targeting, managing, measuring, and reporting sustainability performance. This helps businesses improve accountability and transparency in reporting ESG performance.

The goal of DT is to use technology not only for the controls, monitoring & optimization of the various process parameters but to become enabler for more informed business decisions. As Deloitte has published -Our world faces a number of global challenges: climate change, transitioning from a linear economy to a circular one, increasing inequality, balancing economic needs with societal needs. Investors, regulators, as well as consumers and employees are now increasingly demanding that companies should not only be good stewards of capital but also of natural and social capital and have the necessary governance framework in place to support this. More and more investors are incorporating ESG elements into their investment decision making process, making ESG increasingly important from the perspective of securing capital, both debt and equity.

Looking at above, DT & ESG has to go hand in hand for achieving the goals. In COP26, sustainability goals are: Encouraging healthy living. Ensure a safe and secure atmosphere. Encourage more sustainable behaviour. Promote the use of responsible sources and responsible use of resources throughout the supply chain. Global efforts are on for Zero Carbon Emissions for which various Automation & Digital Technologies are helping industries to achieve their Net Zero goals.

Digital twins coincide with features and characteristics found in IoT and AI, which use sensors and algorithms to enhance data analytics to aid in business strategy and risk prevention

Current Scenario

As the World Economic Forum says: In the Information and Communications Technology (ICT) world, customers increasingly cite ESG as part of the criteria for selecting vendors. "New IT", which includes innovations such as edge computing, can make ESG more effective and efficient, while ESG goals can be embedded in New IT now as it develops.

Of the three pillars of ESG, Automation & DT plays a vital role in Environmental. Negative environmental impact can be reduced by three popular Rs : Reduce, Reuse & Recycle

- **Reduce.** Reducing the amount of waste created
- **Reuse.** Give waste a second life by reusing it or donating it to be used by someone else, circular economy.
- **Recycle.** Enable the materials thrown away to be used again by making them into new

Reduce With the use of technology, raw material consumption can be optimized like fuel for production of energy (coal, biomass etc.) with the use of smarter combustion controls. With the use of digital tools process parameters deviation assessment can be done & then same can be optimized to run process more closely to the set point. It will not only reduce consumption of raw material but also energy to produce same amount of the product. It is not that these are not known but the ways the data are used to predict and maintain have been enabled by the technology. With the use of Advance Process Controls (APC) which sits over normal DCS controls enables to plant to operate with narrow band of deviation and thus reduces waste. By way of close monitoring of KPIs & their real time correlation through dashboards, which rest only in control rooms, can be brought online using technology and thus relevant stakeholders can advise plant operators for better controls resulting in reduction of water, air, gas, energy & steam (WAGES).

Reuse As newer & newer technology is coming up, it has become essential to refurbish or reuse the equipment rather than discarding them. Though it is currently on lower scale but industries are doing this. There are industries that repair the costly DCS, PLC modules / cards etc. to put them back in use and save money on account of new procurement. With the use of advance technology, faulty components are identified and replaced to make system healthy. Likewise combining the defective instruments, one can be made healthy by using the components from each other. This thus results in saving environment from the e-waste. Even with the use of technology for segregation, this e-waste is deposited back into the stores for further recycling. Likewise low grade heat which goes into the environment is used in technology like VAM, ORC. for cooling, HVAC etc.

Similarly in power industries, people are making modifications in boilers to take biomass also as fuel and reducing carbon footprints. Turbines are being refurbished to reduce heat rate thus avoiding procurement of new ones. Here also using feed forward controls, optimum heat rate is achieved. Similarly, cooling tower outlet is being recycled for other uses. Even air-cooled cooling towers with better controls are being used to stop using high volumes of water. Similarly, recycling boiler economizers and air heaters fly ash back into the boiler with proper controls leads to reduction of un-burnt carbon loss, resulting in energy savings.

Recycle This last R has vital role in saving environment. Using technology in Zero Liquid Discharge (ZLD), plants do not discharge the effluent but rather recycle in the system. This helps in reduction in water usage. There are various examples where effluent after proper treatment using technology is recycles back for use.

Some of the solutions with the automation & digitalization are:

Optimize energy Measure energy of each motor, compressor etc. & using technology compare their running data with identical ones & also design data. This will enable the concerned maintenance department to take corrective actions. Now a days sensor are available which measure vibration, RPM, flux etc. in one single sensor & provide online data to know where is the problem to avoid secondary damages thus saving energy. Use of Variable Frequency Drives (VFDs) with motors & then with DCS /PLC controls, energy is saved. With the use of smart modules, one can monitor the performance of compressors & motors on mobiles / computers, get alerts & even with cloud expert advice is taken.

Use circular economy In the integrated plants, output of one plant is used as the input in the other plant & thus wastage is reduced & resources are utilized to great extent. With Digitalization, this balance cam be monitored.

Internet of things (IoT) Companies utilizing IoT solutions to track, analyze and deliver data in real-time can make sound decisions more quickly and efficiently. A report from the World Economic Forum states that 84% of IoT deployments are currently addressing or have the potential to address the UN's Sustainable Development Goals (SDGs), which can assist businesses in their ESG plans. With advanced IoT tools and sensors, companies not only can have the capability to monitor data, but they'll also be able to respond to demand and make necessary changes to their respective environment. For example, some midstream companies are using sensor technology to monitor pressure, gas flow, and other variables to predict pipeline leaks. This real-time leak detection and alert system could lead to a reduction in costs and prevent environmental damage. Therefore, this

type of technology could help companies accelerate their respective ESG policies.

Artificial Intelligence (AI) Modern technology has also given companies the capability to use AI to their advantage in ESG investing. For example, using AI enables a company to better detect and reduce the amount of emissions. Much of AI's potential comes from its capability to carry out data analysis and algorithms that allow computers to analyze data and identify key information that can be referenced when making business decisions.

Digital Twins The concept of digital twin technology is to create a virtual environment that replicates real-world processes or services to collect data and predict how they will perform. Digital twins coincide with features and characteristics found in IoT and AI, which use sensors and algorithms to enhance data analytics to aid in business strategy and risk prevention. This advanced technology benefits the "E" in ESG by detecting cost-saving solutions in certain areas of a process or service that would otherwise be seen as wasteful.

Automation & DT play important role in Social also. Under the Social Pillar companies report on how they manage their employee safety, development and labour practices & surrounding environment. Production is changed to Productivity i.e. how safely you have done production with minimum energy. While companies have been looking for their own employees & labour working inside, the Social aspect of ESG has forced them to look out to the surrounding community as well.

Automation & DT help companies in various ways

- With the use of advance sensors, safe operation of machines can be ensured & thus no incidents.
- With the use of advance wearable, an employee can be tracked for his movements in unauthorised areas, buzzer / alarm in case he is trapped and need immediate support.
- Use of helmet mounted tablets help not only in hands free operation but also online meeting, guidance from subject matter experts etc.
- With online dashboard plant

heads & concerned Environment Expert can monitor the Continuous Emission Monitoring System (CEMS) & Continuous Effluent Quality Monitoring System (EQMS) and take corrective actions immediately. With the use of Artificial Intelligence & Machine Learning software, one can predict emissions in real time help understanding how operations relate to emissions & provide a testing ground for operational changes. This is all possible using digital technologies.

- With use of AI embedded software, CCTV is used for monitoring of violation of safety protocols & initiate immediate necessary actions. It was very useful during Covid times when social distancing was of prime importance. Now also it is widely used.
- With the use of electronic Safety Passes, one can find out the actual time a labour has spent at site to improve productivity, behaviour & track movement.

Automation & DT play also help in Governance aspect as well

Digitalization enables leaders to work more efficiently, with more efficient processes and relevant data, enabling faster decision making and taking advantage of new opportunities with the help of adequate technology. Thereby, achieving better and more efficient corporate governance processes. With Digitalization data related to ESG are no more siloed but available to interested parties. Thus Accountability & Transparency both are achieved through Digitalization. It helps top officials of the companies to take informed & fast decisions.

For example Monitoring, Reporting & Tracking of Legal Compliances are possible through Digital Tools available in the market which keeps companies up to date & dependency on manual work is eliminated. Similarly Engagement platforms such as e-Suvidha App, WhatsApp Groups, Teleconferencing etc. support the stakeholders.

ESG solutions serve to collect the relevant data, calculate key metrics, set and track ESG KPIs, and preview data in interactive dashboards from across all entities within a company. These tools would also facilitate the reporting process by ensuring consistent calculations while keeping ESG data safe and accessible from a single repository. This will help businesses to be compliant with ESG regulations, share their data with stakeholders and strategically manage ESG performance. Dashboards can provide management with the required level of transparency, enabling and improving strategic sustainability management by C-level management.

To summarise we can say incorporating the right tools and establishing the required integrations across different data sources will help organisations avoid costly mistakes when it comes to meeting their ESG reporting needs, as these continue to increase. Companies will also be able to bring added value to their businesses and derive further insights on data once their Digital Transformation and ESG strategies align. It is sure that companies who give due importance to ESG & work upon will be able to face competition in the future for which Digital Transformation will play a vital role.

The G in the ESG is on its way to bigger G-Green which is the need of the hour!! ■

SCHNEIDER ELECTRIC-AVEVA BRING BROADER PORTFOLIO FOR INDIAN CUSTOMERS

Real time data and transitioning into conditional data and prescriptive mode is what new digital technologies enable

STEPHEN REYNOLDS
INDUSTRY PRINCIPAL
CHEMICALS
AVEVA

AVEVA is now fully owned and is part of Schneider Electric. What will be its likely impact on existing and future customers in India?

We are hoping that it will have a very positive impact. It will help us in keeping the open-ended environment for software development, helping our customers with software development with the tools they have and also with the AVEVA portfolio. We have worked with Schneider Electric, particularly in India as an integration partner and now with this fully owned status, the working relationship will grow only stronger as we have a great team and concepts across the portfolio that allow for better service as well. In addition, AVEVA continues to grow in the chemical segment. So, we hope to see more support there.

How will AVEVA and Schneider Electric work together in the Indian chemicals market?

The Indian chemicals market continues to be strong. It is highly active and we have a tremendous amount of customer base to talk to. For India, we continue to see good activity, bringing up good discussion on how it connects globally as it doesn't operate in vacuum. We have seen many disruptions happening in industry during Covid. With Schneider Electric-AVEVA, we will now have a much broader base of support coming into India and being available to the customers.

AVEVA enables companies to engineer efficiently and optimize operations, driving growth, and sustainability simultaneously. How do you ensure all these solutions will help chemical companies?

Digital transformation is a direct evolution of operational excellence. We talk about people, process and technology but operational excellence is taking people in a process as far as they can go. Implementing standard work, organizing work spaces, understanding what we can do with what we have. The next step is technology. As we do a lot of improvement to process, typically there is digitalization and more information. As the information builds up, it necessitates the transformation into digital space.

With the larger broader portfolio, we have connected information across the whole spectrum of the chemical industry. With our OSISoft we focus on real time data, with AVEVA taking data from exceptions. From engineering, simulation, design to operator training and commissioning of a plant. Now its maintenance through operations and sustainability and connecting with integrated digital twins so

> Our simulation and design packages now include greenhouse gas emissions for a number of processes where it is able to identify the problems

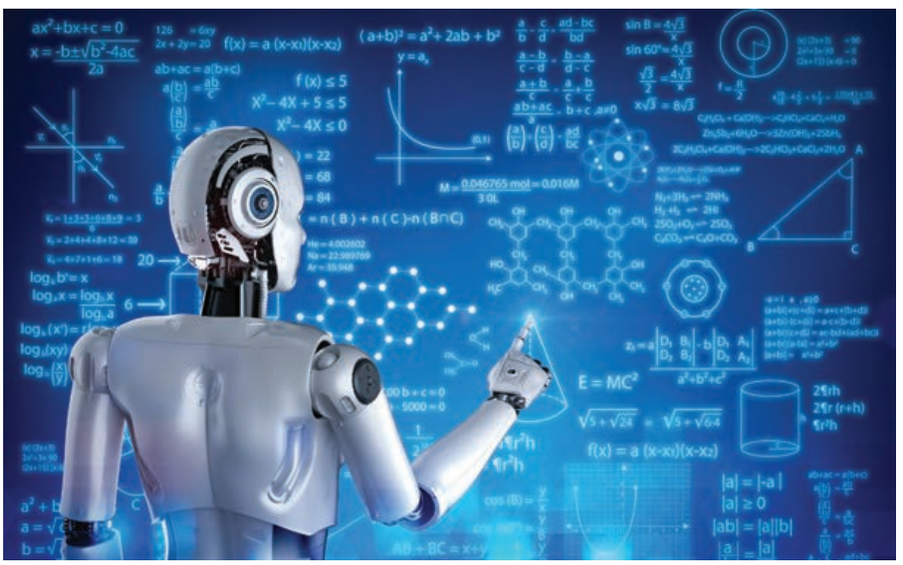
that information is never lost and always readily available. As we transition into the standard operational excellence into the digital connected work environment, the information is at their fingertips to drive data driving decision making.

