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April 2022

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At the outset, let me thank our respected leaders, readers, and partners for supporting us in bringing out the Second Edition of Chemical Industry Outlook 2022 Annual Compendium.

The last two year's have been very challenging for everyone globally. Industries across the world suffered a lot. We at Indian Chemical News tried our best to be with the industry. We put our best efforts with the support from the industry to keep industry professionals updated on the latest developments in the chemicals, petrochemicals, and energy sectors.

The chemical industry is poised to become a major ingredient in fuelling India's economic growth and has roots spread across a wide range of end-user industries - Personal Care, Home Care, Automobile, Consumer Electronics, Food & Beverages, Paint & Coating, Garment, and others thereby playing a major role in achieving the country's ambitious US \$5 trillion economy goal by 2025.

To reach US \$300 billion, the Indian chemicals industry needs to tap attractive business opportunities in petrochemical intermediates, downstream petrochemicals, specialty chemicals, and others. The coming decade is expected to bring in investments worth more than US \$87 billion, particularly in petrochemicals and specialty chemicals. India's strategic location advantage, skilled and competent manpower, good governance, high-quality infrastructure, robust investment policies, strong regulatory framework, promising labour reforms and trade agreements, and lucrative tax incentives have further propelled it into the league of preferred manufacturing destinations.

Back to pre-COVID levels, the industry is expected to grow at a CAGR of about 9.2% by FY25. The government has implemented schemes such as Make in India, Aatmanirbhar Bharat, and Production-Linked Incentive (PLI) with the objective of improving the competitiveness of domestic manufacturing, attracting investments, and increasing exports. These initiatives are expected to boost domestic production and also increase demand for chemicals and petrochemicals within India.

With the Indian chemical industry doubling in the next five years, there was a need for an annual chemical industry compendium cum handbook which focuses on the yearly progress of the Indian chemical industry. Our first annual edition titled Chemical Industry Outlook 2021, released last year in March was titled "Exploring New Horizons of Growth". The first edition received tremendous response from the industry. The print and digital versions of the Compendium were widely promoted, circulated and referred to by the key stakeholders including Government, Industry Associations, Chemical Manufacturers, Consultants, R&D organizations, Academia, and Vendor community.

Continuing with the initiative, Indian Chemical News (ICN) is happy to present the Second Annual Edition of industry compendium titled "Chemical Industry Outlook 2022: Making India A Global Manufacturing Hub", an exclusive collection of premium content for key stakeholders in the industry. The compendium is a collection of latest trends and analysis from Chemicals, Petrochemicals, and Energy sector.

While overview provides key recommendations for each sector, the guest columns from senior industry experts from diverse backgrounds give us a holistic view. The guest columns have been invited from select industry leaders from the industry, academia, industry associations, R&D Organizations and others to give it a holistic perspective.

We hope that the Second Edition of Chemical Industry Outlook will provide deep dive information about the growing influence of Indian chemical industry and its ramification to the Indian economy both in terms of internal consumption and exports.

As always, we look forward to your continued support, guidance and valued feedback on creating knowledge led platforms for showcasing the vibrant outlook of chemicals, petrochemicals, and energy sector.

Happy Reading!

Pravin Prashant
Editor
Indian Chemical News
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ಭಗವಂತ ಖುಬಾ
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Minister of State
Chemicals & Fertilizers and
New & Renewable Energy
Government of India



MESSAGE

I am happy to know that Sindhu Media Private Limited through Indian Chemical News (www.indianchemicalnews.com) is publishing 2nd edition of its compendium titled 'Chemical Industry Outlook 2022' in April 2022. The theme of the Compendium 'Making India a Global Manufacturing Hub' is in line with the vision of the Ministry of Chemicals and Fertilizers, Govt. of India.

There is a need of indigenous production, better R&D and innovation to make India a preferred destination for investment worldwide. World leaders are looking positively at the country as a potential investment destination. Industry and government have to together take steps to tap new opportunities. We are taking steps to ensure that chemicals and petrochemicals industry become major contributors to the growth of the Indian economy. Government of India has relaxed the customs and ensured tax rebates to chemicals and petrochemicals sector. We are exploring all possible measures to offer an encouraging environment to the Indian chemicals, petrochemicals and energy sectors. Ease of doing business and the feel good factor has improved in the last 7 years.

The chemicals and petrochemicals industry must work on new environmentally friendly chemicals, minimizing the hazardous effects. Zero pollution technologies can create huge value addition. We need R&D for solutions to pollution and ensuring zero discharge.

I am aware that 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 'Aatma Nirbhar'.

I am sure that the Compendium will discuss and highlight all contemporary issues and offer a roadmap to make Indian chemicals and petrochemicals sectors to create a strong position in the global market.

I extend my best wishes and success to the 'Chemical Industry Outlook 2022'.


(Bhagwanth Khuba)

Kashi Nath Jha

Joint Secretary
Department of Chemicals & Petrochemicals
Ministry of Chemicals and Fertilizers
Government of India

FOREWORD



India is well on its way towards achieving the vision of a \$ 5 Trillion economy and the Chemical and Petrochemical sector is going to play a crucial role in it. This sector is the mainstay of industrial development and provides building blocks for many downstream industries. The robust growth that we have seen in our sector even through the tough times of Covid-19, has ensured that our sector has a huge potential and capability to grow even further not only to meet our domestic needs but also to meet the global requirements.

The government's focus is on strengthening the sector by supporting Industry with the development/adoption of new technologies and techniques. Various steps such as forming Petroleum, Chemicals & Petrochemicals Investment Regions (PCPIRs), Plastic Park Schemes are taken to strengthen the industry. Under various multilateral and bilateral agreements (FTAs), India has committed to gradually eliminate the tariffs on various chemical and petrochemical products in addition to non-tariff import barriers such as quotas based on amount and source.

It is immensely pleasing to note that Indian Chemical News shall be releasing its second industry compendium titled "Chemical Industry Outlook 2022 - Making India a Global Manufacturing Hub" during April'22. I am hopeful that the compendium will highlight all the emerging opportunities for all stakeholders of the industry.

I wish "Chemical Industry Outlook 2022" all success!

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Indian Chemical News (ICN) is a pioneer in the dissemination of valuable information in the Chemical, Petrochemical, Pharma and other allied segments like Crop protection chemicals. ICN has successfully brought the major stakeholders on one platform i.e, Industry leaders, Government officials, Academia, Industry Associations, R&D Organizations etc. We at ACFI are supporting Indian Chemical News in their diverse endeavour and wish them Good Luck as always.

Coming to the Indian Agrochemical Sector, during the past decade, tremendous growth has taken place. Indian companies have progressed from the manufacturing of Agrochemicals to the point where they are producing more innovative Agrochemical products which are helping the Indian Farmers to increase their farm yield.

We at Agro Chem Federation of India (ACFI) are committed towards promoting the safe & judicious use of agrochemicals and the promotion of new technologies & products which are eco-friendly and provide the farmer with greater crop protection solutions. We seek to achieve Sustainability in Agriculture for the benefit of the overall agri sector of India. Our aim is to provide quality agri inputs to the farming community at affordable prices.

We are happy to Associate with ICN to achieve our common goal of serving the Agriculture fraternity and Industry.



Dr. Kalyan Goswami
Director General
Agro Chem Federation of India

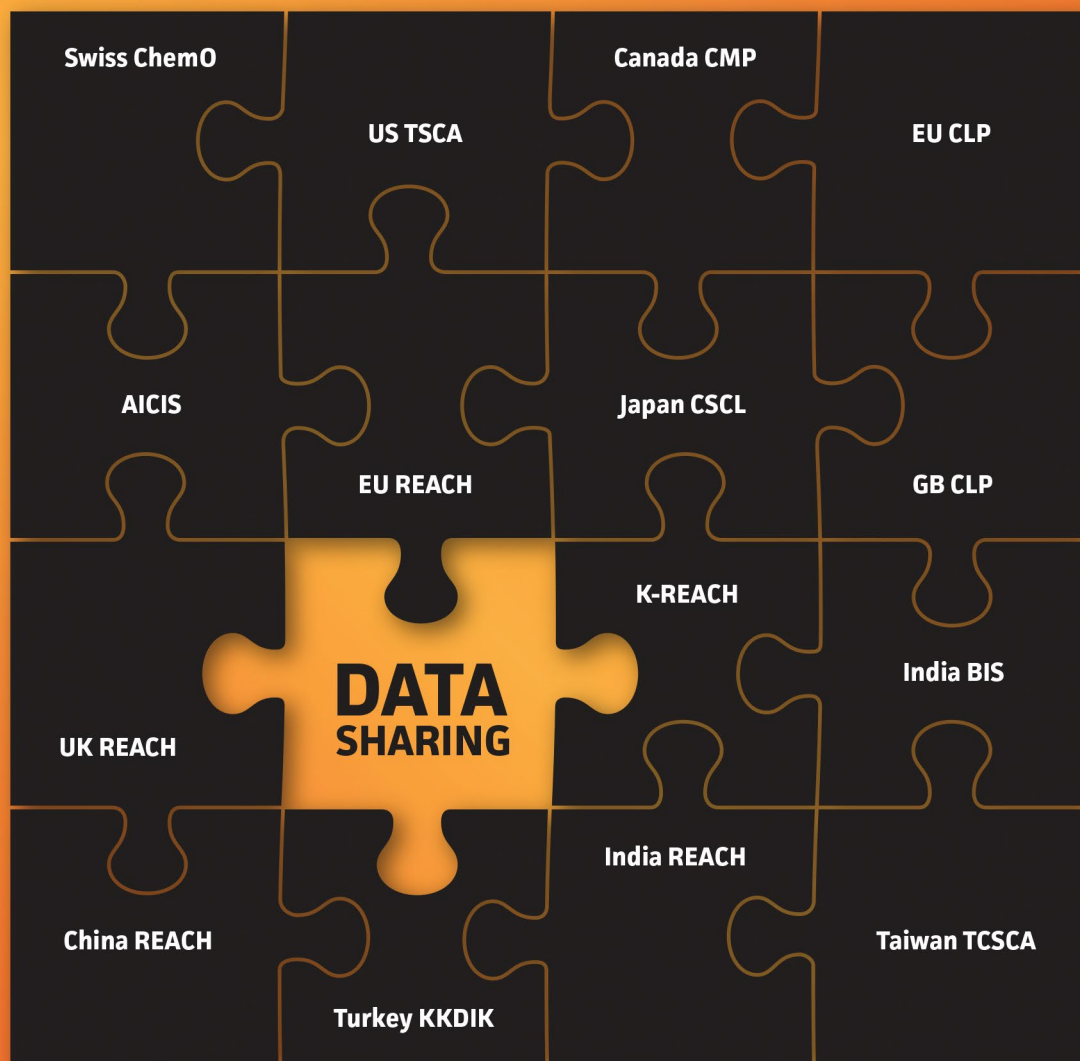


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Alkali Industry includes bulk chemicals which acts as the basic crucial component for various industries. Caustic Soda is one of the major contributors in Alkali chemicals. There are various market drivers that exist for the alkali industry to grow substantially. In 2020-21, over 3.5 million metric tons of caustic soda and 3.1 million metric tons of soda ash were produced in the country. Caustic soda and soda ash are basic chemicals finding applications in various industries, including manufacture of textiles, paper and pulp, glass, soaps & detergents, etc. There exists a huge growth opportunity for alkali chemicals in India.

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 2022'.



Kapil Malhotra
President

7th April 2022



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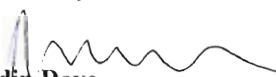
India is the 4th largest global producer of Agrochemicals after US, Japan and China and second largest producer in Generics. Currently Indian pesticide industry market size is estimated to be over US\$ 6 billion with exports accounting to the tune of US\$ 3 billion. The industry is expected to grow at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

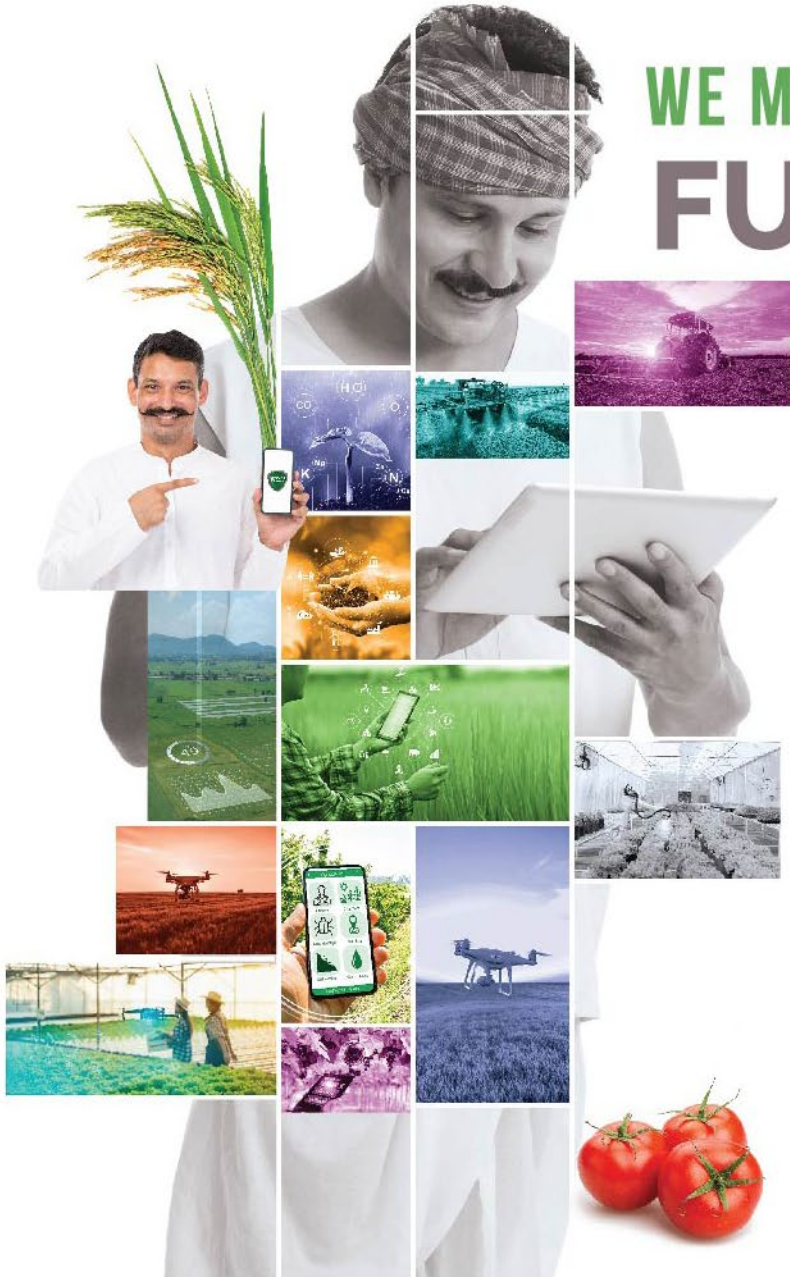
Every year in India pests eat away one fourth of food produced by the Farmers and annual Crop Losses due to Pests and Diseases amounts to 15% to 25% of the total output of the country (which presently is to the tune of whopping Rs.1.48 lakhs crores worth crops). This necessitates more emphasis on crop protection and judicious use of pesticides that can cut down these losses that occur at multiple stages of crop growth. 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.

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I extend my best wishes and success to the 'Chemical Industry Outlook 2022'.


Pradiy Dave
President, PMFAI & Chairman, AIMCO Pesticides Ltd.



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THE NEXT THREE YEARS: THREE AREAS FOR BOLD ACTION

The market share of the top 20 ChemCos has reduced from 19% to 14% over the past 15 years creating opportunities for carve-out acquisitions



AMIT GANDHI
MD & PARTNER
BCG INDIA



AMITA PAREKH
MD & PARTNER
BCG INDIA

Indian ChemCos are saddled with high performance expectations, driven by strong macroeconomic tailwinds. The markets have certainly baked it in – chemical stocks have noticeably decoupled positively from



We believe an aggressive roadshow approach by companies in a targeted fashion will be beneficial. Set up greenfield/brownfield capacity in India with reliability on supply and IP; start with 5-10% movement of supply; take-or-pay arrangements to safeguard interests of both parties.

the overall index over the past couple of quarters.

Multiples are reaching a level where they are raising thorny questions: there is a lot of cash being generated in the business, capital is accessible at levels seldom seen before – how is management utilizing capital to deliver for stakeholders? This piece proposes three specific areas for management teams to boldly build their business, and to deliver against this task.

1: BUILD HOCKEY-STICK VALUATION OPTIONS

Management teams are faced with a constant barrage of questions about participation in future trends. Sustainability is top of the agenda, but so are many other “future” areas – health trends impacting specialty value chains, reinvention of energy, fundamental process innovation, AI/ML, ...

There is a fundamental challenge to resolve, best encapsulated by Mark Twain: “Prediction is difficult – particularly when it involves the future”.

Essentially, while there is broad alignment that these trends will happen, no one can predict when they will be material. How do management teams participate in these effectively?

The answer – set up Corporate Venture Capital (CVC) arms. These are dedicated teams (small: typically 2-3 strong) with a mandate to invest in future technologies and build option value for the firm. They have assured funding every year of a certain amount – say Rs. 20-100 cr. per year, depending on the firm’s size and risk appetite.

The design of the CVC is critical to its success. Some key points to consider: What are the strategic goals? Which fields to invest in and what investment model to apply? What is the value proposition to startups? What should the governance and value models be?

An effectively designed and executed CVC can accelerate value creation, and give a competitive edge to the firm.

2: EXPLORE OUTBOUND M&A FOR SPECIALTY CHEMICALS TECHNOLOGY (EUROPE/US/JAPAN)

Base companies follow a very different valuation pathway compared to specialty chemical firms. For example, delivering a billion-dollar valuation for a base chemical firm might mean generating ~Rs. 700 cr. at 8-10x multiple. By contrast, this would be ~Rs. 200-300 cr at 20-30x for a specialty-first firm. The latter is, of course, significantly more capital efficient (both absolute, and on asset-turnover) – but carries higher risk due to the need to foray into newer areas.

Thus, the imperative to build a strong, scale specialty business at speed is clear. However, with wave 1 of specialty firms in India already successful in key value chains, the question for management teams is how to quickly get a competitive edge.

The answer: outbound M&A to acquire technology, with the target being small to mid-sized firms in Europe / US / Japan ideally.

The climate is favourable: global chemicals M&A has been on a high over the past decade, with \$134 bn worth of deals in 2021 alone. Global conglomerates have been streamlining portfolios to focus on their core – the market share of the top 20 ChemCos has reduced from 19% to 14% over the past 15 years. This has created opportunities for carve-out acquisitions.

Firms should use these acquisitions as the “core” of their foray into newer specialty chemicals – reducing the risk, and accelerating outcomes.



3: AGGRESSIVELY PURSUE ROADSHOWS WITH GLOBAL CHEMCOS

The geopolitical trade shifts are real. BCG's trade finance model predicts that out of a projected ~\$18tn of global trade in 2023, at least \$170 bn of trade from traditional supply chains is prone to readjustment. Chemicals will be an important component of this, and our survey of global executives shows this is more than just intent signaling – real capital decisions are now backing the movement.

The move to India will not be automatic, however. There are many potential destinations for this business – Eastern Europe and South East Asia being the prime ones.

We believe an aggressive roadshow approach by individual chemical companies in a targeted fashion will be beneficial. The pitch: set up greenfield/brownfield capacity in India with reliability on supply and IP; start with 5-10% movement of supply; take-or-pay arrangements to safeguard interests of both parties.

If the value chains and partners are chosen well, this can be a high-valuation foray at scale for a base or intermediates firm.

CONCLUSION

It is a tough time to lead a Chemicals firm in India – the asks and expectations from investors are unrelenting, and the option set feels virtually unlimited.

We believe answering three questions can help navigate this effectively:

- What is our Corporate Venture Capital strategy to deliver hockey-stick valuation in uncertain future trends?
- What is our outbound M&A strategy for specialty chemicals technology and market access?
- What is our roadshow strategy to lock in business emerging from global trade shifts?

Bold moves on these three areas can ensure a significantly elevated valuation profile, a stronger underlying business, and a satisfied stakeholder base. ■



Amit Gandhi, MD & Partner leads BCG's Chemicals and Agribusiness practice in India and BCG's Strategy topic for Asia-Pacific.



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INNOVATION TO INVIGORATE CHEMICALS & PETROCHEMICALS SECTORS

These sectors shall gain immensely from policy reforms, and a culture of innovation, as applications proliferate and new materials come to the fore



MAULIK D. MEHTA
CEO & EXECUTIVE DIRECTOR
DEEPAK NITRITE LIMITED

The chemicals & petrochemicals sectors in India is well poised for a stable phase of multi-decade growth. Robust domestic 'aspirational' demand from rising affluence, higher per capita income, poverty alleviation, and effective social security policies by the government, shall be growth drivers for the sector -- backbone for many industries. As a building block for almost every industry, the sector shall gain immensely from policy reforms, and a culture of innovation, as applications proliferate, and new materials come to the fore.

Both these sectors have been a superlative value creator for the Indian economy. For one, it has created wealth – giving high returns to investors amid volatility. It has also created jobs, at a time when the entire economy, in general, was reeling under the unprecedented impact from the pandemic, thus providing

lives and livelihood.

Today, despite the numerous challenges, namely, from inflation, geopolitical concerns, and supply chain disruption, the sector continues to deliver value. Yet, we have barely scratched the surface and the headroom for growth is immense. Anecdotal data can provide some insights.

For instance, the industrial (and industrious) state of Gujarat is the highest contributor in terms of both, Gross Value Added (GVA) and Value of Output, for the chemicals and the chemical products sector.

It contributes over 1/3rd to India's total pie. The United Kingdom, a country slightly larger than the size of Gujarat, and a comparable population, is among the top producers of chemicals globally, and is also an export powerhouse contributing over 3% of dollar (US\$) value-worth of chemicals exported.

Of course, one may argue that factors such as economic and industrial development, infrastructure, continuity of regulation & policy, are better suited for development of chemical industry in the advanced economies. However, the comparison is simply to provide a glimpse of the tremendous potential that the chemical sector holds, especially as India comes of age, as a global superpower.

The Gross Value Added (GVA) of the chemical sector has grown with a CAGR of 13.49% between 2013-14 to 2018-19. The growth in Value of Output for the manufac-



With 100% FDI-route available for most chemicals, and the emergence of 'China+1' policy – that is, the deliberate efforts by the global economy to diversify manufacturing and logistics from China, PCPIRs can be the perfect ecosystems for the industry.



turing sector between the same period was 7.24%, while that of the chemical industry was 8.20%. Undoubtedly, the industry has consistently outperformed the rest of the manufacturing sector, in terms of growth in value of output.

Some estimates suggest that the industry is slated for a 9.3% growth to reach US \$300 billion by 2025. However, going by the current trends, it would hardly come as a surprise, should the real figures outpace the estimates.

India currently is a net importer of most chemicals, barring a few, namely, pharmaceuticals products, man-made staple fibres, man-made filaments and tanning or dyeing. Data suggests that the percentage share of exports in the total pie of overall exports has increased steadily over time. Important factors such as economic growth and social emancipation are catalysts that shall boost domestic consumerism and consequently, higher per capita utilization of chemicals (directly or indirectly).

Two major initiatives by the Government, that of 'Make in India' and 'Atmanirbhar Bharat', are aptly designed for the chemicals & the petrochemicals sector to flourish in the country. The industry needs to build scale via ecosystem – this entails creation

of Petroleum, Chemicals and Petrochemicals Investment Regions (PCPIRs) across all four corners of the country, infrastructure linkages for a hub-and-spoke model and finally, integrating the value chain.

Under the PCPIR Policy 2020-35, the government envisions investments of up to Rs. 20 lakh crore, by 2035, across all PCPIRs in the country. With 100% FDI-route available for most chemicals, and the emergence of 'China+1' policy – that is, the deliberate efforts by the global economy to diversify manufacturing and logistics from China, PCPIRs can be the perfect ecosystems for the industry.

As multinational giants coexist side-by-side MSMEs, a concoction of global capital and technology, along with local expertise and skilled manpower, can create scale and quality that can make India, one of the largest producers, and exporters of chemicals. This is taking shape in some ways today – however, proliferation of PCPIRs can revolutionize the Indian chemical industry.