Chemical companies are focusing on driving operational excellence through digital transformation. Steps which will help companies to achieve operational excellence?

It is a journey. The first thing for the players is to understand where do they stand currently, where they want to be and what is necessary for them as a company or chemical plant to succeed. We want to be their trusted partner in this journey. We don't want to just sell them software but also offer a solution that fulfills the long-term improvements. The steps include understanding the process and people you have so that the operational excellence part is really the foundation of digital transformation. Understanding what processes are important, what information you have today and what information you will need in the future. Of course now with Schneider Electric in play, we have a direct line to the process automation and hardware system.

Understanding what you have and need is going to drive home the information that you are going to require to drive operational excellence. And then it is privatizing the solution. Very often chemical plants will start with understanding the real time visualization of the process. That's step one. Then very quickly depending on the amount of equipment they have, reliability becomes a concern. So they have to ensure protective analytics around their assets.

As that activity occurs maybe it is time to look at the asset information and digitize it for better decision making. This continues on through optimization and then energy and yield management. Supply chain costs are as vulnerable they are these days due to situations, even little matters. Some of the next steps are to get hold of such situations and understand the conditions that could lead to failure. Real time data and transitioning into conditional data and prescriptive mode is what new digital technologies enable.



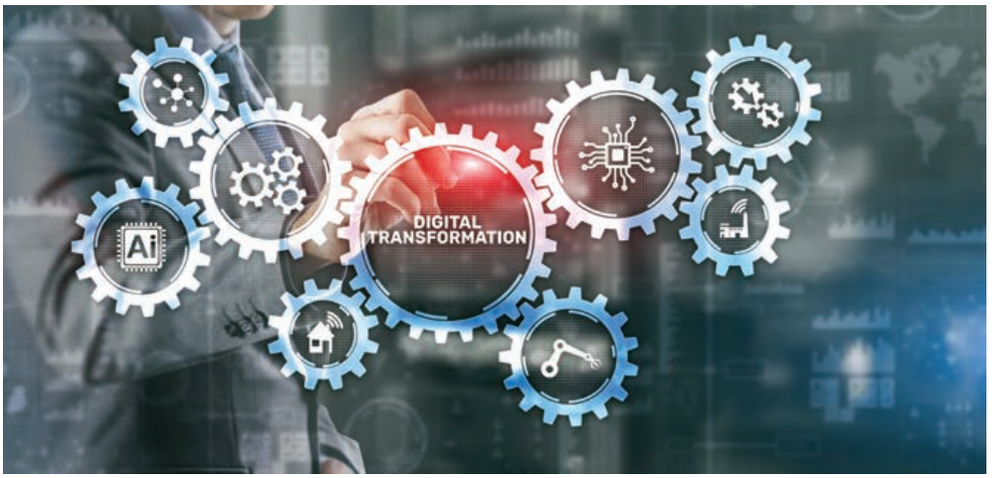
Chemical companies are looking at reducing energy and waste, improving circularity, and also improving sustainability score. How do you see data analytics, process simulations, and digital twins helping them in this journey?

Energy optimization has always been the hallmark of the chemical industry because it has been constrained by margins. So energy is one of the main costs that it hopes to manage. I think from a digital standpoint, having the data on fingertips and right information handy allows us identify our energy landscape where we are using the most of what we can take back, integrating with our equipment, understanding the electrical, natural gas, steam, commitments we have, looking around our missions, and monitoring systems. Connecting that with our data systems that we can understand, what process steps lead to the largest carbon footprint. How do we scale those back? I think having that data available is going to be the key.

If you look at some of our technology, it is going to enable those calculations in real time. Our simulations now can calculate greenhouse emissions, our scheduling and planning tools allow you to simulate different feedstocks, different utility and usage so that you can calculate your carbon footprint, go into your plan and make proper decisions. The basic reliability of the process, continuing what we do everyday, being reliable so that those extra emissions don't occur.

Circularity of course is the newest aspect of this net zero campaign and it's the one that has the most question marks because many of the technologies are

As we transition into the standard operational excellence into the digital connected work environment, the information is at their fingertips to drive data driving decision making



going to be new. Recycling for many years has been mechanical as when we see a plastic bottle we turn it into a park bench. With the variety of plastics and variety of additives into the chain, identifying and sorting the plastics that make sense has been difficult. Roughly 9% of the world's plastic actually gets recirculated. So circularity is going to allow us to develop those chemical processes not only to grab the split polymer but convert it back into either monomer or the base raw material so that we can build the new again.

So now we are recycling the carbon molecules and not just the plastic. Some of these technologies are being developed and many of the pilot plants have come online. The digital process and community will enable more efficient design and decrease the run in time. Reverse supply chain, getting the plastic back from the market and reprocessing. There are a lot of JVs happening in this space. Therefore, we will see the data grow and be able to manage the communication beyond the boundaries. AVEVA technologies are ready to support in this direction.

Every company has got net zero plans. Solutions provided by AVEVA to measure and deliver low emission value chains?

From a specific toolkit, of course on real-time data monitoring, AVEVA PI System is one of the best. It monitors the real time application of data so that we are performing to the target.

Our more successful customers use that real-time data against operating limits so they define where they need to be to perform their targets. They aggregate those missteps, so when they violate a limit, that is an opportunity. They use these opportunities to develop projects and that circles back, bringing in the new control limits.

AVEVA PI System helps them to consolidate those gains. In addition to that, from an engineering point of view, our simulation and design packages now include greenhouse gas emissions for a number of processes where it is able to identify the problems. It helps assess where you could picture those impacts and design better from the very beginning. And as we model those processes, we bring the data from design into operations moving forward.

We are seeing customers these days using these models for real time decision making. In terms of planning and scheduling, the unified supply chain tools, especially for petrochemical players allow them to plan for carbon footprint so that they can choose their raw materials, energy consumption choices, carbon credits, and calculations could be done for production run and net zero emissions.

How robust are these models from a net zero perspective and how do you plan to achieve 90% accuracy level?

From a planning and scheduling point of view, those are the allowances that are input by the users, so it is based on their knowledge of their process. From the simulation engine, the first principle models are in place. It's just an extension of the chemistry at this point. And as our knowledge improves, those models will improve.

Innovations that AVEVA is integrating in the next version of software? Are you focusing on any specific software this year?

We have a great team in India and with the addition of a team from Schneider Electric, our portfolio has just broadened. It will further continue to improve.

Last two years of my involvement in India, we have focused on real-time data, the operations data. Next step will be how we use that data. For AVEVA PI customers, the natural transition has been into their asset base, looking at asset strategy, predictive analytics, understanding what equipment is critical and then prioritizing and putting the next level of analytics on top of them. I think that has been a big push. It is not a new product but will be new for many customers who continue their digital transformation.

AVEVA's outlook for India during 2023?

India continues to grow and excel. As the industry continues the journey, the level of information and data will grow. These technologies are not just to buy and put on shelf but they are solutions to use. They will help the industry to get better faster and I think the key to AVEVA's success is that these tools are useful to you not just today but enablers of growth for tomorrow. And that's going to be critical for India's growth story. ■

Supply Chain & Logistics

Transforming to a
New Better

REIMAGINING CHEMICAL SUPPLY CHAIN OF TOMORROW

Chemical companies are revisiting their supply chain and logistics strategies to balance costs, carbon footprint, and resilience TEAM ICN

Supply chain challenges in the chemical industry can stem from several factors, including volatile raw materials prices, supply shortages, and transportation disruptions. Hence, the reevaluation of supply-chain structures has become critical for chemical manufacturers to meet the scale of changes required for the next decade. The supply chains will need to balance costs and carbon footprint while managing resiliency, a tough act that will require companies to consider strategies markedly different than those of the past three decades.

Chemical products are often highly specialized and require specific storage and handling conditions. In addition, the chemical industry is subject to strict regulations regarding the transport of hazardous materials. As a result, managing the supply chain for a chemical company can be a complex and challenging task. The price of crude oil, to emphasize, has more than doubled in the past two years. This has put pressure on chemical companies to increase prices, which has led to decreased demand from customers. Another challenge is the regulation of chemicals. In recent years, several high-profile incidents have involved the release of hazardous chemicals into the environment. As a result, governments worldwide are introducing stricter regulations governing the production and transport of chemicals. This leads to increased costs for chemical companies and disruptions to supply chains.

With a chemical supply chain that spans from chemical manufacturing to chemical distribution, it is essential for this industry to match the changing trends. However, with many moving parts and many stakeholders involved, including chemical manufacturers, distributors, retailers, and consumers - there are challenges in keeping operations running smoothly.

Companies that want to improve their supply chain performance need to understand the attributes of a truly excellent chemical

Key Drivers for Revamping Supply Chain & Logistics

CUSTOMER CENTRICITY
- Meeting the need for flexible supplies
- Reducing lead times to support customer production
- Customizing supply chain solutions as per the need

SUSTAINABILITY
- Delivering products for a circular economy
- Reducing overall carbon footprint
- Meeting government regulations locally

MODERNIZATION
- Digitalization for both operational and strategic purposes
- Increasing speed of innovation
- Increasing transparency for customers through integration

CARGO-BASED SUPPLY CHAINS
- Extensive compliance expertise for dangerous cargo
- Smart solutions that account for weight to value ratio
- Optimized solutions for low margin products

PUSH DRIVEN SUPPLY CHAINS
- Managing inventory costs for made-to-stock (MTS) processes
- Increasing customer loyalty for made-to-order (MTO) processes
- Optimizing working capital with better logistics planning

CAPTURING NEW MARKETS
- Responding to demand with agility
- Reaching customers all over the world
- Tapping into developing markets

The supply chains for chemicals have evolved and adopted new digital technologies in the past few decades. Artificial intelligence (AI) is no exception

supply chain. These attributes pertain not only to day-to-day performance but also to culture and leadership. Outstanding day-to-day performance in chemical production naturally means complying with regulations and standards formulated to avoid health and environmental problems. It also means meeting customers' needs and exceeding peers on critical performance metrics, which is why industry leaders make customers a strategic priority.

Understanding Key Trends

The supply chains for chemicals have evolved and adopted new digital technologies in the past few decades. Artificial intelligence (AI) is no exception to this trend, with chemical companies turning to AI tools for several purposes - from chemical production optimization to chemical allocation management, risk assessment, and mitigation, as well as inventory control.

Leadership is putting a great deal of thought and effort into managing the distribution and placement of their products, identifying the optimal number of warehouses to maintain, and retaining control over their processes. Such efforts often go hand in hand with establishing clear responsibilities and interfaces in the supply chain organization. And finally, leading companies are increasingly relying on digital technologies and data analytics to help run their supply chains efficiently and effectively.

In many chemical businesses, the warehousing network, transportation flows, and insourcing and outsourcing of logistics have developed over an extended period, without review in light of today's logistics marketplaces and service providers. For example, many companies operate on-premises warehouses at most of their manufacturing plants and use direct shipments to customers even for small orders. But companies that consolidate warehouses, introduce regional hubs, and develop clear outsourcing strategies can create substantial value by decreasing logistics costs and delivery lead times, and increasing product availability.

Outstanding supply chain culture and leadership translate into alignment within the company on strategic direction, goals, and performance initiatives across all functions. For a company seeking significant performance improvement, a fundamental redesign of supply chain structures and processes will be necessary.

Addressing Pain Points

The western coast of India has been the key hub for the chemicals and petrochemicals industry with Gujarat and Maharashtra alone accounting for 62% of major chemical and petrochemicals production across India. Since production clusters are concentrated in one particular region, better infrastructure and logistics are required to supply chemical products across the country. The lengthening of supply lines makes the distribution of chemicals more transport intensive. The involvement of a large number of stakeholders such as shipping lines, transport agencies, and environmental agencies in the transportation of chemical products increases the logistics and supply chain complexity of the chemicals industry. Therefore, as they face greater pressure to reduce prices, companies must find new ways to make their supply chains more cost effective.

Due to continuous consolidation within the chemicals market and value chains shifting to Asia, optimization of the global supply chain is the key. In supply chain management, knowledge about regional features as well as an expedient global supply chain network that is fit for future growth is indispensable. Furthermore, scalable processes enable companies to quickly integrate new acquisitions and focus on generating value. Companies have to develop a strategy that aims at increasing value through supply chain improvements. In this process, the focus of supply chain management evolves from being efficiency focused to demand-driven and finally to value-driven.

Way Forward

Although many chemical companies have worked to improve key functions involving logistics, manufacturing, procurement, and sales and marketing, the interfaces between these functions are in many cases vaguely defined, which can create needless conflicts. To counter such problems, companies must clearly define roles and contributions to essential processes and assign distinct accountability for goals and metrics. Doing so will create a strong basis for proper alignment of responsibilities and will support smooth operation of the supply chain from end to end.

To achieve excellence, companies should also design and make available dashboards that people throughout the organization can understand. These dashboards should employ common definitions along with aggregations and drill-downs of metrics and target values. Within the strategy layer, companies can take a major step toward supply chain excellence by creating appropriate product segmentation and then outlining segment-specific goals, policies, and processes. ■

MAKING INDIA US $10 TRILLION ECONOMY USING SUPPLY CHAIN AS AN ENABLER

India's logistics currently accounts for 13-14% of the GDP, and with seamless connectivity, superior infrastructure, and strong export and logistics efficiency, it can be brought down to 7-8%

K. R. VENKATADRI
CHIEF COMMERCIAL OFFICER
TATA CHEMICALS LTD.

India as a $10 trillion economy was a dream that was shown to every countryman by our Prime Minister Shri Narendra Modi a few years ago. Our leader's vision included making India the third largest economy, a haven for start-ups and a world leader in electric vehicles and energy storage devices. If we assess our country's standing today vis-à-vis back then, the momentum at which we are growing, it's no surprise that this dream will soon be a reality.

According to the report of the Centre for Economics and Business Research (CEBR), the Indian economy will hit the $10 trillion mark by 2035. With the introduction of dynamic initiatives, backed by proactive policy reforms, India is fast becoming one of the world's leading economies. Last year, the Indian economy overtook the United Kingdom's in terms of size, making it the fifth largest globally.

Optimism around India continues at a time when the world faces a prospect of an imminent recession speaks volumes of our country's progress. Owing to the easing of laws and compliances, India has consistently been recording high annual FDI inflows. Today, our country is one of the world's largest start-up ecosystems and one of the leading digital economies testimony of where we are heading in the next decade.

India's Growth Trends

There have been several megatrends driving India's growth and, going forward, they will propel India's economic growth. The government's ongoing commitment towards introducing policies and announcing outlays lays a major thrust on fresh investment and encouraging businesses. The country has seen immense contributions from industries, including pharma, chemicals, industrial machinery, electronics, auto and textiles. India aims at Capex-led growth, mergers and acquisitions and PE/VC-led investments to drive its growth in the coming years. Globally, there is a tremendous thrust on supply chain diversification. India is among the top four destinations for relocation of American companies.

Technology has played a key role in redefining logistics and supply chain through WMS, automation, AI & ML and IoT for order placements and tracking

Roadblocks and Action Plans

India's growth story is plagued by several challenges, including unemployment, high logistics costs, poor infrastructure, underutilised capacity and skill gaps. However, the government has been quick to recognise these challenges

and jump into action. Unified Logistics Interface Platform (ULIP) ensures ease of business through simplified and transparent document clearance and reduction in freight costs.

The country's infrastructure is seeing a major overhaul to ensure better connectivity for people and goods. In recent years, tunnels, bridges, roads and railways have successfully connected the remotest locations in our country with the mainland. Multi-modal logistics parks have provided better access and state-of-the-art storage facilities.

Through the introduction of programmes such as the National Career Service, employers and employees can both have their needs addressed. Encouraging PPPs and new businesses have been two of the major factories driving India's growth and will continue to remain growth drivers. The government is also laying special emphasis on skilling the nation's youth to meet the demands of emerging industries such as clean energy.

While the focus on clean fuels through the Green Hydrogen Policy is a key step to self-reliance in energy and raw material demands, going forward, the government needs to set up a web of energy relationships with neighbouring countries such as Myanmar, Vietnam, Kazakhstan and the Gulf nations. Free trade agreements with UAE and Australia will help boost the import of key raw materials.

As for private companies, they need to take charge of tie-ups with major exporters of foreign countries to boost relations and securitisation of raw materials. Joint ventures between Indian and foreign players will go a long way in building such relations.

Supply Chain: A Great Enabler

A resilient, efficient and transformative supply chain will strengthen the platform for India's $10 trillion dream. If we look at the sector over the past two decades, it has become one of the top propellers in economic growth worldwide. According to a McKinsey Global Institute report, India's logistics sector will increase at a CAGR of more than 10% from $200 billion in 2020 to $320 billion or more by 2025.

Technology, the game changer across industries, has played a key role in redefining logistics and supply chain through warehouse management systems (WMS), automation, AI & ML and IoT for order placements, tracking to inventory management.

According to a Gartner report, leading supply chain organisations acknowledge technology as the key factor in giving them competitive advantages by helping improve decision-making and manage assets. By identifying tech as a critical investment area, the report states that by 2026, more than 75% of commercial supply chain management application vendors will deliver embedded advanced analytics (AA), artificial intelligence (AI) and data science.

Our logistics, at present, accounts for 13-14% of the GDP, and with seamless connectivity, superior infrastructure, and strong export and logistics efficiency, it can be brought down to 7-8% of the GDP. With National Logistics Policy, the Government of India envisages developing a technologically-enabled, integrated, cost-efficient, resilient logistics ecosystem. It will include boosting road, rail infrastructure and waterways, using digitisation and through skilling and upskilling.

SCM and Chemical Industry

Manufacturing exports are expected to cross the $ 1 trillion mark by 2028, and the chemical industry looks to take a major charge in achieving the target. One of the few sectors to remain relatively unscathed by the pandemic, the Indian chemical industry contributes around 7% of the Gross Domestic Product (GDP). The sector

will play a critical role, especially in the next five to 10 years, to be able to play a key role in India becoming a $10 trillion economy.

With the sector seeing a sea of transformation, primarily owing to the advent of digitisation, the chemical industry will need to embrace changes to become future-ready. Supply chain and logistics assume significance here as organisations will have to tailor their supply chain management (SCM) processes to align with their needs as well as those of their customers. Automation of supply chain processes is one of the best ways to adapt to changes in the markets. A key factor for the chemical industry is to contribute towards investing in robust cold chain machinery because there are products chemicals and drugs - which are required to be transported in refrigerated conditions.

It's a no-brainer that customers themselves are the starting point for companies to achieve customer excellence. Therefore, it is critical to take the support of data-driven insights to serve them better by providing customised services. Predictive analytics is another area that can help with advanced results. Customisation of products according to demand is a trend that is helping companies survive volatile times and improve the production capabilities of customer-specific products. This also helps in working out competitive pricing, which is beneficial for both, companies and customers.

An important part of digitisation is collating data such as personal health records and patient health records, an area that the government needs to prioritise in the coming years through which several industries can be streamlined.

Sustainability holds the Key

Traditionally, the chemical industry is a power guzzler. While India is making several efforts to transition from coal-based to more sustainable forms of fuels, there is still a long way to go. In the United Kingdom, Carbon Emissions Tax was introduced as a measure to impose a tax on businesses for each tonne of carbon dioxide emitted over the set allowance. Going forward, India can consider similar measures to ensure a reduction in emissions. Our government has already taken measures to what is being looked at as the hydrogen economy. Encouraging the production and eventually use of clean fuels such as green hydrogen and ammonia, there will be a positive impact on the environment. Sops need to be provided at the national level to create machinery for the widespread generation of clean fuels. Our policies should be aligned by giving priority to PLI schemes to those businesses investing in green initiatives.

A challenge faced by the chemical industry is putting a lid on emissions. However, research and innovation using technology can ensure the discovery of radical processes that will indeed help in curbing pollution. Another factor that will help in this regard is boosting infrastructure, which will cut down on transportation time and the eventual use of fuel needed for the same. While India always had tight regulations concerning effluent generation, our country now needs to set up global-scale effluent handling facilities. This will help avoid effluent-related issues while working with cost-effective alternatives.

To sum up, the Indian economy is indeed a 'bright star', which is growing well and will continue at it faster than the rest of the world. The efforts and investments put in by the government is aiding the process. The digital push will ensure technological interventions enable capabilities to improve the productivity and cost-effectiveness of products and services. The chemical industry will aid the growth of the economy and continued focus on sustainability, technology and supply chain will make this industry one of the key pillars of the Indian economy. ■

LOGISTICS & SUPPLY CHAIN CHALLENGES IN INDIAN CHEMICAL INDUSTRY

The chemical industry needs clear cut policy initiatives and speed in implementation of the standard government growth policies, especially in the logistics/supply chain infrastructure

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The domestic chemical industry is the third largest in Asia and seventh in the world and is expected to touch US $300 billion by 2025 from US $220 billion, clocking an annual growth rate of 15-20 percent. To achieve this, the government is also working on a draft chemical policy that will focus on meeting the rising demand for chemicals and reducing imports. The industry is also targeting chemical exports of US $30 billion by 2023 from US $12 billion in FY17. In the first half of this fiscal, exports rose almost 27 percent to US $7.19 billion.

One of the reasons for slow chemical industry growth are the norms of Pollution Control Boards (PCBs). Production of certain chemicals has been significantly restricted by the Pollution Control Boards, and industries are therefore unable to increase production to meet the demand. Over the past five years, there has been no capacity expansion by the companies because clearances were not given by PCBs. This has dented exports which provides huge opportunities and, of late, is also impacting domestic industries, and has led to large scale imports from China. The domestic industry is simply unable to meet the demand due to policy bottlenecks. This is why Chinese manufacturers are hurting our industry.

The warehouse design should aim at desired utility of space, orderly layout, safe product storage according to hazard, safe operations, emergency handling, and security

Logistics and Supply Chain Challenges

The chemical industry needs clear cut policy initiatives and speed in implementation of the standard government growth policies, especially in the logistics/supply chain infrastructure. The business of any company depends upon efficiency of manufacturing, supply chain, and marketing. Supply chain efficiency depends on the effectiveness of logistics which includes warehouse operations. Warehouse operations can be effective provided warehouse design, layout, infrastructure, processes, staff and safety norms, transportation are appropriate to the requirements. For accomplishing the above requirements, these functions should satisfy the desired parameters. Above all, corresponding national legal requirements have to be met. The relevant international norms should be met as per agreements. In the case of warehouses that store chemicals and/or materials that may be hazardous to humans, plants, animals or the environment, it is extremely important to have a design that ensures safety.

Safe transportation of hazardous chemicals across the country is one of the biggest challenges. A boom in the chemical industry has also led to an increase in the safety concerns of chemical logistics as freight traffic has increased sharply. An

increase in the number of untrained staff to handle packaging and transportation of hazardous chemicals and lack of awareness about the new and emerging trends and technologies are some of the issues that challenge the transportation of hazardous chemicals in India.

Poor Transportation Infrastructure

India's roads haven't been able to keep up with the transportation demands of rapid urbanization. Poor quality of roads existing in India are a major cause for concern. Process flow of the logistic industry increased accidents and also led to a loss in productivity due to delays.

Crossing checkpoints: If a vehicle goes through numerous stoppages e.g. toll booths, greater the chance of it meeting with an accident as the contact with the human ecosystem increases.

Pilferage in transit: Pilferage is a major concern. Costly chemicals are replaced by some other low value substance with truck drivers being the major culprits. Consequently, raw material quality is compromised.

High level of fragmentation: A large share of the pie goes to small truck operators who bulk deliver non hazmat. These do not need handling precautions and are highly cost competitive as compared to the service providers with standards set for all types of carriage handling. The latter suffers in this case. MSDS (Material Safety Data Sheet) not properly followed which results in various chemical disasters of warehouses resulting in huge losses in property and productivity.