PCPIRs apart, the government's overall economic vision and reforms shall aid growth. For instance, the recently announced

GatiShakti Master Plan in the Union Budget 2022, shall boost consumption of specialty and construction chemicals, and at the same time, address the issue of logistic challenges faced by the very sector that helped build it.

Similarly, the push to decarbonize mobility via adoption of Electric Vehicles (EVs), shall increase uses, ranging from aiding battery technologies to applications in new age mobility. The India electric vehicle market is expected to reach US \$17.01 Billion by 2026, growing at a CAGR of 23.47% by 2026; favourable policies around ownership and maintenance of EVs are expected to accelerate the adoption of these vehicles.

The government has already introduced the Production Linked Incentive (PLI) scheme for automobile and the auto component industry, to enhance India's manufacturing capabilities for Advanced Automotive Products (AAT) to boost its quest towards clean mobility.

Similarly, the National Policy on Biofuels, 2018, is essentially a step towards energy transition and diversifying India's energy mix. However, it can succeed only when the chemicals Industry scales up to capture the

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specific demands for fuel blending.

At a broader level, structural shifts are going to be critical for 'Make in India' to take shape. India's manufacturing sector, in general, has been a laggard, when compared to its peers in South Asia or even, among other emerging economies. Despite the good show, there is a lot for the chemical indus-



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try to achieve. While 'China+1' is still taking shape, India's neighbours and other peers have already taken off at a steeper plane.

China has in many ways been the world's manufacturing hub over the past two decades and is also a mega consumer. In my view, the Indian chemicals & petrochemicals industry should not only aspire for scale and efficiency

but explore niche areas where it would have a competitive edge.

For instance, industries such as cosmetics, fashion, and FMCG are poised for robust growth, as the pandemic recedes, and spending levels rise. This augurs well for segments such as perfumery cosmetics, essential oils, and products that are linked to the senses, where India has an edge. Also, it would equally aid faster growth of chemicals linked to packaging of products.

What this brings to the fore, is that it is essential to explore, diversify and build scale by integrating the value chain, and not simply by focusing on a single segment of the industry.

'Atmanirbharta' can succeed, only when the industry builds capabilities across the value chain. This shall reduce dependence on imports, deleverage risks emanating from supply chain disruptions, and more importantly boost the economy.

As the government shifts focus on industries such as electronics & semiconductors, renewable energy, and pharma, the role of the chemicals & petrochemicals industry shall evolve into a more specialized one. Eventually, it shall emerge as a bridge towards making in India, for the world. ■



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- Carbon Smart Range
- Bio-fuels
- Potable Spirits

SHIFT TOWARDS INTEGRATED MANUFACTURING

The company is strengthening its position as a fully integrated complex, as part of the raw material required for these products are available within the plant itself thereby bringing efficiency to the plant, helping to improve margins, and creating value for its stakeholders



MAULIK PATEL
CHAIRMAN & MANAGING DIRECTOR
MEGHMANI FINECHEM LIMITED

India is on a very promising trajectory in its bid to be a US \$5 trillion digital economy. To realize this goal, the Indian chemical Industry has a huge role to play. The government estimates that by 2025, the chemical Industry will grow to a sizable US \$304 billion and attract investments of over Rs. 8 lakh crore.

One of the biggest challenges we face as an industry is contracting gross margins due to soaring raw material costs and increasing operating costs due to higher freight, especially owing to the backdrop of the COVID pandemic. The charter for stabilization has already been prescribed by the government with PLI (Production Linked Incentives) initiatives such as Aatmanirbhar Bharat, Make in India, etc. However, there needs to be more focus on manufacturing essential chemical compounds in India and

controlling the extent to which we import essential chemical compounds such as ECH (Epichlorohydrin), CPVC (chlorinated polyvinyl chloride), and Chlorotoluene.

ECH is an epoxide and a colourless liquid. From a technical perspective, in India, 80% of ECH goes into Epoxy Resin manufacturing and in turn, it goes into Industries such as paints & coatings, adhesive, construction, automotive, windmills, electronics, and other industries. The remaining 20% of the ECH is consumed by the pharmaceuticals industry and for making water treatment chemicals.

ECH has a huge potential in the chemical industry, as per a Grand View Research report, the ECH global market is projected to reach US \$4.40 billion by 2030. In short term perspective, the consumption of ECH globally from 2021 – 2026 annually, is said to be at an estimated rate of 4-5%. Additionally, with government spending on infrastructure, the developments in the manufacturing sector, automobile sector, and windmill segment in India, the demand for epoxy resin is only said to increase, thus leading to a higher demand for ECH in the country. Currently, as of FY 2022, India's demand for ECH is completely met by imports (100%) from Thailand, Indonesia, Korea, etc.

CPVC or chlorinated polyvinyl chloride is another important chemical compound that is the key component for making high-quality durable pipes. CPVC is an industrial-grade set-up used for thermoplastics to improve its properties, such as heat resistance and flame retarda-



Currently, India's demand for ECH is completely met by imports (100%) from Thailand, Indonesia, Korea, etc. MFL is aiming to develop a state-of-the-art, world-class R&D centre that will help the company identify new molecules in the Chlorotoluene eco-system.

tion, making it the best building component for developing and manufacturing pipes.

As per Bonafide Research, the Indian plastic pipe segment is expected to grow at a CAGR of more than 13% for the next five years. Today CPVC based pipes are used as hot water pipes in houses & buildings and industrial applications due to their temperature resistance property. Globally many countries use it in fire line applications also. Currently, India imports 95% of its demand for CPVC from countries such as Thailand, Japan, China, Korea, etc.

Meghmani Finechem Limited (MFL), a chemical manufacturer in its promise aligned with the 'Make in India' initiative is also an industry-first to manufacture several of these important chemical compounds that need to be imported from overseas. The company leads by example when they announced to set up a sustainable manufacturing plant in India to manufacture ECH at its factory at Dahej in Gujarat. There is a huge potential for an ECH manufacturing hub in India, with around 75,000 tonnes of ECH on annual consumption and India imports all of its ECH requirements. To be able to compete on a global level and make India a global manufacturing hub, Indian chemical manufacturers need to take notice and manufacture compounds such as ECH, which are completely being imported from overseas, thus reducing overheads, shipping costs and retaining the domestic currency and balance of payments. Meghmani Finechem towards this initiative has set aside a Capex of Rs. 275 crore.

Additionally, the manufacturing plant will be using the Glycerol process where its major raw material (Glycerin) is based on a renewable resource. Thus leading the dialogue for creating 'Make in India' while remaining sustainable, environment-friendly and carbon-neutral. It's been a long time due, that manufacturing companies introspected their processes and opted for alternatives that are carbon-neutral, environment-friendly, and sustainable for future generations.

CPVC resin holds a very important role in the piping and plastics manufacturing industry. With almost 95% imports from over-

seas, the need of the hour for the Indian chemical and manufacturing industry is to build manufacturing capabilities to produce CPVC resin in India and compete on a global scale. Meghmani Finechem had announced a forward-integration initiative to manufacture CPVC resin at its Dahej manufacturing unit. The unit will be functional within a couple of months and will have a capacity of over 30,000 MT. This will be the largest CPVC resin manufacturing plant in India and will aim to curb the imports and dependency on imports for meeting CPVC resin demands. This is one of the several key initiatives by the organization in addition to the announcement of the sustainable ECH manufacturing initiative. To en-



rich its enterprise value, MFL is continuously moving with its planned expansion projects and adding value through forward integration. The company's expansion into the chlorotoluene and its value chain is yet an example of Indian chemical manufacturers making leaps into the global value chain. The Rs. 180 crore project is the first plant in India into toluene chlorination and will produce pharmaceutical and agrochemical intermediates. Indian Chlorotoluenes and its value chain demand are fulfilled through imports and hence, this facility will cater to the requirement for domestic and export markets.

In today's world, it is essential to be fully integrated complex, Meghmani Finechem has over the past few years have entered into value-added derivative products which strengthened its fully integrated complex and by further entering into ECH, CPVC and Chlorotoluene and its value chain, the company is further



strengthening its position as fully integrated complex, as part of the raw material required for these products are available within the plant itself. This brings efficiency to the plant, helps to improve margins, and creates value for its stakeholders. Also, MFL has done various Capex in the past for adding value-added products, MFL has always remained efficient in completing the projects on time and using the best and latest technology.

Parallely, MFL is aiming to develop a state-of-the-art, world-class R&D centre that will help the company identify new molecules in the Chlorotoluene eco-system and further strengthen the fully integrated facility. This investment in the R&D centre will be the foundation for the next phase of growth of the specialty chemical market. The facility will be set up at Changodar, Ahmedabad.

For India to be sustainable and be a global manufacturing hub in the chemical manufacturing space, a series of initiatives need to be undertaken by the government and private entities. For starters, the chemical industry needs to be recognized and incentivized by the government, like the case of the pharmaceutical industry. Additionally, having a consistent model of power and energy would go a long way in powering up the chemical industry. For Instance, different states have different DISCOMs, different power compliance policies and grids. For chemical companies to manufacture sustainably and remain carbon-efficient, the need of the hour is to create a consistent power distribution ecosystem throughout the country. This should also be reflective on special economic zones, industrial belts such as the Gujarat PCPIR (Petroleum, Chemicals and Petrochemicals Investment Region) i.e. the Dahej, Bharuch region. Capitalizing, incentivizing and ensuring seamless energy and power supply, infrastructure deployment within these regions is an initiative that will go a long way in encouraging companies to invest, manufacture and help India realize its potential as a global manufacturing hub. ■



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SPECIALTY CHEMICALS: POISED FOR QUANTUM LEAP

Integral to India's economic surge and its aspirations to become a global manufacturing hub by fulfilling end-consumer needs



SHOBHIT AGGARWAL
CHIEF STRATEGY OFFICER,
GLOBAL CHEMICALS,
FASHION YARN & INSULATORS
ADITYA BIRLA GROUP

India's specialty chemicals sector has been playing a pivotal role in driving the chemical industry's growth. It constitutes approximately 20% of the total chemicals market in India by value. India is emerging as a preferred manufacturing hub including contract and custom synthesis for specialty chemicals both for domestic as well as export markets. Indian specialty chemicals industry is expected to grow 11-12% to reach an estimated USD 64 bn by 2025. Further, it is expected to provide an opportunity of an additional USD 60 bn across specialty chemicals segments over the next 8-10 years.

The numbers are big but what makes specialty chemicals a segment to watch out for is the role it plays in enabling India's advances in megatrend industries such as nutrition and wellness, hygiene and personal care, water treatment, lightweight vehicles (including EVs) and renewables.

In order to capitalize this growth potential, Indian specialty chemical companies need to ride the wave of evolving trends by servicing newer sectors, venturing into new chemistries. Industry also need to adopt new ways of doing business with emphasis on collaborations and digitization.

EVOLUTION OF A REVOLUTION

Interestingly, India accounts for 16% of dye specialty chemicals globally, but we are

still less than 5% of the overall global specialty chemical pie. The reason for this is India has always focused on a restricted range of traditional segments like agrochemicals, pharma and textiles to some extent. However, other markets have ventured into segments like automotive, polymers, food, nutrition, life science, defense, etc. increasing the pie of the specialty chemicals.

There is an ongoing evolution towards sustainable products and processes, circular economy and end of life material recovery. Thus, the chemicals industry is witnessing an increasing scope of servicing new sectors with products and solutions, with an increasing need for specialty chemicals and materials.

The Indian industry today will thus evolve to capitalize on the larger trends at play to move synchronously with global companies. This will lead to a surge of new chemistries that will flow into India and being offered by Indian chemical companies, which were conventionally the bastion of only the major international players.

Indian specialty chemical companies will need to adopt to these changing requirements with strong technology support, investment in research & development, identification of customer needs and focused customer collaboration.



COLLABORATION WITH THE STAKEHOLDERS

As complexity and sophistication enters the downstream industries and consumer demand for contemporary products and technology grows, the customers of downstream industries would look at the Indian industry to provide not just products but robust solutions.