Storage Facilities/Warehouses for Chemicals

The warehouse design should aim at desired utility of space, orderly layout, safe product storage according to hazard, safe warehouse operations, emergency handling, and security of warehouse. The most important part of the design is the concept of inherently safe design, such as creating a stable building constructed for built in protection. This should cover design of walls, floor, roof, ventilation, retention water catchment basins, fire walls, fire doors, etc. The layout should take care

of product storage, loading/unloading, parking, utility, safety equipment, and welfare facilities. The chemical warehouse should ideally be situated away from residential areas, heavily populated places, areas which should have good connectivity of roads, and emergency centres like hospitals, police controls, ambulances, fire services, etc. should be around the location.

Product storage plays an important role: Product characteristics may have health, safety, and environmental hazards. Hazardous chemicals improperly stored and improperly handled in the warehouse, can cause fire or explosion resulting in injury of personnel at site, as well as the neighboring areas and loss of property inside the warehouse and outside. An understanding of hazards and associated risks will help in selecting better control measures. The potential safety and health and environmental impacts can be prevented by implementing control measures in the early design stage.

The Globally Harmonized System (GHS) hazard class can guide hazardous product storage. GHS also guides labeling and hazard communication which helps in identifying hazards and also helps in handling measures.

Guidelines for Safe and Secure Storage System for Chemicals

Available chemical guidelines shall always propose a safer way to establish safe storage and warehousing of chemicals whether already existing or in a planning stage. A proper storage of chemicals can contribute to the safety and health of employees and also the environment. Points which will help improve safe and secure storage systems system for chemicals are:

Key responsibilities: Those of the service provider or owner of the chemicals, employer and employees.

Legal framework: Including main points to be regulated and state of the existing legislations whether we have implemented them while storing chemicals.

Hazard identification and communication: Importance of chemical safety data sheet, classification, and labelling. Chemical register check for compatibility while storage in warehouse.

Hazards: Highlighting common causes of incidents and hazard classification of chemicals.

Seating and design of storage area: Design of warehouse, location of warehouse or sites, the integrity of the structure and control of site.

Highlight loopholes in the system and take corrective actions for safe storage. Legislations to be implemented very strictly at all levels at all places.

Requirements in storage locations: Emergency exits, fire door, alarm systems, manning all 24 hours in chemical warehouses, handling cargo lifting equipment to be checked and driven very safely in warehouses.

Safety: A key factor in logistics: Hazardous chemicals improperly stored and improperly handled in a warehouse can cause fire or explosion, resulting in injury of personnel at the site, as well as the neighbouring areas, and loss of property in and around the warehouse area. An understanding of hazards and associated risks will help in selecting better control measures. The potential safety, health and environmental impacts can be minimized by implementing control measures in

the early design stage. The GHS guides hazardous product storage, and labeling & hazard communication, which helps in identifying hazards and handling measures.

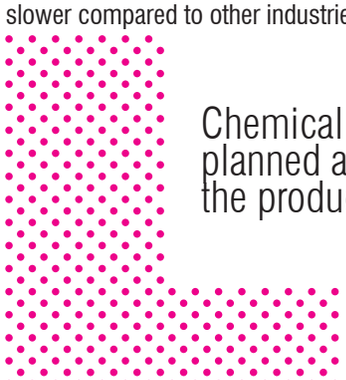
Chemical transportation must be carefully planned and controlled at every stage from the production facility to the end-user. Companies need to consider the type of containers used for transporting the chemicals and ensure the right modal mix whether it should be transported by truck, train, or sea; the organizations that will have access to the materials during shipment; and how they can get real-time information about the location and status of the materials, in order to minimize risk. Logistics management for the chemicals industry demands continuous improvement in operational safety and security. Supply chain security and risk management will be the key differentiator.

Chemical warehouses also need to be specially designed for safety. If you have flammable chemicals, you need to have a designated room that contains a sprinkler system and wide aisles. Chemical warehouses also need to be designed to ensure waste streams are contained in case of an accident. Compliance involves not only complying with governmental rules, but also following voluntary 'good practice' guidelines like 'Responsible Care'. To achieve certification, companies need to have a detailed and documented process for responsibly managing the logistics associated with chemicals. Logistics models have evolved over time to address the changing needs of the market and vary based on scope of service offering and degree of collaboration across the supply chain. However, the pace of automation in the chemical industry has been much slower compared to other industries. Rapid advances in supply chain technology enables increased functionality across multiple sites and countries and have a great potential to improve performance of supply chains.

Need to work as partners: Continuous improvement of safety and security standards will remain a high priority for chemical companies. This will require close cooperation with logistics service providers and joint improvement programs. Stringent selection and continuous monitoring of the performance of logistics service providers will remain necessary. The encouraging growth of the chemical industry in India has naturally brought issues concerning hazardous chemical storage and distribution into sharp focus. The bottlenecks pertaining to infrastructure, suitable storage facility, equipment, and technology are posing serious challenges for the growth of the sector. There is a need for continuous engagement at the strategic and tactical level between the chemical industry and logistics service providers. However, with the government providing a few sops in the areas of storage facility, equipment, etc., the logistics sector seems to be moving on the right track. Hazardous materials storage and distribution risk management involves establishing, organizing, planning, executing, and monitoring a set of operations that aims to decrease the probability of accidents and reduce the relevant potential consequences. Governments and regulatory bodies around the world are overhauling chemical regulations. Both environmental and industry groups note that these changes could signal a kind of détente between the chemical industry and its watchdogs over the next few years. In other parts of the world, however, the relationship between industry, activist groups and regulatory bodies remains more acrimonious.

Adopting next-generation digitization: A recent PwC study found that chemical companies plan to invest 5% of annual revenues on digitization over the next five years - and nearly a third of them reported having already reached an advanced level of digitization. These initiatives can produce near-term benefits across three primary business dimensions: operations, customer- facing, and organizational. In operations, the application of digital technologies to functions such as maintenance is already improving plant and network performance and minimizing downtime, reducing operating costs by 2-10%. But there are greater savings to be had. By using digitization to integrate business and manufacturing systems, optimize production footprints, and redesign processes, chemical companies can capture gains of up to 25% in capacity utilization. Chemical companies have long struggled to make the shift from "product sellers" to "solution providers" in the customer-facing aspect of their business. Digitization can make a big difference in this regard. For example, with an application in the paper chemicals segment, suppliers are using sensors and other digital technologies to track how their products are integrated into their customers' operations; in turn, this enables the chemical companies to improve their products based on utilization patterns and enhance their ability to proactively address customer needs.

Among the results for chemical firms are stickier customer relationships, a greater share of customer budgets, and the potential for increased revenue based on provable performance metrics. Advances in machine learning offer chemical companies a valuable opportunity to do more with fewer people and effectively lower the cost of running the business. Moreover, greater processing power and decision-support systems enabled by artificial intelligence can help reduce organization layers and create a more efficient and potentially innovative operation by, in essence, removing traditional centralized spans of management hierarchy and replacing them with more localized control. ■



Chemical transportation must be carefully planned and controlled at every stage - from the production facility to the end-user

EVOLVING E-COMMERCE AND CHEMICAL INDUSTRY

Handling and transporting hazardous chemicals require special expertise and handling procedures. E-commerce platforms must provide solutions to ensure the safe and efficient transportation of these materials

DR. RAFI SHAIK
FOUNDER & CHIEF SCIENTIFIC OFFICER
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The E-commerce industry has revolutionized the way we shop and do business, offering greater convenience and accessibility to customers and companies alike. However, the chemical industry has been slow to embrace this digital platform due to its complex and highly regulated nature. Nevertheless, there has been a major movement towards e-commerce adoption in the chemical business over the past several years and it explores how this change is shaping the industry's future.

Why was Chemical Industry Late to Adopt E-commerce?

The chemical industry is one that's highly regulated and involves complex processes. These factors made it difficult for the industry to adopt E-commerce in the past. The industry has strict compliance requirements and E-commerce platforms were unable to provide the necessary level of security in the past. The industry is also quite reliant on traditional methods of communication like phone calls, faxes, and email.

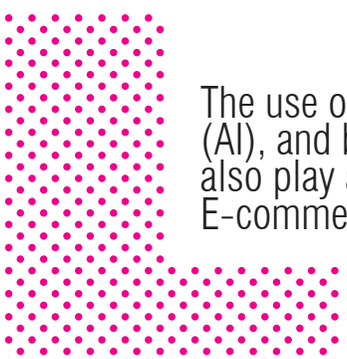
However, E-commerce platforms have since evolved to meet the needs of the chemical industry. Many platforms now offer secure and compliant solutions for the industry, making it easier for companies to adopt E-commerce.

Challenges of E-commerce

The chemical industry faces unique challenges that have made it difficult to adopt E-commerce in the past. One of the most significant challenges is compliance. The chemical industry is heavily regulated, and companies must comply with strict safety, environmental, and health regulations to ensure that their products are safe for use. Traditional procurement methods have long been the norm in the industry, as these methods allow for better control over compliance issues. E-commerce platforms, on the other hand, need to provide secure and compliant solutions to meet the industry's strict regulatory requirements.

Another challenge is security. The chemical industry deals with sensitive information, including data on hazardous materials and their uses. Companies must ensure that their data is secure to prevent any unauthorized access, theft, or misuse. E-commerce platforms need to provide robust security solutions to ensure that the customer data remains safe and confidential.

Finally, logistics is another significant challenge for the chemical industry. Handling and transporting hazardous chemicals require special expertise and handling procedures. E-commerce platforms must provide solutions to ensure the safe and efficient transportation of these materials.



The use of automation, artificial intelligence (AI), and blockchain technology could also play a significant role in the future of E-commerce in the chemical industry

Benefits of E-commerce

Despite the challenges, E-commerce offers many benefits to the chemical industry. One of the most significant benefits is improved efficiency. E-commerce platforms offer faster and more efficient transactions, allowing companies to save time and effort in procurement. Buyers can easily search for and purchase products online, reducing the time and effort required for traditional procurement methods.

Another benefit is the increased reach of E-commerce. With E-commerce, companies can sell their products to customers worldwide, expanding their reach and increasing revenue. E-commerce also offers a better customer experience, with customers able to easily search for products, compare prices, and make purchases online.

E-commerce platforms also provide valuable data and analytics that can help companies improve their sales and marketing strategies. Companies can track customer behaviour and use this information to make informed decisions, identify trends, and improve their products and services.

Carbanio - India's Leading B2B Chemical Marketplace

Carbanio is India's largest B2B chemical marketplace, providing a digital platform for companies to buy and sell chemicals online. The company was founded in 2015 by Dr. Rafi Shaik who recognized the need for a digital platform that could bring together buyers and sellers in the chemical industry.

Carbanio offers a wide range of chemicals, including organic and inorganic chemicals, pharmaceutical intermediates, laboratory reagents, etc. The platform allows buyers to search for chemicals by name or CAS number making it easy to find the right products for their needs. Sellers can list their products and manage their orders online, streamlining the procurement process and improving efficiency.

One of the key features of Carbanio is its focus on compliance. The platform ensures that all products listed meet strict regulatory requirements, giving buyers peace of mind when purchasing chemicals online. Carbanio also provides a secure and confidential platform for transactions, ensuring that customer data remains safe.

Carbanio has seen significant growth since its launch in 2015, with a wide range of companies using the digital platform to buy and sell chemicals. The company has received numerous awards and recognitions for its innovative approach, including the Startup India award from the Government of India.

As E-commerce continues to grow in the chemical industry, companies like Carbanio are leading the way in providing digital solutions that meet the industry's unique needs. With its focus on compliance, security, and efficiency, Carbanio is well-positioned to continue its growth and success in the years to come.

Future of E-commerce

The chemical industry has made significant strides in adopting E-commerce, and the future looks promising. As E-commerce platforms continue to evolve, we can expect to see more companies in the chemical industry embrace the platform. With growing interest in digital solutions, E-commerce is expected to play an increasingly important role in the industry's future.

In the future, we may see E-commerce platforms that are specifically designed for the chemical industry. These platforms would offer solutions that are tailored to the industry's unique needs, including compliance, security, and logistics. The use of automation, artificial intelligence (AI), and blockchain technology could also play a significant role in the future of E-commerce in the chemical industry.

Conclusion

E-commerce has the potential to transform the way the chemical industry operates, offering improved efficiency, increased reach, a better customer experience, and valuable data and analytics. While there are still challenges to overcome, the chemical industry has made significant strides in adopting E-commerce. As E-commerce platforms continue to evolve, we can expect to see more companies in the chemical industry embrace the platform, and it is likely to play an increasingly important role in the industry's future. ■

QUALITY INFRASTRUCTURE IN CHEMICAL LOGISTICS AND PHYGITAL APPROACH

There's a lot to be done for the chemical logistics industry to be at par with the growth story of India's chemical industry

RAJKIRAN KANAGALA
SR. VP & GROUP HEAD
EMERGING BUSINESS UNITS
STRATEGY & BUSINESS DEVELOPMENT
TCI GROUP

Over the course of last three years, supply chains across have gone through a paradigm shift. From automobiles, consumer goods, B2C/D2C, all have adopted a 'PHYGITAL' approach of functioning. When it comes to the evolution of chemical industry in India, the numbers say it all. It has grown significantly, almost triple in size during the last decade & is expected to experience a compound annual growth rate (CAGR) of 12%-15% by 2025, with its estimated value reaching to a whopping USD 300 billion*. However, for chemical supply chain in India, wherein the 'PHYSICAL' aspect currently faces the challenge of lack of investment in logistics infrastructure and ownership of physical assets; 'DIGITAL' for tech-adoption and being ready for emergency response, the question of – 'IS IT ACTUALLY READY TO CHANGE?' still cannot be answered with full confidence. There's a lot to be done for the chemical logistics industry to be at par with the growth story of India's chemical industry and more importantly be counted amongst its peers.

ISO Tank Containers are designed to safely transport hazardous chemicals, minimizing the risk of accidents and spillages during transportation

As we know that chemical logistics is a specialized domain that requires expertise to effectively manage the risks associated with chemical handling, logistics and storage, so we, as the logistics fraternity need to answer some tough questions, like:

Should a driver who carries chemicals be paid premium for his skillset?

Should there be norms for the clients to rise above the dilemma of cost v/s safety?

How do we bring in change that's sustainable?

Yes, at TCI, we have been doing our bit to resolve these challenges and enable processes that help the chemical logistics industry make its mark, like D2C has. We are investing in assets, like ISO Tank Containers, that are game changers for safe and secure transportation of chemicals, both hazardous and non- hazardous. We promote multimodal movement as it is cost-effective & helps reduce the overall carbon footprint.

Benefits of ISO Tank Containers

To elaborate on benefits of ISO Tank Containers, these provide:

Enhanced Safety

ISO Tank Containers are designed to safely transport hazardous chemicals, minimizing the risk of accidents and spillages during transportation. The containers are made of high-quality steel or aluminum, which provides strength and durability while preventing leaks and contamination.

Improved Efficiency

ISO Tank Containers offer a more efficient method of transporting chemicals compared to traditional packaging such as drums or barrels. The containers can be easily loaded and unloaded from trucks, ships, and trains, reducing handling times and improving supply chain efficiency.

Reduced Handling Costs

ISO Tank Containers can be reused multiple times, reducing the need for packaging and associated handling costs. This helps to reduce transportation costs and lower the overall carbon footprint of the supply chain.

Increased Security

ISO Tank Containers are sealed during transportation, minimizing the risk of theft or tampering. The containers can be easily tracked using advanced technologies such as GPS, providing real-time visibility of shipments.

Versatility

ISO Tank Containers can transport a wide range of hazardous and non-hazardous chemicals, making them a versatile and flexible transportation option for chemical companies. They can also be customized with features such as heating or cooling systems to meet specific transportation requirements. Most importantly the ISO Tank can go on a Truck, a Ship, and a Train!

When it comes to safe storage of chemicals, in addition to PESO (The Petroleum and Explosives Safety Organization) certified warehouses, the temperature-controlled warehouses are being built using the advanced technologies and are equipped with state-of-the-art refrigeration systems. These facilities maintain a constant temperature range, typically between 2°C to 8°C, to prevent degradation and ensure the safe storage and transportation of temperature-sensitive chemicals.

For responsible handling of chemicals, various initiatives like 'Responsible Care' by Indian Chemical Council are being adopted. By doing so, chemical logistics companies in India can demonstrate their commitment towards safety and security by training the LSPs, the entire ecosystem to be involved. Training remains and should be the topmost priority! Are chemical producers and users doing enough in this area, the answer is NO, time to reflect.

Other than this, hazardous waste management rules, Green Rating for Integrated Habitat Assessment (GRIHA), Sustainable Development Goals (SDGs) and Global Product Strategy (an initiative launched by the International Council of Chemical Associations (ICCA) to promote the safe use of chemicals) are fostering the creation of a safer & more sustainable chemical industry; to build trust and confidence amongst all stakeholders.

Through our sub-division, TCI Chemical Logistics Solutions, we handle nearly 1 million tons of liquids, solids, and gases annually. We manage an asset base of 650+ ISO T11 tank containers, dry bulk cargo steel containers and T20 Tank containers. We own fleet of 200+ vehicles for Chemical operations and have

PESO compliant warehouses that meet modern fire safety infrastructure standards for safe storage of a wide range of hazardous & non-hazardous chemicals.

Adding to the critical areas of work, the ongoing transition to ESG (Environment, Social & Governance) norms/principles, not just for chemicals but for all other industries, will take time of about 5-7 years for on-ground implementation. As a part of this, proper training for all associated stakeholders involved in chemical logistics should be planned. This will also help on-ground executors to understand the importance of MSDS (Material Safety Data Sheet) & how it plays a critical role in avoiding mishaps/accidents.

We wish to make a clarion call, let's all find a solution to this conundrum by investing in logistics assets, building quality infrastructure for chemicals handling, training the key actors i.e. drivers, blue collar workers & handlers on how to live with chemicals safely. Hence, making their lives better. ■

WE SEE DIGITAL.DATA. EXCELLENCE AS A KEY GROWTH DRIVER

Our aim is to foster growth in our global divisions with clear differentiated strategies

ALOK SHARMAN
REGIONAL DIRECTOR
SOUTH ASIA AND MD - INDIA
BRENNTAG INGREDIENTS INDIA

Key global and Indian trends in the Chemicals and Ingredient Distribution business in 2023?

The Indian chemical sector is projected to grow by 11-12% from 2021-2027 and by 7-10% from 2027-2040, thereby tripling its global market share by 2040. This phenomenal growth is fueled by a range of factors:

Rising domestic consumption: India is expected to account for more than 20% of incremental global consumption of chemicals over the next two decades. Domestic demand is expected to rise from US $170-US $180 billion in 2021 to US $850 billion - US $1 trillion by 2040.

Changing consumer preferences: The growing demand for bio-friendly products globally could benefit India, as it is among the leading producers of many chemicals that are used in such products.

Shifting supply chains: Triggered by the evolving geopolitical scenario and the trend to diversify from the existing core manufacturing markets, firms are seeking to make their supply chains more resilient. With its strong value proposition, India could be a preferred destination in the “China plus one policy” for many companies.

Over the past 5-7 years, India has made substantial improvements in its policy and regulatory environment, making it much easier for enterprises to establish themselves and flourish. India’s Ease of Doing Business Ranking jumped from number 143 in 2015 to number 63 in 2020, and its manufacturing foreign direct investment during FY16 to 20 exceeded the figure for the preceding five-year period by three times. On some parameters, however, India lags behind its peers. These include the ease of starting a business, registering property, paying taxes, and enforcing contracts. Getting timely environmental clearances (ECs) is also a major challenge in India.

With a net trade surplus, the specialty segment is the strongest pillar of India’s chemicals sector.

Agrochemicals: Agrochemicals in India is currently a US $5.5 billion market, growing at a CAGR of 8.3%. By 2040, it is expected to account for almost 40% of India’s overall chemical exports.

Food and feed ingredient chemicals: Constituting flavors and fragrances, food and feed additives, and nutraceuticals, this subsegment is a US $3 billion market in India, growing at a CAGR of 7-9%.

Inorganic Chemicals: As inorganic chemicals require little processing compared with other segments, this segment is predominantly dependent on feedstock availability. India, unfortunately, has a scarcity of raw materials for most chemicals in this segment. However, it has a high demand for many inorganic chemicals, making it an attractive market.

The chemical distribution market, on a global scale, is likely to grow steadily over the foreseeable future due to an increasing number of chemical manufacturing unit expansions among other major regions. High demand

> The use of innovation and technology in the chemical supply chain operation has also given distributors the ability to harness their supply chain operations

for various commodity chemicals from the industrial manufacturing sector coupled with growth in automotive and transportation is likely to boost market growth. In terms of revenue, Asia Pacific emerged as the largest market globally for chemical distribution, with a market share of 59% in 2021.

The specialty chemicals market is poised to reflect the fastest growth in terms of revenue, worldwide, due to increasing demand for coatings, adhesives, sealants, and elastomers (CASE), specialty polymers and resins and especially from construction, automotive, and industrial manufacturing sectors globally.

The chemical distribution market is highly competitive in nature with companies such as Brenntag leading the market as the world's largest distributor of chemicals and ingredients. Distribution companies in this space have an exhaustive array of product offerings and leverage on their global presence to cater to customers' needs.

The use of innovation and technology in the chemical supply chain operation has also given distributors the ability to harness their supply chain operations. These technologies include radio frequency identification (RFID), global positioning satellites (GPS), and Internet of things (IoT) to provide real-time data for timely and seamless order fulfillment.

In terms of key focus areas in chemical distribution in 2023, the following are some examples: Industry focus - specific industry, region, and product line expertise with the ability to meet customer and supplier needs on a global scale; Sustainability - sustainable, and safe practices that protect the planet, help grow business, and build a better tomorrow for future generations; Technical acumen - strong innovation expertise and the ability to deliver practical solutions that meet the latest trends and regulatory requirements; and Reliability - full-service distribution capabilities and a vast network that leverages the global supply chain at the local and regional levels.

Brenntag's performance during FY 2022-23 and update on the company's initiatives in the Essentials and Specialties Business Units during FY 2022-23? FY 2023-24 plans for Brenntag Specialties and Brenntag Essentials?

Our two divisions, "Brenntag Specialties (BSP)" and "Brenntag Essentials (BES)", both contributed to the remarkable success by delivering an excellent performance and mostly organic growth in FY 2022. As forecasted, Brenntag Specialties grew at a stronger rate.

Our new growth strategy, including ambitious medium-term targets for 2026, is the next phase of our company's transformation and builds consistently on the foundations laid by "Project Brenntag" and the achievements to date. The strategy involves individual growth plans for Brenntag Specialties and Brenntag Essentials. Applying these divisional strategies and leveraging our company's global footprint and fundamental strengths, we will further develop the differentiated profiles of our two divisions (BSP and BES) and propel their growth above the market growth rate.

Our "Strategy to Win" also sets out a clear program for the company's digital, data-driven transformation. We see "Digital.Data. Excellence" (DiDEX) as a key growth driver for our Group. We will drive efficiency at all levels of our organization and develop Brenntag into a data- and technology-driven business that uses its wealth of data to develop new business opportunities and smart, innovative solutions and thus generate further growth. We are evolving into an agile, flexible and, ultimately, the preferred business partner in the chemical and ingredients distribution ecosystem.

It is also expressed in our new global branding, which we presented together with the "Strategy to Win" in November 2022. Strategy, vision, and brand together, they are a clear signal to our business partners, shareholders, and employees that we forge ahead as global market leader, assuming responsibility and setting standards. As the global market leader, we have undertaken to promote a sustainable future. In publishing our "Future Sustainable Brenntag" strategy and vision in April 2022, we set ourselves an ambitious ESG agenda. This includes achieving net-zero emissions by 2045, increasing the extent to which we use sustainability criteria to steer our product portfolio and driving sustainability in our supply chains.

To achieve our ambitious growth targets, Brenntag has always focused on both organic growth and growth through acquisitions as well. The global chemical distribution market remains highly fragmented and offers us exciting opportunities for consolidation. As part of "Strategy to Win", we have therefore also increased the range for strategic M&A investments. The recent acquisitions in APAC of Aik Moh Group and Neuto Chemical Corp are just a few examples of how we have been expanding inorganically.

Progress of "Project Brenntag", the first step in Brenntag's comprehensive transformation journey establishing a new operating model with two global business divisions?

"Strategy to Win" represents the second phase in Brenntag's transformation journey. The first phase, "Project Brenntag", started more than two years ago and focused on implementing the new operating model with two global business divisions and clear customer segmentation, optimizing the site network, and on structurally addressing productivity improvements by 2023.

The ambitious Project Brenntag targets included an additional annualized operating EBITDA contribution of EUR 220 million. As intended, Project Brenntag has laid the foundation and enabled the company to achieve improved sustainable organic earnings growth.

Brenntag is the undisputed and resilient leader in an attractively growing and highly fragmented, indispensable market. We have now defined how to strengthen and expand this position.