Through active collaboration with the value chain, Indian companies will need to start thinking of solutions that will impact the entire downstream ecosystem – make processes more efficient and products more sustainable. This would need increased R&D, innovation and application development. For instance, mobility ecosystems of the future involving fleets of autonomous and electric vehicles, will require a whole new range of materials and specialty chemicals to pro-

duce everything from custom-made interiors, lightweight materials and batteries, to simplified powertrains.

At Aditya Birla Group's Advanced Materials business, we are witnessing enhanced collaboration with customers for developing green and sustainable technology. For example, by using our pioneering technology platform 'Recyclamine', a non-recyclable epoxy thermosets can now be recycled, and material additives can be salvaged. This technology can be applicable across industries like wind, automobiles, sports equipment, and other segments. It will not be long before India adopts these technologies in a major way.

Besides collaboration with customers, strategic partnerships with global players and complementary domestic players will help in creating a sustainable large scale business by leveraging each other's capabilities and synergies e.g. Grasim Industries Ltd, Chemicals Division announced a partnership with Lubrizol for setting up largest CPVC plant in India

DIGITAL DISRUPTION

Digital, undoubtedly, will be one of the key drivers of our future. From process automation, digital simulation, artificial intelligence, predictive analytics and preventive digital interventions, today's chemical companies are exploring technologies that drive efficiency, quality and cost optimization.

Given the pressure on the margins (especially in contract manufacturing), specialty companies will require to adopt digital solutions in the areas of manufacturing efficiencies for cost reduction, online product information and sales portals, supply chain optimization, etc. The holistic adoption of digitalization by the chemical 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 par-



India accounts for 16% of dye specialty chemicals globally, but we are still less than 5% of the overall global specialty chemical pie.



allel experimentation supported by data analytics, can help companies respond faster. There is a potential for a 3-5% improvement in return on sales through digital deployment in production operations. Digital-enabled initiatives in marketing and sales could further improve the industry's average ROS by 2-4%.

Combining a digital channel with process digitisation will create an improved customer experience, while lowering the cost to serve. Digitisation can also improve safe operations by ensuring compliance, creating digital workflows, facilitating critical communications, keeping track of key performance indicators, etc.

Yet another area of impact would be traceability of products and solutions globally. This would enable assurance to user industry segments on quality and specifications of chemicals and materials when being used in critical manufacturing and products with high sensitivity. This can be extended

even for end consumers, in areas such as food, fabrics, and construction materials.

Global specialty chemical companies have already started investing significantly in digitization, e.g., a European specialty chemical major invested Euro ~100 million in digitalization as early as 5 years ago. Another major specialty chemical major has implemented an integrated approach to digitizing R&D with focus on data science and connected knowledge systems.

Companies need to have a clear roadmap to establish an accommodating culture that promotes flexibility and learning. There is a need to develop a complete ecosystem for the adoption of digitalization.

LOOKING BEYOND CHINA

The global pandemic and the subsequent disruptive impact have encouraged many companies to de-risk their supply chains. Increased dependence on a single manufacturing source, rising costs in China and growing



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US–China competition, stringent environment, and compliance costs, etc. have created vulnerabilities which have driven firms to diversify supply chains outside of China.

India is uniquely positioned to benefit as MNCs increasingly adopting 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. Today, the Indian Government allows 100% FDI in chemicals, and has plans for Production Linked Incentive schemes in the Chemicals sector.

With this shift from manufacturing out of China, India is already becoming a preferred manufacturing hub for many specialty chemicals segments e.g. agrochemicals and its intermediates (also supported by domestic consumption growth). India has already witnessed modest benefits from the trade diversification with sectors such as textile, specialty chemi-

cals, and electronics that have been tipped to register significant growth.

Additionally, the concept of distributed manufacturing systems is increasingly becoming attractive for manufacturers. Moving from a single-country dominant manufacturing set up to a multi-country operation is being looked upon as way of mitigating risks associated with global supply chain disruptions and political headwinds. This of course is a business choice more complex than a mere manufacturing set-up as it's a tradeoff between a reliable supply chain versus scale benefits. For the Indian specialty chemicals player with global aspirations, this can be the potential way forward.



THE ROAD AHEAD

A consistent value creator, India's chemical sector remains an attractive hub of opportunities. The sector has created great wealth

for investors in the past and stocks of many specialty companies have risen manifold. Robust demand across end-user industries led by rising domestic consumption, strong export growth and rising import substitution are expected to be primary growth drivers for the chemical sector.

Several factors will play a significant role in India's growth story. With global oil and gas majors looking for downstream chemical opportunities, it could increase the focus on petrochemicals leading to higher investment in the sector which could ease feedstock challenges and boost self-sufficiency.

The demand environment is also expected to be favourable, with volume uptick across end-user industries led by rising domestic consumption, the push for self-sufficiency leading to potential import substitution and higher exports. 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 demand.

To sum up, the fast paced growth of the Indian Specialty Chemical industry is inevitable. This growth trajectory will witness a transition to specialty materials as user industries evolve. The specialty chemicals are reshaping the future of India's economic landscape with a renewed approach to products and solutions, and if India's demands and megatrends emerges real, the specialty chemicals industry will need to further gear up, may be faster than we would imagine. ■

India is uniquely positioned to benefit as MNCs increasingly adopting 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.





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INDIA GLYCOLS: MILES AHEAD IN SUSTAINABILITY

IGL will not only be the provider of import substitutes of Bio-specialties (specialty chemicals of minimum carbon footprint and extraordinary performance) but it will also become a resource point of quality products for net zero goals



PROF. DR. R. K. KHANDAL
PRESIDENT, R&D AND
BUSINESS DEVELOPMENT
INDIA GLYCOLS LIMITED



V. P. JOSHI
HEAD, R&D
INDIA GLYCOLS LIMITED

India Glycols Limited (IGL), a pioneer in renewable chemicals, is an example of success through innovations and green technology employed to produce chemicals having low carbon footprint, based on life cycle analysis, completely bio-degradable derived from renewable resources including agricultural wastes and alternatives to those derived from fossil resources. The success story of IGL can be attributed to six main factors: Remaining ahead of its time; Highly diversified product range; Several firsts to its credit; JV with Clariant International; Reliable source for quality products; and Future growth path.

Remaining ahead of its time: The global chemical industry has come full circle. In the last hundred years; those who were going for synthetic chemicals, at one time, from fossil resources have started looking for renewable resources. Four decades ago, when world-scale production capacities of

mono-ethylene glycol (MEG), a monomer for polyester, were being set up in India, M. L. Bhartia, the founder chairman of Bhartia group, took a visionary decision to set up a relatively smaller size plant to manufacture MEG through renewable resources i.e. sugarcane molasses. Today, the whole world is looking for chemicals, including MEG from bio-resources, thereby replacing fossil resources.

IGL, a public limited company, is one of the leading companies of 'Bhartia Group'. Located at Kashipur in Uttarakhand, IGL was established in November 1983 with a mandate of producing high quality products derived from renewable resources. Designing and innovations for new products, processes and technologies, had been the driving forces for sustainability. Novel chemistries based on renewable resources have been the main focus area for the state-of-the-art of R&D in IGL.



The products are being developed keeping in mind the aim of providing indigenous products for different industry sectors, by using local resources, while matching with global standards of quality. As an R&D driven organization, remaining always ahead of its time, IGL

has emerged as a leading manufacturer of Bio-Glycols, Bio-Ethylene Oxide, Bio-Glycol Ethers, Bio-Surfactants, Bio-Polymers, and performance chemicals with the distinction of being the first and the only company of its kind in the world, manufacturing bio-based performance chemicals adopting green technology. The company has a vast product range that covers a wide variety of specialty chemicals and herbal products such as nu-

traceuticals, phytochemicals, bio-polymers including Guar Gum, industrial gases and liquor. User industries prefer products of IGL because they have significantly low carbon footprint.

IGL has several firsts to its credit including the state-of-the-art of manufacturing of derivatives of bio-polymers like Guar Gum. "Ennature Biopharma" Division, a 100% EOU unit which is GMP compliant, HACCP and CEP approved, established in 2008 at Dehradun, Uttarakhand, makes IGL as the leading manufacturer of nutraceuticals, APIs, etc., adopting green technology of Highly Selective Supercritical Fluid Extraction (SCFE-CO2).

Graduating from being a manufacturer



of bio-specialties, IGL has now become the first and the only one to produce specialties derived from C-smart resources (from emitted carbon), which became possible due to tripartite agreement with LanzaTech and Unilever. A couple of years ago, coming up with the concept of carbon rainbow, management of Unilever decided to replace all ingredients derived from fossil resources, of their key products for cleaning application, by surfac-



IGL has now become the first and the only one to produce specialties derived from C-smart resources (from emitted carbon), which became possible due to tripartite agreement with LanzaTech and Unilever.



tants made out of purple alcohol (C-smart alcohol as per LanzaTech) produced using novel technology of absorbing emitted carbon. U. S. Bhartia, known for nurturing innovations, supported this idea of converting purple alcohol into a range of purple surfactants and poly glycols at IGL. As a result of this, several new age products could be launched by Unilever at global level.

IGL also manufactured MEG from C-smart alcohol which was used to launch polyester fibre of the next generation by a leading manufacturer, Lululemon. Success of this trend-setting achievement of this tripartite cooperation will certainly pave the way for the global chemical industry to use such products, while targeting to be net zero, in near future. This will be rated as an innova-



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tion of the highest order, enabling industry to replace products derived from fossil resources by chemicals from waste: IGL remains ahead of its time and would always be known for the above innovations.

Highly diversified product range: From its name, IGL, it is not easy to make an idea about its product range. To begin with, it started with 60 MT per day of MEG. Today, its installed capacity is 600 MT/day of equivalent MEG. Started manufacturing bio-ethylene oxide (EO) and bio-EO derivatives (EODs) in 1995. World scale plant of bio-glycol ethers was the next product range added. Since Nitrogen and Oxygen happened to be the key raw materials for MEG etc., IGL became the leading manufacturer of various gases including Argon, Nitrogen, and Oxygen. IGL supplied medical Oxygen during COVID pandemic to save lives. Food grade CO₂ is being made from the fermentation process in distilleries. The mixture of CO₂ and EO in different ratios is a popular product of IGL for sterilization of Bio-medicines. Expansion in production of alcohol followed by Extra Neutral Alcohol (ENA) was the obvious reason behind launching a range of



IGL is well placed to become the leading manufacturer of a large number of products that will have potential to replace conventional products derived from fossil resources.

ethanol along with DST, Government of India; and produced purple surfactants.

JV of IGL and Clariant International Limited: IGL formed a JV with Clariant International Limited (51% share) in July 2021. The JV known as a Clariant IGL Specialty Chemicals Private Limited (CISCPL) has emerged as a unique set-up having strengths and capabilities of the two lead-



Accreditations of ISO, NABL and Registrations of REACH, Halal, Kosher etc. make IGL as a reliable and preferred supplier by the customers, across the globe. Products of IGL enjoy the confidence of user industry sectors such as agrochemicals, textiles, EP-paints, oil & gas, pharmaceuticals, home and personal care, construction, fertilizer, lubricants, automotive, etc. The installed capacity of IGL is around 550,000 MTPA of various products. IGL exports 30% of its products, fetching several awards.

Future growth path: Future of IGL is certainly very bright. Having several key starting materials at its hand, IGL is well placed to become the leading manufacturer of a large number of products that will have potential to replace conventional products derived from fossil resources. A significantly high capacity of key starting materials: Bio-ethylene; Bio-EO; Ethanol; CO₂; N₂; and O₂, IGL is poised to exploit these starting materials for several new chemistries. There will be possibilities of a variety of products produced by IGL to replace conventional ingredients derived from fossil-resource. Thus, IGL will not only be the provider of import substitutes of Bio-specialties (specialty chemicals of minimum carbon footprint and extraordinary performance) but it will also become a resource point of quality products for net zero goals. It would be appropriate to say that IGL today is the perfect example of "Make-in-India", while helping the cause of benefiting farmers, through the indigenous product design capability of IGL, R&D. In future, IGL will be a trustworthy partner for those dedicated to net zero. ■



products for the liquor industry. EODs and their value-added products, being made by JV now, made the product range of specialties really huge. From this, it is evident that the growth path has been a real challenge but IGL converted that into opportunity through innovations.

Several firsts to its credit: IGL has always been unique in its approach, being different from conventional ways, it stood out as an example for others to emulate. Besides being the first manufacturer and exporter of several bio-based products in the world, IGL also has the following to its credit being the first in the world: Supplier of bio-MEG so that Coca Cola could launch their beverages in "plant bottle"; Supplier bio-MEG to several leading manufacturers of polyester used for packing of food and pharmaceutical products; Supported demonstration of technology for 2G

ing companies dedicating themselves for the noble cause of environment-friendly green chemistry including Bio-based surfactants, in the world. The JV will be a dependable source of bio-based EODs for various Industries across the world.

Reliable source for quality products: All facilities of IGL are equipped with state-of-the-art technologies of manufacturing and plant operations undertaken with the best of systems designed to ensure standards of safety of equipment, manpower, and environment. The Distributed Control System (DCS) in the plants has been in place from the very beginning so that the products are uniform, consistent, and high quality. All facilities have been approved and certified by ISO 9001; ISO14001; ISO 22000; OHSAS 18001; FSSC 22000; SA 8000; ISO 50001.



Apcotex NBR Powder



Apcotex NBR Polyblend



Apcotex NBR Latex for Gloves

Apcotex High Styrene Rubber



Apcotex NBR Bale



Apcotex VP Latex

Apcotex NBR Latex

Apcotex Industries Limited is currently the market leader in India in the field of Synthetic Rubbers (NBR & HSR) and Synthetic Latexes (XSB Latex, VP latex, Acrylic latex, Nitrile latex etc).

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COROMANDEL: GEARING UP FOR EXPANSION

The company is planning for a multipurpose plant for the manufacturing of more technical items which will enhance its presence in key chemistries and enhance its portfolio

The global agrochemical industry has managed to register a steady growth despite the many challenges over the last two years. Albeit the multiple avatars of COVID along with the ongoing geo-political challenges, viz. Ukraine-Russia war, and the US-China trade war, have posed as major concerns globally, the world has continued to steadfastly recover and rebuild itself. An important thing to take note of is that the focus for most economies has been realigned from 'One Global Market' to fostering and strengthening regional blocks and domestic markets. As a result, the governments across the globe have been prioritising to bolster their own national food and energy security, and self-sufficiency.

Governments of major economies have been focusing on building strong internal ecosystems that can support their GDP growth ambitions, with minimal reliance on external factors. The Indian government has been proactively supporting the manufacturing industry.

The Indian government is addressing these challenges through multiple measures to encourage the growth of agrochemical manufacturing in the country. One of the key preambles in the recent budget discussions

was working towards an 'Atmanirbhar Bharat' supported by the Make in India initiative. The emphasis was on veering the role of India in the global supply chain:

- From a raw material supplier to a value-added product supplier – To reduce the exports of our natural resources and import back the value-added products. Instead, we need to focus on boosting the exports of the value-added products.
- Shift from being looked at as a "Consumer Economy" to a balanced "Producer - Consumer economy".

Both these role-shifts will primarily pivot on the Make in India initiative supported by the thrust on the PLI (Production Linked Incentive) scheme. This initiative has been proposed with the vision of further underpinning the establishment of an ecosystem which is conducive to growth in the manufacturing sector along with the growth of MSMEs, supported by investments by large-scale enterprises and Public Private Partnership (PPP) projects. The initiatives discussed in the recent budget are centred around the objective of increasing the contribution of the manufacturing sector to the

nation's GDP from what is currently 15%. India's large young working population, in addition to our natural resources which can be used as raw material bases, are few of the many valuable assets that we need to leverage.

Furthermore, the Prime Minister has proposed a 'Zero Defect and Zero Effect' Ideology. Zero Defect – High quality compliance and zero defects of the goods manufactured in the country. Zero Effect – Least impact on the environment from effluents and emissions from the manufacturing sector.

The government is committed to building the capabilities to support the regional manufacturing ecosystem through several investments in logistics capabilities (strengthen rail connectivity to manufacturing hubs), supporting investments in R&D centres (for Innovation and value addition) and SEZ (Special Economic Zones) reforms to boost exports.



HOW COROMANDEL IS PLANNING TO LEVERAGE GROWTH

Ever since its inception, Coromandel has always been committed to the wellbeing of the farming community. The Murugappa Group has always believed in the principle that "What is good for the farmers, is good for the Nation and What is Good for the Nation will be good for us."

Coromandel has a strong presence in the manufacture of Agri inputs including fertilisers and pesticides. We operate several technical and formulations plants in India, producing Active Ingredients and several types of formulations. We provide high quality agrochemicals to Indian farmers and export to global markets as well. We also have a very strong presence in biopesticides manufacturing through our Neem extraction facility in Thyagavalli, Tamil Nadu which is the world's largest plant for Aza extraction.

Driven by the group's vision and the Make in India initiative of the government we

We also have a very strong presence in biopesticides manufacturing through our Neem extraction facility in Thyagavalli, Tamil Nadu which is the world's largest plant for Aza extraction.



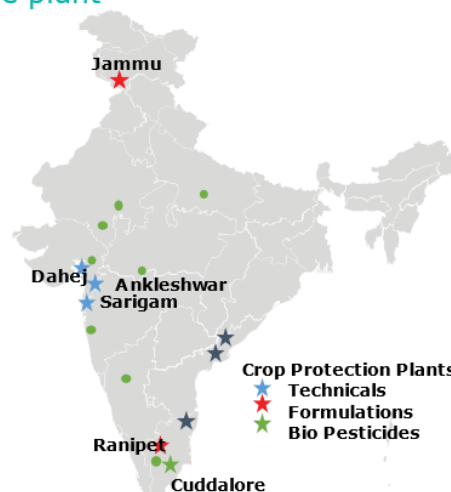
Agrochemical Manufacturing Capabilities



3 Technical Plants | 3 formulation plants | Biopesticide plant

Highlights

- World's Largest manufacturer of Aza
- 3rd Largest manufacturer of Mancozeb
- Reliability, Quality & Safety focus, Low cost
- Significant manufacturing expertise across company and group



continue to take various steps to strengthen our manufacturing footprint across the following areas - Core competitiveness and sustainability.

Cost competitiveness – With a focus to bring down the costs, we have been working on backward integration for key intermediates. We are also improving the conversion efficiencies through automation of critical processes in the plants. In order to bring in consistency in process ops, we are instrumenting and automating the traditional production methods, thereby building safe systems. Flexibility in production is being built-in through development of multi-purpose and multi-product plants.

Sustainability: Sustainability has been a key focus area with several initiatives for greener processes, improved safety, and reliability.

- Investments in environment friendly management systems, state-of-the-art R&D facility that enables the establishment of inherently safer and greener processes.
- Safety in operations through investments in people, process and technology.
- Improved reliability through the standardization of process operations, equipment, and building in appropriate spares in the system.



Coromandel strongly believes in building an organization that is primarily process oriented. Towards this, we have instituted a team for total quality management and business excellence to focus on development of internal processes and systems to keep pace with the ever-growing demands from our customers.

As a result of our continuous efforts and initiatives all our manufacturing sites are well prepared and equipped to handle any situation. This was demonstrated recently when we clocked around 90% production uptime during the COVID pandemic.

The company is planning for a multi-purpose plant for the manufacture of more

technical items which will enhance its presence in key chemistries and enhance its portfolio. We are also considering adding a state-of-the-art formulation facility to aid the increasing demand in Indian and export markets. These initiatives are aligned with the global trends and will contribute to the nation's progress towards becoming an agrochemical manufacturing giant.

Coromandel has always been and will continue to be guided by our group's philosophy that "No man you transact shall lose, then you will not". We believe that these initiatives will help support the farming community both in India and globally, by incorporating cost effective and sustainable solutions to crop protection. ■



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COLOURFUL TIME FOR INDIAN CHEMICALS INDUSTRY

The company has expanded its horizons by setting up a new division - Soujanya Life Sciences for key ingredients in pharmaceuticals and agrochemicals



JASHAN BHUMKAR
DIRECTOR
SOUJANYA COLOR PVT. LIMITED

As a young, third-generation entrepreneur I am often asked how I feel to have come back to India after five years of education abroad, to my family's business, and to the chemical industry. Most people assume I was coerced into joining the business, and are surprised and perplexed when I cheerfully say that being part of the chemicals industry has probably been the only thing I've always been sure of, from as early as I can remember, most likely the age of three!

Just to set the context: Our company, Soujanya Color is a global leader in sustainable colour solutions, in particular liquid preparations of pigments & dyes. The com-

pany was founded by my grandfather Late C. J. Bhumkar about 40 years ago. My mother, Priyamvada Bhumkar has led the company to greater heights; our flagship unit in Mumbai, Asia's largest colour manufacturing plant was set up under her leadership. Today, we are present in 50 countries across 6 continents, and provide colour to various end-use industries including paints & coatings, printing inks, home & personal care, cosmetics, polyurethanes, polymer composites, agro-products (seed coatings, fertilisers, etc.). Indeed, from the time you wake up till the time you go to bed, including the colours of the printed ink of this compendium, we make everything around us colourful.

Through my childhood visiting our factories being carried around them in my grandfather's arms, and through my education in chemical engineering at UC Berkeley and Cambridge University, I've always been fascinated by the chemicals space, I truly believe that the chemicals industry, particularly in India, is going through one of its most exciting phases right now. I would like to dwell on some of the ongoing developments and trends that I believe present tremendous opportunities for the future.

One major trend is the renewed focus on cost consciousness, forcing even some speciality areas to be treated as commodities. Needless to say, the cost pressures can be most obviously attributed to the COVID-19 pandemic with the numerous issues it caused on the supply side. A large number of raw materials were simply not available for weeks or months together. International freight costs at least doubled and in some cases even tripled, making heavy reliance on imported

raw materials almost not an option. With the demand side not slowing down, companies were compelled to respond to these challenges in a variety of innovative ways.

We, at Soujanya, tried to go to the very depth of our core technology of formulating and processing pigment dispersions. We focused on the few things that we could control, and derived cost efficiency from these places. Some of them were more conspicuous – we were able to harmonise some key additives across what we initially thought were vastly different formulations. Some initiatives on the other hand, were more subtle: for example, we started studying in great detail how often-ignored factors such as mixer blade shape, tip speed of a stirrer etc. affect tinting strength of the pigment. We were able to derive remarkable efficiencies just by delving deeper into our expertise and doing what we do best.

While the drive towards cost efficiencies has been extremely strong, the demand for higher and better product performance is ever-increasing too. Seamlessly servicing multiple end-use industries means that companies have to develop a profound understanding of those applications, and the performance of their products in them.

In the colour space, we simultaneously face demands to make some products that are durable for over 15 years and some that are washed off in less than 3 seconds! A yellow pigment used in decorative paints has the natural tendency to fade in sunlight, and has to be treated, stabilised, and formulated accordingly in order for it to withstand UV light and for paint companies to be able to give 10-15 years non-fading guarantees.

On the other hand, a yellow dye used in detergents has the natural tendency to stain the fabric, and therefore must be treated, stabilised, and formulated accordingly so that it does not stain, and is washed off instantly,



ANUPAM RASAYAN INDIA LTD.

without affecting any of the cleaning properties of the detergent.

The expanding focus on and relevance of sustainability has equally presented many opportunities. ESG initiatives have become absolutely essential to operate in today's times. Integrated management system certifications (ISO 9001, 14001, 18001), and audits such as ECOVADIS and Responsible Care have become mandatory to even have a starting conversation with key customers.

On the product side, greener chemistries have taken forefront. We at Soujanya are offering to all our paint industry customers a smooth pour-over transition from conventional colorants for VOC-free drop-in ones across all their point-of-sale tinting machines, at no additional cost. Our VOC-free products for the paint industry are eco-label certified with the GreenPro label from CIL.

The paint industry in India has seen many new entrants with many more slated to come in the next few years, and most of these are launching with VOC-free colorants to begin with. The personal care and cosmetics space is even more interesting on this front, with a growing enthusiasm for natural-sourced, bio-based, and biodegradable ingredients. We are at the moment keenly engaged in R&D to develop stable, scalable and economically viable formulations based on biodegradable and/or natural colorants.