Our aim is to foster growth in our global divisions with clear differentiated strategies. Moreover, we build a comprehensive digital and data framework and architecture to better serve our global customer base and achieve the next level of operational efficiency, growth, and excellence.

With our comprehensive and ambitious 'Strategy to Win' we aim to outpace the underlying market growth. Brenntag will play a crucial role in the ecosystem of sustainable global chemicals and ingredients distribution.

The company is also building a comprehensive digital and data architecture to better serve its global customer base and achieve the next level of operational efficiency, growth, and excellence. Steps taken in this regard?

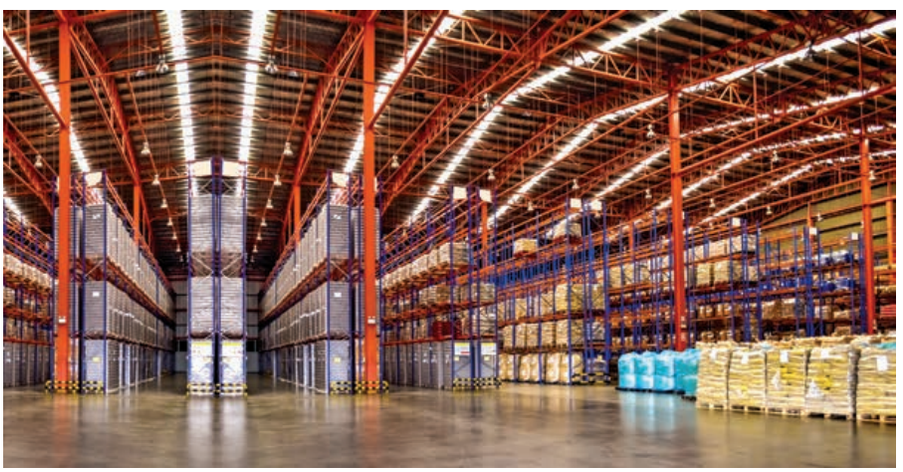
Digital.Data.Excellence (DiDEX) is to be an engine of growth contributing to Brenntag's fundamental transformation into a data and technology driven business and industry leader. Brenntag aspires to become the easiest business partner in the chemical distribution ecosystem, generate value from its data, modernize its digital business architecture and thus provide the most efficient and agile supply chain.

In the course of this next step in its transformation, Brenntag will make targeted investments in its Digital.Data.Excellence (DiDEX) capabilities. As an omnichannel partner, Brenntag is further developing virtual platforms such as Brenntag Connect and offering new, fully digital services such as Track & Trace. The Brenntag Excellence initiative is aimed at building a stable, efficient, and streamlined organization in combination with dynamic and fast processes. The initiative supports the implementation of the new business model and digitalization, and thus enables further growth, greater customer- and supplier centricity, and more agility.

Leveraging the potential of data with the help of special tools and business intelligence, Brenntag will make more effective use of its unique global market, customer and supply chain expertise as well as available data so as to better serve customers, better manage processes and create added value.

Creating a scalable information technology platform Brenntag is working together with leading technology companies to build a comprehensive, scalable and modular global platform. This global platform will offer an improved digital environment and a better IT infrastructure for the company's various functions and business units across the supply chain.

Brenntag will play a crucial role in the ecosystem of sustainable chemicals and ingredients distribution, globally. How are you ensuring its safe distribution?



BEST (Brenntag Enhanced Safety Thinking) is a global Brenntag initiative to improve the safety behaviour and the safety culture in the whole company. Brenntag India is a member of Responsible Care (RC) which is a global chemical industry's initiative that drives continuous improvement in health, safety and environment (HSE). We are committed to promote sustainability, demonstrate product stewardship, make plants and surrounding communities safe as well as to constantly improve occupational health and safety and environmental protection. In March 2023, Brenntag India organized a full day training session for our transporters on the safe delivery of chemicals with a deep dive into safe transportation guidelines and application. This session was well appreciated by our transporters and have requested and are looking forward to more training sessions.

Strategies to address the complex challenges within the supply chain resulting from geo-political situations?

It is reported that 32% of CEOs surveyed by PWC said geopolitical conflict was a key danger to growth, and 71% said it may hinder sales. Global or regional disruptions can cost, complicate, and inefficient supply systems. Tariffs, sanctions, and other measures disrupt critical goods, providers, and markets and increase regulatory burdens. Political or military emergencies may force companies to pursue new shipping routes.

In Brenntag, we embrace the following four-step strategy: Watch: Monitoring geopolitical events that may affect key supply regions and industries; Identify and Reviews: Identify risk exposure and conduct regular reviews by mapping known supply chain nodes; Assess: Evaluate how easily each node can be disrupted, as well as how likely an event is to happen, how bad it could be, and how well your company can handle or reduce each risk; and Plan: Plan to adapt corporate strategy and operations to changing global or regional conditions with little notice and insufficient information. Balance inventory between efficient just-in-time and shock-resilient just-in-case solutions for contingency planning.

Growth opportunities in India and company's plans to augment India operations in FY 2023-24?

India is one of the focus countries of growth for Brenntag in the Asia Pacific, having achieved the highest country sales growth in Brenntag Specialties for FY22. Brenntag Essentials in India has also recently brought on board a dedicated commercial director to lead the business growth in India. Brenntag India is also at present focusing on augmenting our supply chain in terms of warehousing, production and expanding application development centers to serve our customers and suppliers.

How is the company striking a balance between sustainability and business priorities? Key initiatives with respect to global and Indian context?

In Brenntag, sustainability and business go together. Brenntag India, along with its Lubricants Business Unit endorses and supports sustainability through the circular economy.

Like last year, in May this year Brenntag India will be sponsoring and participating in the Rosefield Conference on Circular Economy in Used Oil.

Currently India is facing challenges in used oil re-refining such as re-refining technologies to deliver the OEM-required RRBO (re-refined base oils) specifications, reverse logistics of used oil at source at fair prices, the availability of used oil for re-refining vis-a-vis other competing end uses. Brenntag is working towards being a part of the group to generate workable ideas and solutions to address these challenges by technology upgradation, collaborative efforts, segregation, and collection of used oils and to ensure used oils flows back to re-refiners efficiently.

Brenntag India is also developing sustainable warehousing which takes into consideration various issues such as reducing operational and energy costs, minimizing land usage, reducing waste, innovative use of natural lighting, automatic lights, and other renewable energy options, water optimization sources like water flow reduction mechanisms and rainwater harvesting system, minimizing carbon footprint through solar panels and the use of biodegradable products ,eco-friendly packaging materials, recyclable shipping pallets, with furniture and fixtures being made from recyclable materials.

Brenntag India is also a member of RSPO (Roundtable on Sustainable Palm Oil). RSPO is a global, not-for-profit organization that brings together stakeholders from across the palm oil supply chain to develop and implement global sustainable palm oil.

CSR projects undertaken in FY 2022-23 and plans for FY 2023-24?

Brenntag India has an employee-led CSR committee who spearheads our CSR initiatives, supporting NGOs engaged in various areas like: Education upgrading rural primary School near Thane Area (Mumbai); Highway safety awareness near Thane (Mumbai); Tree plantations; Care of the aged; Upliftment of rural woman; Special and underprivileged children; Leprosy patient care, etc.

With its "Future Sustainable Brenntag" program, the company has set itself an ambitious ESG agenda to become the leader in responsible distribution of sustainable chemicals and ingredients. Elaborate ESG agenda?

Sustainability has been an integral part of Brenntag's corporate strategy for many years now. Being a global market leader means bearing responsibility worldwide. Brenntag is aware of this responsibility and over the past few years has continuously expanded its sustainability organization and activities. It has established a global sustainability program and comprehensive governance structures with a view to driving the integration of numerous ESG matters into its business processes. Responsible and sustainable chemical and ingredients distribution is a fundamental element of Brenntag's strategy; it provides the basis for Brenntag's future as a global leader. Through its new ESG strategy, Brenntag is paving the way to achieve its long-term sustainability vision Future Sustainable Brenntag.

The strategy comprises the following 6 focus areas: Management structures for business ethics; Portfolio and investment steering; Fair and safe employer; Responsible partner for suppliers and communities; Climate protection and reduction of emissions; and Resource efficiency and circular economy.

All actions are guided by the United Nations Sustainable Development Goals (SDGs). Brenntag has identified eight SDGs that are of most relevance to the company and to which it can make the greatest contribution. These eight SDGs are: Good health and well-being; Gender equality; Affordable and clean energy; Decent work and economic growth; Industry, innovation and infrastructure; Reduced inequalities; Responsible consumption and production; and climate action.

Safety is one of Brenntag's cultural pillars and a top priority. Steps taken to reduce TRIR (Total Recordable Injury Rate number of work-related accidents requiring medical treatment beyond first aid per one million hours worked)?

Our aim by 2030 is to achieve a TRIR of less than 2.0 and prevent serious accedents completely. We operate in accordance with the "Safety First" principle, relying strongly on personal commitment and responsibility. In order to raise employee awareness of occupational health and safety, Brenntag continuously addresses the topic through various different channels. Every year we celebrate "Safety Day" in Brenntag India. All our employees actively participate in this event by sharing Near miss reports, best safety culture practices. Brenntag has also established the "Safety First Moments", where at the beginning of meetings employees talk about all kinds of safety issues arising in everyday professional or private life. Once a year, Brenntag presents the Global Safety Awards in two categories: Safety Excellence Award for the best safety record and Safety Phoenix Award for the strongest improvement in terms of safety.

In addition to the strong organic growth, Brenntag also pushed ahead with four successful acquisitions strengthening its product and service portfolio and its presence in key focus industries and geographies. How will this help India and South Asia geographies for Brenntag India?

To strengthen organic growth, Brenntag plans to drive market consolidation through M&A activity that creates value. While maintaining financial discipline, Brenntag's focus is on expanding our position in emerging markets in both divisions, improving strategic capabilities and market positions, augmenting the existing portfolio, and improving technical capabilities. As part of the "Strategy to Win", we have therefore also increased the range for strategic M&A investment. We are constantly on the lookout for best fit M&A opportunities, which includes India and South Asia as a growth focus region. ■

FIRST FULLY AUTOMATIC ISO TANK CONTAINER CLEANING SYSTEM IN INDIA

The facility has dedicated exclusive cleaning bays for ISO tank containers as well as for cleaning of road tankers and food grade ISO tanks

CAPTAIN PANKAJ MEHROTRA
DIRECTOR
ZODIAC TANK CONTAINER TERMINALS

Would you elaborate about the company and services offered from the facility located near Nhava Sheva Port with respect to cleaning facility, tank testing, and tank repair?

Zodiac Tank Container Terminals was commissioned in March 2021, is a Samsara Group company, one of the leading shipping agency and logistics organizations operating since 1996 in India. Zodiac Tank Container Terminals state-of-the-art facility was developed as a 'one-stop-shop' for all ISO tank container cleaning, maintenance & testing, and road tanker cleaning matching with world-class quality standards.

The facility has dedicated exclusive cleaning bays for ISO tank containers as well as for cleaning of road tankers and food grade ISO tanks. The facility is carefully planned and run by a competent workforce using a fully automatic ISO tank container cleaning system with advanced German technology from Weidner. The cleaning facility is strategically located on Mumbai to Pune Highway, about 55 km from Nhava Sheva port with an excellent connectivity through a toll-free road, old Mumbai-Pune highway and also Mumbai-Pune Expressway.

Key milestones achieved by Zodiac Tank Container Terminals in the last two years? What are your expansion plans for FY 2023-24?

Zodiac Tank Container Terminals is the only ISO tank container cleaning & maintenance facility in India with ISO 9001:2015, ISO 14001:2015, and ISO 45001:2018 certification. It is the only professional facility for cleaning of road tankers carrying edible oil/products and chemicals, which is fully compliant with environment protection regulations. It is the first such facility in India with a roof top solar power plant and our entire facility is running on solar power. The facility is also compliant with Kosher and Halal certification and Welders certified by Bureau Veritas. Recently, we have safely handled the T75 LNG gas tank at our facility. Zodiac is also signatory to Responsible Care.

Can you elaborate on the technology used in the facility - The German made cleaning machinery set-up from Weidner?