At this time where "disruption" has become a buzzword, and valuations of companies across various sectors are ballooning with "unicorns" becoming more of a norm than a novelty, I see the chemical industry staying put and reaping what I'd like to call "returns on relationships". All of us in the chemical industry know that it takes years to achieve the status of a primary supplier or even that of an alternative. Moreover, we deal with formulations closely tied to our customers' unique technologies, sharing which would be a very sensitive matter.

Having endured years of multiple stringent tests and approval processes, and having delivered quality solutions, companies can cherish the position of being the partner of



choice at all stages of the customers' product life cycles.

We, at Soujanya, can now proudly say that we are the go-to partner for all colour-related needs of our customers, be it a new product launch or a concept-level experiment or a technical improvement in an existing product. Moreover, owing to the faith that they have in our ability to execute and deliver, customers now ask us proactively what else other than colour we can offer or how we can help solve a particular non-colour related problem that they face. The case of a few other companies might better illustrate this point. PI Industries, for instance, has built a hugely successful custom synthesis business. They have made bold Capex moves and have seen them through by ensuring flawless execution along the entire long process. The EBITDA margin of their custom synthesis business now stands consistently above 20%.

Another stark trend in recent times has been the lateral movement of players across segments within the chemicals space. Companies well-regarded as experts in one segment (say pigments or pharma or organic chemicals) have entered other spaces (say pharma or agrochemicals) through both inorganic and organic routes.

Companies that are cash-rich with deeper pockets, and those that have strong focus and capabilities in technology/R&D have been able to navigate and enter higher barrier industries. For example, PI industries

recently acquired Ind Swift Laboratories' API (Active Pharmaceutical Ingredients) division giving them access to a wide portfolio of API products as well as to the target's USFDA-approved facility. On the other hand, Natco Pharma recently made a decision to leverage its R&D capabilities to diversify into the agrochemicals segment, and has already invested a large amount of funds into this initiative.

At Soujanya, we have similarly expanded our horizons by setting up a new division, Soujanya Life Sciences with the aim of being the partner-of-choice for key ingredients in the pharmaceutical and agrochemicals space. The basis of all these changes, I have realised, might lie in the difference between expertise and core competence. We have unmatched expertise in colour because we have done this for forty years, but through it all the core competence we have built is the flawless delivery of complex chemical solutions. Deeply rooted in our core values, we hope to use our capabilities to make a larger impact and eventually make lives better in a more profound way.

Long-lasting relationships, strengthening expertise, bold yet strategic capex moves, a focus on efficiency, differentiating product and service models through enhanced performance and a genuine commitment to sustainability all make the Indian chemicals industry a golden combination of time-tested stability with infectious dynamism. The time is now, and it is indeed a colourful one! ■



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PLANNING NEW PLANTS FOR MANUFACTURING NEW FLUORO ADVANCE INTERMEDIATES

It has started phase-wise commercial production in its new plant located at Jhagadia Industrial Complex in Gujarat



RAVI DESAI
HEAD-SALES
ANUPAM RASAYAN INDIA LIMITED

Anupam Rasayan India Limited is a manufacturer of life science and other specialty chemicals, with its plants located in Sachin industrial region and Jhagadia industrial region of Gujarat state of India. The Company has currently 7 manufacturing sites. The Company is a manufacturer and supplier of a wide range of products from agrochemicals (actives and advanced intermediates), pharmaceutical intermediates, and polymer intermediates to biocides, combining excellent product quality and competitive pricing. Our strength is the multi-step synthesis processes, which is rare in the custom manufacturing industry. The Company has expanded its research and development (“R&D”) centre, to provide impetus in promoting process optimization, enhancing safety, environment sustainability and curtailing the costs.

Despite the ongoing pandemic and its deep impact on supply chains and various facets of the businesses, the Company was

able to keep all of its production and supporting operations running at full capacity due to the adequate safeguards put in place as well as the flexible work practices.

The company performs many chemistries as part of its core strength. Among these chemistries, Fluorination (Halex Reaction) using Potassium Fluoride is a key chemistry, which the Company performs on a very large scale and is a leading player in India with production capacity of 4000 – 5000 MT/Year. It is also expanding the current capacity by adding new Fluorination block with again around 4000 Tons/Year capacity based on the commitments received from customers in Japan, Europe and USA.



The company aims to become an entity recognised worldwide for the quality of its products, technology and ability to work with the complex chemistries. The Company has newly commercialized the following processes: (1) Cryogenic Reaction, (2) Ammoxidation, (3) Sodium Azide Chemistry, (4) Denitro Chlorination, (5) Photo Chlorination, (6) Photo Bromination.

The Indian manufacturer has further also selected the chemical processes like (1) Hoffmann Rearrangement, (2) Cyclopropane Chemistry, (3) Ethylene Oxide Chemistry, (4) Isobutylene Reaction, (5) Chlorination using POCl₃ and PCI₅, (6) Butyl Lithium Chemistry, (7) Pinner Reaction and (8) Vilsmeier Haack Reaction to be implemented in future. In a bid to optimize production processes, the Company is moving from batch production to continuous production in addition to updating its manufacturing equipment and infrastructure. The new R&D centre focuses on plug flow reactors with installations of Corning G1 and G4 advanced flow reactors.

With Tanfac acquisition, Anupam will become one of the rare companies who can manufacture HF/KF, Intermediates based on HF/KF, Advance Intermediates and finally Active Ingredients/End Products therefore offering the value chain and further enhancing the multi-step synthesis capabilities.



The Company is committed to conduct its operations in environmentally sustainable manner, and has been achieving it with the help of zero liquid discharge (ZLD) plants, soil biotechnology, effluent treatment plant, multi-effect evaporators and other such environment pollution control equipment. The Company also plans to invest in renewable energy and further strengthen its effluent control systems.

The company has recently acquired Tanfac Industries Limited (Tanfac). Tanfac is a large-scale manufacture engaged in the manufacturing of Anhydrous Hydrofluoric acid (16000 Tons/Year), Aluminium Fluoride, Potassium Fluoride (2500 Tons/Year), Potassium Bifluoride, Boron Trifluoride Complexes and various other Fluorinating agents.



REACHLAW

COMPLIANCE. SUSTAINABILITY.

Advance Intermediates Anupam is discussing with customers. These products require lot of technology know-how therefore they are not manufactured in India and Anupam has already developed many of the products for customers. With Tanfac acquisition, Anupam will become one of the rare companies who can manufacture HF/KF, Intermediates based on HF/KF, Advance Intermediates and finally Active Ingredients/End Products therefore offering the value chain and further enhancing the multi-step synthesis capabilities.

It has started phase-wise commercial production in its new plant located at Jhagadia industrial complex in Gujarat; upon commercialisation of the entire plant the combined production capacity of the Company will become more than 40,000 MT/PA.

Anupam is in trade negotiations with various Japanese Agrochemical, Pharmaceutical and Polymer manufacturing companies and, in addition, hopes that Japanese industry will be keen to use its new intermediates and AIs for use in the production of high-performance polymers, resins, agrochemicals and pharmaceuticals. ■

As Anupam is largest consumer of Potassium Fluoride, Tanfac is strategical acquisition for Anupam giving access to our own HF and KF. Anupam is already large scale manufacture of Fluorination using KF and with this acquisition, Anupam plans to starting Fluorination using HF therefore this will catapult Anupam in a new phase of products which are not manufactured in India.

Anupam plans to expand Tanfac's HF and KF capacities to support Anupam's new products which are Intermediates &

Advance Intermediates Anupam is working for leading customers in Japan, Europe and USA. The products Anupam is working will be consumed in Agrochemicals, Pharmaceuticals and Polymers (Fluoro Elastomers and Fluoro Electrolytes) which will be supported by In-house HF and KF from Tanfac. Please find below the strategy Anupam is working on for Tanfac and Anupam:

Along with expanding HF and KF capacities at Tanfac, Anupam also plans to build new plants for manufacturing new Fluoro



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SPECIALTY CHEMICALS: THE NEXT SUNSHINE INDUSTRY

Having emerged as a strong alternative to China, Indian specialty chemicals industry could have a clear edge albeit promising policies and diversification by key players



M. P. AGGARWAL
PROMOTER
SAJJAN INDIA LIMITED

In the last couple of years, the specialty chemicals business in India has garnered a lot of positive attention due to its enormous potential. As a matter of fact, most of the experts would agree that the biggest export opportunity for the Indian chemical industry lies in specialties.

The sector has witnessed healthy revenue growth during FY2021 and has largely bucked the adverse impact of COVID-19. The growth trend has continued in the current fiscal also, although the profit margins are expected to witness some moderation due to sharp increase in feedstock prices, while remaining healthy. In the medium term, while relatively mature segments like agro chemicals, dyes and pigments etc. are expected to have moderate growth of 7-8% per annum, segments like construction chemicals and fluorochemicals are expected to have higher growth.

If we look at various reports, the global market for specialty chemicals is anywhere between US\$ 750 to US\$ 800 billion. Growing at 16% CAGR, it is expected to reach

about US\$ 1000 billion by 2025. In India where US\$ 32 billion specialty chemicals constitute 22% of the total chemicals and petrochemicals market, this niche industry is expected to be US\$ 64 billion strong by 2025.

While the exports at just around 4% might look dismal as compared to China that has around 15% of the market, there is a positive outlook about demand for specialty chemicals growing at a 12% CAGR. A revival in domestic demand and robust exports could spur a considerable increase in the capex of specialty chemicals manufacturers. Market experts are predicting revenue growth of 19-20% in FY 2022, up from 9-10% in FY 2021, owing to the recovery in domestic demand and higher realisations owing to rising crude oil prices and better exports.

DRIVING FACTORS

Specialty chemicals are low-volume, high-value products used in a large number of consumer-facing sectors. These are value added products targeting specific applications, which entails relatively high research and development investment. Some of the key specialty chemical segments are agrochemicals, dyes and pigments, surfactants, flavors and fragrances, fluorochemicals, construction chemicals, and water chemicals. The industry has a mix of organized and unorganized players, with segments like agrochemicals and dyes and pigments having several large players, who have scaled up over the years, while other segments have relatively few large players.

Specialty chemicals industry in India has been deriving almost equal revenue from exports and domestic sales. But that might change soon as China has been losing its cost-competitiveness of late owing to in-



Specialty chemicals industry in India has been deriving almost equal revenue from exports and domestic sales. But that might change soon as China has been losing its cost-competitiveness.



creased environmental costs and reduced government sops. There is a strong possibility that Indian industry will outpace its Chinese counterpart and double its share in the global market to 6% by 2026 from 3-4% in fiscal 2021. This, along with pandemic-induced disruptions, has forced customers to diversify their supplier base. India, with its cost-competitive manufacturing and technical expertise, is well set to seize the opportunity. Additionally, the cost-plus pricing model of Indian players is likely to minimize the impact of the sharp increase in raw material prices this year. Raw materials such as benzene, ethylene and toluene, which are crude derivatives, form around 55% of the overall cost structure. Raw material prices are also expected to remain elevated in the near term due to the ongoing Russia-Ukraine war. However, downside risk to operating profitability is limited given players' ability to pass on cost increases, though with a lag of a few weeks.

There are certain challenges which need to be addressed to leverage the opportunities, like high dependence on imported feedstock, lack of scale, increasing environmental regulatory requirements, and low R&D spend. The good news is that many of these issues are being addressed backed by industry initiatives and government policies. Several recent measures including rationalization of duties on feedstock, trade protection steps including both tariff and non-tariff measures for several chemicals, and support for cluster-based development approach through plastic parks and revised PCPIR (Petroleum, Chemicals and Petrochemicals Investment Region) policy, should aid in increasing domestic feedstock capacity and reduce import dependence in the medium term.

The future growth will be powered by two ingredients – strong tailwinds in exports due a shift in global supply chain driven by the China+1 policy of vendors and demand recovery in domestic end-user segments. Meanwhile, resurgence in demand has



spurred players to ramp up their capacity expansion plans.

Existing players like Sajjan India, ISO-9001, 14001, 45001 certified, a leading contract manufacturer with expertise in large scale production of Active Ingredients, Intermediates and specialty chemicals that have a proven track record, and which can handle complex reactions, multiple step chemical processes and hazardous raw materials are witnessing encouraging opportunities. With the experience we have gained over the period of time and the fantastic team we have created; we see ourselves being able to perform very efficiently to the satisfaction of our foreign partners. With 40+ years of strong business associations with global multinationals, the company has been actively contributing to the growth of the sector. We have two Unit – Unit 1 have five plants and Unit 2 have 1st plant is under commissioning and the production is going to start by end of April'22 and 2nd plant building is ready for the new products.