We are the first facility in India to have a fully automatic ISO tank container cleaning system with advanced German technology from Weidner. Weidner is a German company with over 40 years of experience in the special cleaning equipment. They have set standards in the cleaning equipment industry due to their innovation power and high quality. The system is user-friendly, high performance,

Our quality services have prompted various customers to bring their ISO tank container across the globe to our facility in India for repairs and cleaning

low maintenance, robust and efficient. It has fully automatic cleaning procedures through various cleaning programs which can be done anytime by the operator. The Weidner cleaning plant also comprises a scrubber unit and steam generator.

How has been the response with respect to ISO tank and road tank cleaning facilities? How are you providing quality service?

The response is extremely good from various stakeholders in the trade. We have not only met their expectations but were able to provide world class cleaning, testing, and repair services in India which till date was not available.

Our quality services have prompted various customers to bring their ISO tank container across the globe to our facility in India for repairs and cleaning. This will help bring more business into India. Besides ISO 9001, ISO 14001, and ISO 45001, various reputed chemical manufacturers and global ISO tank operators have audited and approved the facility.

How do you ensure regulatory compliance with respect to achieving Zero Liquid Discharge?

Zodiac Tank Container Terminals is fully compliant with all applicable regulations and best global practices related to health, safety, quality, and environment. The company has an Effluent Treatment Plant (ETP) which has Zero Liquid discharge consisting of aerators, double RO, electrode system & evaporators and issued a Red Category license by Maharashtra Pollution Control Board. Being ISO 9001, ISO 14001, and ISO 45001 standards terminals, periodic audits help us in maintaining our standards.

Environmentally friendly technologies adopted by Zodiac to promote a clean and green environment? Key initiatives by the company to help customers achieve sustainable practices in the shipping and logistics sector?

We have set up the facility with an aim to provide an international standard of cleaning with environment care at its core. The German made tank cleaning equipment from Weidner is most efficient and has measures for noise

containment, low energy consumption at high efficiency, use of biodegradable detergents, water and energy saving techniques, etc.

Our facility is fully compliant with all applicable statutory regulations including Maharashtra Pollution Control Board. This facility is first of its kind to operate on solar power in India. Zodiac Tank Container Terminals is an ISO 14001:2015 certified company and promotes and imbibes best practices in the environment. Customers using our facility are indirectly achieving sustainable practices in the logistics industry.

In 2022, the company successfully commissioned a 150 kWp rooftop solar power generation plant at its Khalapur facility. How does this facility help you in terms of providing green and clean energy?

Towards our initiative to promote a clean and green environment, Zodiac Tank Container Terminals has been at the forefront in adopting environmentally friendly technologies to safeguard nature, climate and communities. In 2022, we successfully commissioned a 150 kWp rooftop solar power generation plant at our facility. This initiative is first of its kind in the ISO tank container and road tanker cleaning & repair facility in India. Our depot is entirely consuming electricity generated from solar power plants. It has been recognized by our partner Oorja Solar which is a testimony towards our commitment to promote a cleaner environment and inspire communities to adopt similar methods.

How is the company developing highly customized services in collaboration with its customers? Any examples?

Zodiac has been on the forefront of providing customized services to its customers. Cleaning of road tankers carrying chemicals and edible oil/products in a fully environmentally compliant as per regulations is one such successfully developed service. For ISO tank containers, besides top-class cleaning standards including scrubbing/ steam treatments we have created fully in-house capabilities of major repairs which are approved by reputed classification society/ certifying authorities.

We will soon be commencing re-furnishment of ISO tank containers. With fully equipped workshops, professional welders/manpower, and world class quality standards, we are creating Zodiac Terminal as a cost effective hub in the region for carrying out extensive repairs of ISO tank containers, placing India on the map for many globally reputed ISO tank operators.

How is the company striking a balance between environment-friendly policies and sustainable growth in future?

It is very important for any chemical cleaning facility to comply with environment related policies applicable rules and regulations being fully implemented. We have been at the forefront in implementing various environment-friendly initiatives as mentioned earlier and we shall continue to do so with support from more chemical customers/ ISO tank operators which are adopting such practices across their supply chains, which is a norm today, Zodiac Terminal is confident of achieving long term sustainable growth in this initiative. ■

PORT OF ANTWERP-BRUGES TO BECOME AN IMPORT HUB FOR GREEN HYDROGEN

The Port of Antwerp-Bruges stands out as a multifunctional world-class port because of the outstanding coordination of handling and logistics services and industries within the port

LUC ARNOUTS
VICE PRESIDENT – INTERNATIONAL RELATIONS & NETWORK
PORT OF ANTWERP-BRUGES

Port of Antwerp-Bruges is home to 1,400 companies and accommodates the largest integrated chemical cluster in Europe. What's your plan for 2023?

The Port of Antwerp-Bruges is committed to contribute to a climate neutral Europe. The future of Europe's largest integrated oil and chemical cluster will be shaped by sustainable and green investments on our two platforms and by strategic partnerships. The Port of Antwerp-Bruges is not only responsible to ensure the necessary state-of-art infrastructure but must also be the driving force for an innovative climate, a breeding ground where green chemistry can take shape.

NextGen District - An area of 88 has been dedicated to the development of a circular economy. Currently five companies have been granted a concession: Triple Helix, recycling polyurethane foam and PET shells into new raw materials; PureCycle, recycling PP plastics into renewed PP plastics; Bolder Industries, recycling end-of-life car tyres into new raw materials; Plug Power Inc, production of green hydrogen; Ekopak NV, circular water recycling company; and construction of the first plants will start in 2023.

Antwerp NorthHeat Network - The Port of Antwerp-Bruges is working closely with local partners on the first open-access heat network in Belgium. The network will use processed heat not only for industry but also to heat buildings in the city, good for a reduction of 80,000 tonnes of CO2 emissions a year.

Power-to-methanol - Port of Antwerp-Bruges and ENGIE, Fluxys, Indaver, INOVYN, Advario, and PMV are committed to producing sustainable methanol with the power-to-methanol project. The construction of a demo plant at INOVYN's site in Antwerp will start in 2023. The site will produce 8,000 tons of sustainable methanol annually from captured CO2 and renewable hydrogen.

Antwerp@C - Antwerp@C is a project dedicated to innovative CO2 reduction. Together with seven leading chemical and energy companies, we are working on the transition to a circular and climate neutral port. The capture and storage of CO2 (Carbon Capture & Storage (CCS) and, over time, the reuse of CO2 as a raw material for various applications Carbon Capture & Utilisation (CCU) are seen as important steps in the transition to a carbon-neutral port.

The Port of Antwerp-Bruges is located within a 500 km radius from 60% of the European purchasing power and is directly connected via multiple modes

What makes the Port of Antwerp–Bruges different in terms of infrastructure and facilities?

The Port of Antwerp-Bruges is

located within a 500 km radius from 60% of the European purchasing power and is directly connected via multiple modes of road, rail, barges, and pipelines to the main industrial and metropolitan areas in the European hinterland. A large variety of regular shortsea and feeder services connect both the dedicated shortsea and deep sea container terminals in the port with key economic centers of both Northern and Northeastern Europe, as well as North Africa and the Mediterranean.

The Port of Antwerp-Bruges is one of the most important pipeline hubs in Western Europe. Within the chemical cluster in Antwerp, the industrial and independent tank storage operations are connected to each other via 1,000 km of pipelines that account for almost 90% of all transport of liquid goods within the port. Zeebruges is connected by pipelines to the Norwegian gas fields via Gassco's Zeepipe and to the United Kingdom via the Interconnector.

The Port of Antwerp-Bruges stands out as a multifunctional world-class port because of the outstanding coordination of handling and logistics services and industries within the port. The port offers a combination of: Container services like container repair, cleaning and decontamination, etc; Warehousing facilities and value added services including high and heavy handling, blending, sampling, temperature controlled warehousing, stuffing and stripping, steel service centers and on-site sanitary - phytosanitary and quality inspections.

The Port of Antwerp-Bruges has the largest concentration of bonded warehouses in Europe, allowing customs duties and tax deferral. Thanks to our bonded warehousing system you can store the goods for an unlimited period, and you don‘t have to pay VAT and customs dues until the goods have been delivered to your customer in the EU. Most of the Logistics Service Providers operate as a one-stop shop, offering complete solutions including freight forwarding, storage, value-added logistics, customs administration, fiscal representation and distribution centers.

Antwerp-Bruges is a European external border; this means that all customs formalities can be done in Antwerp or Bruges for destinations in any of the 27 member states of the European Customs Union. Border Inspection and customs are located within the port area avoiding unnecessary delays. Customs use paperless procedures.

At 287 million tons/year, the Port of Antwerp–Bruges is a global heavyweight. How do you plan to increase the capacities further?

To ensure sustainable growth and to secure Antwerp's position as a hub in the global market, we have been continuously upgrading our infrastructure and adopting new technologies to prepare our port for the future and make it more efficient, safer, and smarter.

Investment in the 'Extra Container capacity Antwerp' (ECA) project, to add more and better container capacity at our port. The extra capacity will not only be provided by the expansion of a new tidal dock, but also by the development of land within the port area. ECA ensures that the Port of Antwerp-Bruges will have an extra container capacity of 7.2 million TEU at its disposal.

With the Complex Project New lock Zeebrugge, the Flemish government, City of Bruges and Port of Antwerp-Bruges are preparing Zeebrugge and its surroundings for the future. The construction of a new lock will provide a second nautical access to the inner port. This will ensure that business and jobs will be anchored in the region for the long-term.

The Port of Antwerp-Bruges has always been a testing ground and a place of innovation and digitization. We have been intensively testing a ‘digital twin’ of the port. We are using and further improving systems that include sensors, autonomous drones, and smart cameras for inspection of our infrastructure, oil spill detection, surveillance, monitoring, berth management, and floating waste detection. In Antwerp and Zeebrugge, we are working to build a private 5G network to increase the speed, reliability and security of the digital applications.

How has the war in Ukraine affected the business dynamics at the port? How did you tackle the challenges arising out of the geo-political situation?

Before the war, Russia was an important maritime trading partner of the Port of Antwerp-Bruges, ranking within the Top 5 whereas Ukraine was by all means a much smaller trading partner. As a result of the International and European sanctions on Russian cargoes implemented gradually ever since, and of the reluctance of many shipping lines to sail to Russian Ports, our cargo streams have decreased substantially, and were limited to non-sanction goods. However, last year PoAB handled as many cargo as the year before, which indicates that some flows have been replaced by flows from other origins/destinations. As for sanctions, please note that the Port of Antwerp-Bruges is not a policy maker in this respect, but fully abides by international, European, Belgian, and local legislation.

The Port is planning to receive the first green hydrogen molecules on its platform by 2028. What is the progress so far?

The Port of Antwerp-Bruges will take up a leading position as an import hub for green hydrogen and will play an active and pioneering role in the hydrogen economy. In addition, together with our industrial and maritime customers, we will continue our efforts to reduce our carbon footprint.

The Port of Antwerp-Bruges is today an

important hub for energy and raw materials. Energy and raw materials are imported, produced or processed, stored and transported to various global and European markets. This unfortunately also releases CO2 into the atmosphere: today a total of 17 million tons of CO2-eq is emitted throughout the port area, of which 14.34 million tons of CO2-eq emissions come from industry and refineries. We are switching to green energy and raw materials by providing the port and all its users with secure, sustainable and affordable energy; we are generating green electricity locally via solar panels and wind farms at sea and on land.

We also supplement local production of green electricity with local production of green hydrogen and, in particular, with the import of large volumes of sustainable hydrogen (carriers) such as liquid hydrogen, methanol, ammonia, synthetic methane and Liquid Organic Hydrogen Carrier (a transport molecule to which hydrogen can be bound and extracted on arrival). Some end users cannot fully electrify and will need molecules. Imports hence are critical to supplement the limited available solar and wind energy capacity in our high energy demand region. Hydrogen and its carriers provide an easy form of transport and storage.

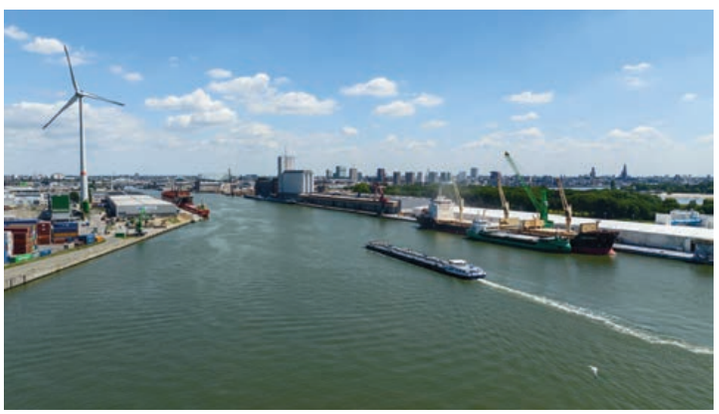
As a port, Port of Antwerp-Bruges plays an important role in the local and international hydrogen chain by focusing on three pillars - Supply and production of hydrogen; Distribution infrastructure; and consumption of hydrogen and transport to end users in the hinterland.