With a total installed capacity of 12,500 TPA and reactors primarily in the range of 12-25 kl. Having signed more than 100 CDAs of the products, the company has maintained quality consistency and quick adaptation to

more stringent specifications with utmost focus on Environment, Health and Safety. Being a zero-debt company, we are in extremely financially strong position to invest significant capital for new potential opportunities. As a results of process optimization and de-bottlenecking, we have reasonable capacity available to grab new opportunities/products and ensure quick scale-up.

OUTLOOK

While currently, the per capita consumption of specialty chemicals is low, it is expected to grow in the medium term driven by changes in consumption patterns, economic growth, expanding middle class and adoption of global practices by consumers and industry. Further, there is significant export opportunity, which will be further supported by the supply chain diversification trend adopted by global chemical majors under the "China+1" strategy. The above factors coupled with some of the advantages like availability of low cost and skilled labor, established relationship with global players in several specialty sub segments, favorable intellectual property rights (IPR) policies and government policies like 'Atmanirbhar Bharat' and 'Make in India' should drive multi-year growth for the sector.



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With focus on increasing domestic manufacturing further favorable policy measures are expected for the chemical sector, which includes further rectification of anomalies in duty structure and expansion of trade protection measures, fiscal incentives for infrastructure additions and policies and support for better ESG compliance and registration of products for export. Making the supply chain more robust, announcement of Production Linked Incentive (PLI) scheme and taxation benefits for this industry are necessary to make our country more attractive as a manufacturing destination.

Apart from the government initiatives, the industry has also been scaling up and increasing R&D investments. The larger players in the organized sector have scaled up through both organic and inorganic routes, including acquisition of overseas entities or domestic units of MNCs. The drivers for M&A include portfolio expansion, technology absorption, new market entry and scaling up of size. The sector is currently in the midst of a capex cycle and several companies have raised funds through



IPO or from private equity investors to support the capex. A sizable portion of this spend will be for backward integration, import substitution, and to meet increased demand for exports. Healthy cash generation will keep reliance on incremental debt to fund capex and working capital low, helping improve credit profiles. It would be highly prudent for the industry to now look for bigger markets such as automotives, electronics, feed, nutraceuticals, aerospace and defense industries.

On its part, industry should have a clear focus on sustainability and reduc-

tion in environmental footprint, making specialty chemicals safe for consumers. To bring finance and more efficiency, we need to create value for the products and make them more valuable for the end users. Moving on a bit from conventional route of contract manufacturing, we now need to accelerate our innovation efforts, file more patents and ensure close coordination between industry and academia. It is also a high time that the specialty chemical companies pay due attention to their downstream portfolio. The focus should be to become the solution partners of value. ■





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EMBRACING SUSTAINABILITY TO EMBRACE GROWTH

The company adheres to sustainable manufacturing practices and embraces sustainability and eco-friendliness across its business operations



SUNIL CHARI
CO-FOUNDER & MANAGING DIRECTOR
ROSSARI BIOTECH LIMITED

Our surroundings have gone through a significant change lately with temperature rising across the globe resulting in extreme weather conditions. This has resulted in emphasis on the role of sustainability for the success of any business. In order to achieve an environmentally sustainable future, companies need to adopt a joint approach. It involves collaboration between their business goals, employees and consumers towards environment protection. The Covid-19 pandemic has further acted as a catalyst for innovation with companies and brands focusing on sustainability and reconsidering the way they conduct businesses and how they interact with the surroundings.

GROWING IMPORTANCE OF ESG

As consumption of natural resources increase at alarming rates, protecting and preserving environment should become a prominent part of every organization's survival strategy. Mindful of their responsibility towards the environment, compa-

nies need to take measures to reduce the environmental impact of their business and operations. It is imperative for companies to focus on reducing their carbon footprint without compromising product performance or customer comfort. This holds true especially for the chemicals sector, which can become a major source of pollution if the waste materials are not effectively managed. India has a vibrant chemicals market that is rapidly growing in size and geography, while simultaneously demanding resources and energy. With such a drastic growth, there is a strong need for sustainable chemistry which can reduce the environmental impact. As a wide range of specialty chemicals gain traction in domestic and international markets and present a massive growth opportunity, it is crucial that specialty chemical manufacturers make sustainable chemistry their number one priority.

Brands need to actively start looking at sustainability as an important component of their corporate strategy. They need to understand that it might not result in immediate tangible benefits but may have considerable positive effects in the longer term. They need to be cognizant of the fact that their overall business goal should go beyond pleasing institutional shareholders, and thus building a strong brand reputation. With Environment, Social, and Governance (ESG) becoming an important success parameter for investors and customers, growing a sustainable business can offer benefits like reaching out to attract a large pool of capital, build a stronger corporate brand and promoting a robust long-term growth, benefiting companies and investors.

Another benefit is improved brand reputation among today's modern consumers.

Modern day consumers are well-aware and want to invest in brands that resonate best with their values, thereby providing additional incentive to businesses to adopt sustainability to boost sales. A good product is not good enough to win over Millennials and Gen Z who are making buying decisions based on social responsibility, inclusiveness or environmental impact shown by a brand. Brands that are committed to a sustainable goal and their actions such as commissioning a greenfield manufacturing unit that ensures zero discharge of harmful chemicals are well appreciated by consumers.

SPECIALTY CHEMICALS COMPANIES CAN ADOPT SUSTAINABILITY

Over the years, sustainability has evolved from being fringe initiatives or merely complying with regulators and dealing with NGOs to becoming a much-discussed topic in boardrooms. This is mainly due to the customers and investors being more concerned about the need to protect resources and thereby grow in a sustainable manner. The specialty chemicals industry can imbibe sustainability at every stage through innovative design, creation, processing, use and disposal of substances. Embracing sustainability initiatives will help achieve environmental and societal needs without compromising the future of our planet Earth.

A lot of specialty chemical companies make the mistake of causing severe wastage and pollution in the race to produce finished materials in the cheapest and fastest possible way. However, this is not sustainable from a long term environmental as well as business perspective. In order to bring about some real impact, sustainability needs to be made a strategic priority by specialty chemical companies. The



objective should be to deliver tailor made, eco-friendly, and cost-neutral products, and penetrate deeper into new consumer segments and categories. The emphasis should be on providing chemical solutions that promote a cleaner, healthier and more efficient world, and ensure optimum eco-efficiency in everything they do.

To be successful, the industry needs to adopt a green ethos and focus on replacing legacy harmful products with environmentally benign chemical products and processes across businesses, products, and verticals.

Specialty chemical companies must also focus on being a contributor to the Zero Discharge of Hazardous Chemicals (ZDHC) practices, which support the implementation of sustainable chemistry and best practices to protect the consumers, workers and the environment. They must be committed and steadfast towards adhering to ZDHC norms, ensuring zero discharge of harmful chemicals during manufacturing. The focus must be on harmonizing standards across supply chain by addressing proper chemicals management and promoting safer chemistry. In addition to this there is a need for application of sustainable chemistry in allied industries like textile, personal care, etc. in making their products sustainable and adding to the circle of green ethos.

SUSTAINABLE PRACTICES ADOPTED BY ROSSARI

The company adheres to sustainable manufacturing practices and embraces sustainability and eco-friendliness across its business operations. Both their manufacturing units at Silvassa and Dahej use state-of-the-art technologies, thereby ensuring cleaner and efficient operations. Water consciousness remains at the core of the company's sustainable manufacturing priorities. Both their plants have been certified - Zero Discharge of Hazardous Chemicals Level-3, which reflect a higher confidence that a chemical product meets the Zero Discharge of Hazardous Chemicals MRSL conformance

Levels. In addition, Rossari continues to implement green initiatives like plantation of trees in corporate offices and manufacturing premises, developing and maintaining gardens near factory premises and maintaining green bodies around its plants.

Overall, the company has begun actively monitoring ESG parameters and plan to assess the progress on a regular basis.

CHALLENGES FACED IN IMPLEMENTATION OF SUSTAINABILITY

Sustainable sources of energy are playing a critical role in meeting the world's energy requirement, its role in the future will be a lot more important. Taking note of this fact, policies and standards are required now to ensure the sustainable development of alternate energy across energy intensive businesses. The implementation of sustainable practices comes with its set of challenges like lack of adequate policy frameworks, high initial cost of implementation, lack of funds, adoption of alternate resources etc. Leveraging sustainable energy is the future and the best way to create a more efficient manufacturing facility.

A robust energy setting is the one that uses both fossil fuels and sustainable energy as it poses large opportunities like better energy security, reduced emission of greenhouse gases, and improved access to energy, rural development and poverty eradication. Sustainable energy options can range from either solar, wind, hydro, tidal, geothermal, bioenergy, etc. With a massive shift towards electrification and dependency on solar energy, the specialty chemical sector should adapt to the ongoing energy shift. The renewable sources require one-time investment, are environment friendly and contribute to the "Green Economy".

To ensure that the advantages offset the threats, leading companies should immediately develop and start adopting sustainability for economic, social and environmental considerations. One solution

to this issue is developing a multi-stakeholder process that engages all parties - government, NGOs, farmers and industry leaders that can benefit from such an agreement. Given the regional variances of climates, agriculture and energy needs, regional standards should be developed and refined. Ideally, each level (international, regional, national and local) should introduce sustainability standards for use of renewable energy by means of regulations that are consistent with the other levels.

CONCLUSION

It is imperative to incorporate ESG factors into core strategy which can help deliver long standing value if not instantly, from a long-term perspective. Sustainability and profitability might not go hand in hand initially, but in the long run they prove to be beneficial, considering the finite resources of fuel and ever increasing input costs of ancillaries like power, fuel, etc. Environment and development are the two sides of the same coin and

S O U J A N Y A

the focus must be on mutual growth of both elements, which will prove beneficial for future generations. The

onus is upon us, at individual and organizational levels, to make necessary changes for the betterment of our economy and society.

India's swift economic and industrial growth, along with urbanization, has come at the high cost of growing carbon emissions, rising demand for natural resources and increasing waste generation.

To overcome these challenges and minimize their effects, the manufacturing sector will need to adopt sustainable manufacturing aggressively. A number of areas within manufacturing can benefit greatly from the adoption of green manufacturing practices. While there are a few early adopters, more and more companies and the sector as a whole need to develop comprehensive plans to embark on this journey towards sustainable manufacturing across sectors to make sure that our growth does not have negative impact on our surroundings. ■

OPPORTUNITIES FOR INDIAN CHEMICALS COMPANIES

India has a large pool of skill workers and competitive wage rates while capital expenditure to build plant is also less than developed countries and at par with China



RAJESH TRIPATHI
SENIOR VP - PROJECTS,
ENGINEERING & IT
SRF LIMITED

The chemical industry in India is positioned to capitalize on near-term opportunities. Traditionally, the European Union (EU) and United States (US) were the key chemical hubs globally. Together they contributed nearly 40% of global chemical sales till 2006. However, developing countries started faring better than relatively mature economies of the West. Over the last decade, the core of the chemical industry shifted from the West to Asia, with China being the key benefactor. China's chemicals industries continues to surpass all other nations. This is reflected in rising China's share in global chemical sales, which increased to 37% in 2018.

China's speciality chemicals market has seen a downturn in recent years due to various factors. Most prominent being the introduction of stringent environmental norms, which has led to the shutdown of several

chemical plants. The US–China trade war have also impacted the production growth in China thereby providing an opportunity to the Indian chemical companies to enhance its market share in the global export market. Currently, the penetration of specialty chemicals in the country is lower than the global average. Going forward, with increased focus on improving products, the intensity of specialty chemicals in these end-use domestic markets will rise.

In the past, growth of the specialty chemicals industry in India has been hampered by factors such as presence of small/unorganised players, who could not cater to the growing demand. However, the industry is gradually moving towards consolidation. Thus, with gradual consolidation in the industry as established players slowly showing interest in downstream specialty and other chemicals segments, specialty chemical players would be in a better position to achieve economies of scale.