How is the Port of Antwerp–Bruges helping in enhancing the trade between India and Europe? What is your outlook for the future?

Port of Antwerp-Bruges has been actively engaged in India for a long time and has had a representation office in Mumbai since 2006.

According to the United Nations, India is set to surpass China as the world's most populous country in 2023, with each counting more than 1.4 billion residents this year. As the domestic demand will increase and exporting capacities will grow, India will become an even more important trade partner for the Port of Antwerp-Bruges. Exports from India to Europe via the Port of Antwerp-Bruges include steel, project cargo, pharmaceuticals, chemicals, automotive components, and engineering goods.

The recent initiatives of the Indian government to boost the logistics sector and reduce logistics cost offer a substantial opportunity for the Port of Antwerp-Bruges. The port expects that these key initiatives will see this sector grow at an unprecedented rate.



The Port of Antwerp-Bruges' central location in the heart of Europe makes it possible to serve a huge consumer market very quickly. Its regular maritime connections with India and trimodal hinterland connections to the whole of Europe, help Indian companies in positioning themselves and their products in the European market.

What will it take to build a world-class chemical hub in India?

We can share our experience and initiatives taken, which has made Antwerp one of the largest chemical clusters in Europe.

The creation of such a successful integrated chemical cluster did not come about overnight. The role of the Port Authority as master planner has been crucial in the whole process. Long term vision and strategic focus have been of paramount importance. The high degree of integration and diversity throughout the value chain of the chemical actors based here is unique in the world. It brings some of the most cutting-edge logistical experts together for the safe storage, handling and distribution of oil, chemical products and gases.

The refineries of TotalEnergies and ExxonMobil, and the three steam crackers in the port ensure the stable local availability of raw materials. In addition, several lubricant production sites are based in the port area. The close cooperation between the companies, both in the chemical cluster at the production level and in the field of energy and services such as sustainable waste treatment, ensures extremely cost-efficient production.

A world-class chemical hub requires high-quality infrastructure and excellent connectivity. This will help ensure the efficient transport of materials and products as well as provide a safe working environment for employees. Within the chemical cluster in Antwerp, the industrial and independent tank storage operations are connected to each other via 57 different product pipelines or 1,000 km of pipelines that account for almost 90% of all transport of liquid goods within the port. Outside the port area an extensive network of pipelines connects the chemical industries in Belgium, Germany, and the Netherlands.

Adopting an innovative spirit is crucial when we make the strategic decision that prioritizes sustainability and resolutely chooses green chemistry solutions. We found many like-minded partners in the industry. INEO for example will make the largest investment in the European chemical sector in the last 25 years building a new cracker in Antwerp with the lowest possible carbon footprint using the most advanced technology.

The port's attraction for the chemical industry lies in its unique combination of advantages: a strategic location at the intersection of the main European transport corridors, the availability of raw materials, an efficient logistics platform and the high productivity of the multilingual workforce. ■

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HAROPA PORT WILL BE OPS READY BY 2028 FOR CONTAINER & CRUISE VESSELS

We continue to invest on our port infrastructure to extend our capacity to accommodate more traffic. We will start the civil work to create a new port of 100 ha on the Seine River 50 km from Paris

KRIS DANARADJOU
DIRECTOR GENERAL
ADJOINT DEVELOPMENT
HAROPA PORT

Haropa Port is the fourth largest North European Port. What's your plan for 2023?

Eighteen months after its creation (merger of three ports - Le Havre, Rouen, and Paris) and following a historic year in which three million TEU was surpassed, Haropa Port has consolidated its positioning in the group of Northern Range Port. In 2022, Haropa Port was one of the only ports in Europe with a progression of container traffic. In addition to the remarkable resistance shown by traffic levels, key milestones have been achieved, foremost among them is the announcement by MSC TiL last July that they would be investing €700 million till 2028 to triple container volume, making us a major port of entry for France and Europe and giving us the means to develop river-based services to the Paris basin.

What makes Haropa Port different? Would you talk about the Green Logistics Corridor?

The model of Haropa Port is based on its ability to provide a unique green corridor to connect the maritime ports of Le Havre and Rouen to the consumption region of Paris and to NW Europe. As an efficient alternative to a very efficient motorway network, the Seine River and the railway system are the backbone of Haropa Port. Our port system includes more than 25 terminals all along the Seine River. It means 25 different places along the Seine River to load and unload containers.

In 2022, rail and river transport on the Seine Axis were increasingly seen as an alternative to road for goods import/export, the modal shares of rail and river expanded from 12% to 13.3% for containers exiting Le Havre. Operators have completely understood the complementarity of maritime terminals and inland terminals. Some goods need to be handled in the maritime port of Le Havre to be transferred by truck in a few hours to Paris. Other goods could be transferred by rail or inland waterways to Rouen or to Paris and/or to various other industrial hubs in NW Europe within a couple of days without any kind of congestion, taking advantage of the possibilities of massification offered by rail and river transport.

Moreover, Haropa port displays a smart cargo community system completely connected to its port community system to follow the flow of goods from vessels arrival to the final delivery.

The global trade between Haropa Ports and the main Indian Ports continues to grow with a strong growth of over 7-8% per year on imported traffic from India to France

At 110 million tons/year, Haropa Port is a global heavyweight. How are you planning to increase traffic in the next five years?

Haropa Port is definitely a multi sector port combining container, dry bulk, liquid bulk and grain traffic. Haropa Port includes maritime and inland waterway traffic, which makes our model particularly resilient in a context of crisis. We continue to invest on our port infrastructure to extend our capacity to accommodate more traffic. In 2022, we have finalised the maritime works to add 700m of quays which will complete the existing 3500m of quays in Port 2000, our main container terminals area.

In 2023, to create a specific access for INW barges, we will fulfil the story of Port 2000 started 20 years ago to have reference port terminals able to welcome the largest vessels in the word, safely, efficiently, and in deep sea conditions. These nautical conditions are unique in the Northern EU.

In 2023, we will also start the civil work to create a new port of 100 ha on the Seine River 50 km from Paris. This project is unique in port history as we have not created a new port in the last 50 years. This aims at fostering the transport by Inland waterways for construction and recycling activities.

How has the Russia-Ukraine war affected the business dynamics? How did you tackle the challenges arising out of the geo-political situation?

The Russia-Ukraine war has led to major geopolitical disruption between Russia and Europe, in addition to fears of an energy crisis. Also, the last summer's drought notably affected certain types of agricultural production in France and the rest of the world. Nevertheless, despite these difficulties for Haropa Port, the past year was a year for a change of scale and high resistance to turbulence and defined resilience. In particular, for the export of Cereals, 2022 was one of the best years of the decade with 8.6 metric tonnes of grain shipped this year (+12%). It was definitely a good trading year (quantity/quality). Due to efficient port logistics, our producers were among the first sellers to propose grains to the market. We were able to sell our shipments to Israel, Tunisia, Saudi Arabia, and Iran - destinations rarely served by France in recent years. These grain volumes were additional to substantial purchases by Algeria, Egypt, West Africa, countries which have suffered from an intense drought this year.

How are you gearing up towards making Haropa Port a Green Energy hub?

Haropa Port aims to be a Green hub by: Development of low-carbon port/ industrial zones; Production of green energy from biowaste;

Deployment of a network of CNG stations: New Industrial Cluster will be implemented in the coming years.

Development of low-carbon port/ industrial zones: An MoU has been signed on the Seine River by chemical groups such as Total, ExxonMobil, Air Liquide, Yara, and Borealis to lead a major Carbon Capture Utilisation and Storage (CCUS) project. Its first step aims at reducing carbon emission by 1.5 million tons/ year by 2030. In the context of this CCUS project, we also aim to put in place one of the first CO2 export hubs in Europe.

Production of green energy from biowaste: PAPREC, a major waste management company, will be operating the future methanisation plant for Greater Paris household biowaste at the port of Gennevilliers.

Deployment of a network of CNG stations: A new generation of multi-energy service stations will be implemented in our main platforms in the Paris Région.

At the Port-Jérôme port/industrial zone (40 km from Le Havre Port) a new industrial cluster will be implemented in the coming years - "Plastic Valley" - dedicated to recycling and producing latest-generation renewable plastic is currently being organised, most notably around the projects of the chemical groups Eastman and Futerro. The site will also see production of renewable hydrogen with Air Liquide's Normand'Hy Project which has an unprecedented capacity of 200 MW to be operational by 2025.

Haropa Port will be OPS ready by 2028 for container and cruise vessels - two years before the European legislation commitments.

Haropa Port has announced a Euro 700 million investment at Le Havre. What's the update on this front?

Terminal Investment Limited (TiL), the ports division of leading liner Mediterranean Shipping Co (MSC), has taken total control of the TPO/TNMSC container terminals at Le Havre, and announced in July 20222 a €700 million investment program. This program will ensure the terminal hub can handle the largest boxships afloat. This ambition promises to shake up the port hierarchy in the competitive group of Northern Range European Ports system and help Le Havre

become an even more significant gateway point for the French cargo market, and beyond. TiL/MSC is going on this program by installing new gantry cranes and also extending the terminal's storage capacity with the installation of fleet services at six berths. The new gantries will be electrically powered and the port will provide shore power for ships.

Haropa port is also focusing on the Digital Transformation Project. What's the update on this front?

Haropa Port is totally focused on its path breaking digital initiatives and innovations in the technology domains for more transparency, greater facilitation, and ecological transition. Haropa Port is the first French port to switch to 5G, making changes in the Port Community System aimed at harmonising the digital tools for port call management along the Seine Axis and preparing for the port one-stop-shop S-WiNG, and S)ONE 100% digital and paperless procedures and solutions, the creation of the Easyport software program for facilitation of port goods throughput, a plan for digital twinning with the port of Rotterdam as part of the MAGPIE project in order to consolidate the port's environmental competence, AI placed at the service of port call predictions to reduce greenhouse gas emissions, among others.

By means of these many innovations, Haropa Port is setting out to make gains in efficiency, rapidity, and flexibility, to provide its customers with greater transparency and to foster the ecological transition.

Haropa Port does have plans to receive the first green hydrogen molecules on its platform. If yes by when and how?

In addition to projects to produce green H2, like the Air Liquide Normand'Hy project with an unprecedented capacity of 200 MW to produce 28,000t of H2/year by 2026, Haropa Port is also working on its capacity to import H2, by mobilizing its storage facilities. The EU commission foresees that the energy mix in Europe will rely on production and on import of green H2 to answer the needs by 2030.

How is Haropa Port helping in enhancing the trade between India and Europe? What is your future outlook?

The global trade between Haropa Ports and the main Indian Ports continues to grow with a strong growth of over 7-8% per year on imported traffic from India to France. We already have a strong position to import textiles, clothing, vehicles, transport equipment, and chemical products. We believe there are many opportunities to develop sectors like pharma, as Haropa Port is in the middle of a Pharmaceutical Valley on the Seine River. Our ambition is also to further develop reefer traffic as we are the main Port for reefer products in France: we also have the facilities and we have developed a strong know-how to manage this kind of traffic.

Key benefits for Indian chemicals and other industries if they prefer the Haropa Port for business?

One of the key assets of Haropa Port is to be able to provide turnkey greenfield or brownfield lands for new investments. We are one of the only ports in Europe to provide large plots of more than 40 ha for the settlement of future plants. Moreover, when you choose to settle on the Haropa Port network (we control more than 16 000 ha on the Seine River Valley), you will join an existing industrial cluster with all the facilities needed (electric, water grids, and pipelines) and you will also be able to develop synergies, circular economies with the neighboring firms.

What will it take to build a world-class chemical hub in India?

The most important characteristic for a hub is to be connected to other chemical valleys around the world. The strong maritime relation between India and France will enhance the position of the Indian chemical hub to import the products it needs and to export its production. The common ambition is to strengthen the supply chain for all the chemical actors in India and France. ■

Terminal Investment Limited (TiL) has taken total control of the TPO/TNMSC container terminals at Le Havre, and announced €700 million investment program

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