India is currently the sixth largest manufacturer of chemicals and has consistently been the one of the leading global producers in segments like dyes and pigments, polymers, and agrochemicals. While Indian companies have been leaders in several segments and have been part of the supply chain of most global customers, for investors, the focus was on China and its rapid build-up in chemicals as well as speciality chemicals, which made it integral to global supply chains.

Over the last few years, there has been a gradual shift in the underlying business, driven gradually by China further tightening environmental compliance norms and purchase managers feeling uncomfortable

with extremely high dependence on a single source. In addition, escalating trade tensions between the US and China became a rallying cry for users to look elsewhere, as China became increasingly belligerent with important economies such as the US, Japan, Australia, and India.

Therefore, the global innovators in chemical sectors are interested for the “China Plus One” strategy to enhance supply chain resilience, by diversifying manufacturing activities into other countries. India stands out as an attractive option thanks to its strategic location, a large domestic market, skilled labour, low labour costs, etc. India has a large pool of skilled workers and competitive wage rates while capital expenditure to build plant is also less than developed countries and at par with China.

Over the past few years, the Indian speciality chemicals sector has been on the priority list of most investors, both local and global, and it was getting reflected in the significant re-rating and improved fund-flow seen into the sector. The size of the Indian speciality chemicals sector is expected to increase sharply in coming years and companies look for backward integration and have set up units at scale significantly larger than what they have done in the past.

To take full advantage of the export market, existing players will have to update their product mix and increase speciality chemicals in their portfolio. This also calls for accelerated investments in R&D and government supports at all level.

The companies should support the implementation of products and environment standards for the benefit of the society that will also institutionalize the consumption of





Bodal Chemicals Ltd.
COLOURS. INTEGRATION. INNOVATION.

WE ARE AN EMERGING GLOBAL LEADER IN SPECIALITY CHEMICALS



UNIT VII



CHLOR ALKALI (UNIT XII)



SULPHUR & BULK (UNIT-VII)



V.S. PARA BASE PLANT (UNIT VII)



UNIT VIII



UNIT XI

Experience of
3+
Decades

10
Manufacturing
Facilities

600+
Customers
worldwide

Portfolio of
200+
Products

Presence in
45+
Countries across
the Globe

70+
Distributors
across India

6
Operating
Subsidiaries
across the World

Production capacity of
Basic Chemicals
Current 2,26,000 MTPA
Upcoming ~3,40,000 MTPA

Production capacity of
Dye Intermediates
Current 33,000 MTPA
Upcoming ~6,000 MTPA

Production capacity of
Dyestuff 35,000 MTPA
Liquid Dyestuff
10,000 MTPA

Production capacity of
Caustic Soda
Current 82,500 MTPA
Upcoming ~16,500 MTPA

New capacity of
Benzene
Downstream
79,000 MTPA

Production
capacity of
TCCA
12,000 MTPA

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REGISTERED OFFICE:

Plot No. 123-124,
Phase - I, G.I.D.C.,
Vatva, Ahmedabad - 382 445.
Gujarat (India)

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HOW MIGHT THE CANDIDATE LIST CHANGE UNDER THE REACH REVISION PROCESS?

As the candidate list is reevaluated as part of the REACH revision, Tim Becker of REACHLaw considers changes we might see



TIM BECKER
SENIOR LEGAL ADVISER
REACHLAW

Since its inception in 2008, the REACH candidate list of substances of very high concern (SVHC) has evolved from a regulatory novelty to a cornerstone of SVHC management for authorities and industry. The future role of the candidate list is now being re-evaluated as part of the ongoing REACH revision under the EU's chemicals strategy for sustainability (CSS).

A European Commission paper for the Competent Authorities for REACH and CLP (Caracal) on the reform of the authorisation and restriction systems (CA/03/2022, 17 January 2022) has provided ideas for a significant expansion of the candidate list scope and obligations.

STEADY GROWTH IN NUMBERS AND RELEVANCE

When introducing the REACH Regulation back in 2006, the candidate list of SVHCs for authorisation was one of the key novelties. In October 2008, the first 15 substances were included in the list. Ever since, the list has grown steadily following Echa's biannual updates. Today it has 450 substances, grouped in 223 entries (the last update was on 17 January 2022).

The role of the candidate list has been further enhanced through the introduction of the substances of concern in products (Scip) database under the revised waste framework Directive adopted in 2018. The Scip database already contains several million articles which are on the EU market and contain candidate list substances. The number shows the importance of the candidate list, both as a regulatory tool for authorities and as a reporting trigger for industry, indicating the continued broad relevance of listed SVHCs in products.

CANDIDATE LIST: THE CURRENT ROLE

Looking at the REACH legal text as it currently stands, the candidate list is the first step in the REACH authorisation process. Substances fulfilling the REACH Article 57 criteria – ie substances which are carcinogenic, mutagenic or reprotoxic category 1A or 1B, persistent, bio-accumulative and toxic (PBT), very persistent and very bio-accumulative (vPvB) or those giving rise to an equivalent level of concern (for example, endocrine disruptors) – are formally identified on the candidate list as SVHCs for eventual inclusion in the REACH authorisation list.

In this regard, the candidate list is seen as an 'ante-chamber' to be used by Echa for prioritising SVHCs for authorisation based on the criteria in REACH Article 58(3) (ie PBT/vPvB properties, wide dispersive use, high volumes). However, the decision on whether to include in the authorisation list SVHCs recommended by Echa, lies with the Commission, which takes into account additional aspects such as the socio-economic consequences of including a substance in Annex XIV.

The candidate list is seen as an 'ante-chamber' to be used by Echa for prioritising SVHCs for authorisation based on the criteria in REACH Article 58(3). However, the decision on whether to include in the authorisation list SVHCs recommended by the agency, lies with the Commission.

Furthermore – and outside of the authorisation process – the candidate list has become a trigger for reporting obligations for SVHCs in substances, mixtures and articles in the supply chain in the following cases:





One development already prescribed in the CSS communication is the expansion of the list of SVHC categories in REACH Article 57 to include endocrine disruptors, persistent, mobile and toxic (PMT) substances or very persistent, very mobile (vPvM) substances.

- provision of a safety data sheet (SDS) for substances and mixtures, if not already required (REACH Article 31(1)(c) and (3) (b)), and 31(9)(a);
- certain disclosure requirements in the SDS, such as for endocrine disruptors, including in mixtures at a concentration equal to or greater than 0.1 % by weight (REACH Annex II); and
- the duty to communicate safe use information on articles supplied that contain candidate list substances above 0.1% weight by weight (w/w) (REACH Article 33).

REACH Article 33 reporting has had a big impact on producers and importers of assemblies of articles (complex objects) in various sectors. The 2015 judgment of the European Court of Justice (ECJ) in case C-106/14 (see link below) which confirmed the requirement of component-level reporting ('once an article, always an article'), further added to the impact on producers and importers.

With regard to candidate list updates, suppliers of articles continue to struggle with the biannual rhythm and the absence of a grace period. The addition of broad and un-specific group entries (more than 1,000 CAS numbers correspond to perfluorobutane sulfonic acid (PFBS) and its salts, including all existing, and even future salt forms unknown today) poses another challenge. In practice it is therefore often impossible to be fully compliant (and timely) with the strict reading of the Article 33 obligation in complex global supply chains.

In addition, a notification obligation to Echa is foreseen for articles produced or imported into the EU/EEA that contain candidate list substances above 0.1% w/w and which are present in those articles in quantities totalling over one tonne per producer or importer per year (REACH Article 7(2)). Given the one tonne threshold and exemption possibilities, the practical relevance of this reporting obligation has always been limited.

CANDIDATE LIST: A BROADENING ROLE

In recent years, the role of the candidate list has gone beyond the REACH legal text as outlined above.

Even though no legal requirement for substitution is associated with the inclusion of a substance in the candidate list, listing has, in practice, had a substitution effect in many cases. Hence, the candidate list has already become a kind of substitution list in practice, where alternatives are technically, and economically, feasible for companies.

This substitution pressure is expected to increase further through the new reporting requirement to Echa for articles placed on the EU/EEA market and containing candidate list substances above 0.1% w/w, based on Article 9(1)(i) of the revised waste framework Directive 2008/98/EC. While these Scip notification and database requirements are designed to inform waste treatment operators about the presence of SVHCs in articles after becoming waste, their most obvious practical function to-

day, based on Echa's implementation, is to provide public transparency on SVHCs. This includes information on non-waste articles being available to the public, something which could not be achieved through the REACH reporting provisions (Articles 7(2) and 33).

The candidate list's move away from its original functions is also evident from the increasing number of listed substances that have been prioritised for regulatory measures other than authorisation – sometimes in spite of an Echa recommendation for authorisation

For example, a number of polar aprotic solvents including n-methyl pyrrolidone (NMP), dimethylformamide (DMF) and n,n-dimethylacetamide (DMAC) have been, or are, in the process of being included in Annex XVII of REACH after a late risk management option analysis (RMOA) by the Commission in collaboration of Echa

concluded on restriction (binding derived no-effect levels (Dnels) relating to exposure of workers) as the most appropriate RMO. These substances had previously been successively recommended for authorisation by Echa in 2013 (DMAC), 2014 (DMF) and 2018 (NMP).

On the other hand, occupational exposure limits (OELs) under the EU occupational safety and health (OSH) legislation have been, or are being, introduced or revised for several candidate list substances used at workplaces, such as cadmium, cobalt salts, and lead and its compounds.

This has reflected a tendency away from the authorisation process after the complex experience with chromates, with many workplace chemicals recommended for authorisation by Echa, whereas the Commission decided to 'postpone' Annex XIV inclusion.

Thus, in practice the candidate list has become a pool of SVHCs to be prioritised for further regulatory action in a broader sense – and a trigger for reporting obligations, especially regarding the presence of candidate list SVHCs in industrial and consumer products.

TATA CHEMICALS

CANDIDATE LIST: THE ROLE UNDER REVISED REACH

There is no doubt that the candidate list will continue to exist following the CSS REACH revision. Reflecting on the outcome of November's member state and stakeholder workshops on REACH authorisation and restriction reform, the Commission said there was "a general agreement to maintain the candidate list, and to use it for prioritising substances for further regulatory action as well as to gather more advanced information linked to uses of substances of very high concern (SVHC) (exposure, emissions) and to their alternatives" (Commission doc CA/03/2022 of 17 January 2022).

One development already prescribed in the CSS communication is the expansion of the list of SVHC categories in REACH Article 57 to include endocrine disruptors, persistent, mobile and toxic (PMT) substances or very persistent, very mobile (vPvM) substances. Through their future recognition as hazard classes, and the possibility of harmonised classification under the CLP Regulation (revision proposal also underway), as well as for PBTs and vPvBs, the process of candidate listing could be simplified and accelerated in a similar way as for CMR Category 1A/1B today, where the hazard is already confirmed in the CLP process. A dynamic link of candidate list entries with CLP Annex VI Part 3 (harmonised classification and labelling table) is also being considered.

Another question is how the future role of the candidate list will evolve as a priority tool and in relation to industry duties. This will depend to some extent on which of the three options tabled by the Commission for the planned reform of the authorisation (and restriction) process will prevail, or which will crystallise as the 'preferred option', taking up elements from different options:

- option 1: keep authorisations with clarifications and simplifications;
- option 2: merge authorisations and restrictions; and
- option 3: remove the authorisation title from REACH.

In its papers on the reform of the REACH authorisation and restriction system (29 October 2021 and 17 January 2022) (CA/03/2022)

the Commission considers that even under options 2 and 3 – which imply an abandonment of the authorisation system as we know it – the candidate list could remain as a tool to prioritise substances for regulatory action, in particular for restrictions but also, for example, for OSH legislation or the Industrial Emissions Directive 2010/75/EU (IED).

The Commission also acknowledges that the list could remain useful for identifying substances to be tracked under Articles 7(2) and 33, as well as a tool for future instruments that might be developed under the sustainable products initiative (SPI), seemingly referring to the new instrument of a digital product passport considered under the SPI.

What appears more open at this point, and surely subject to controversy, is the further option raised by the Commission to introduce a new legal obligation for downstream users regarding candidate list substances. The idea is to gather more advanced information on uses of substances on the list, amounts used, exposure, emissions and waste management, as well as on possible alternatives and substitution activities. This information could be maintained and published by Echa to facilitate substitution.

Such reporting could even be regularly, for example, annually, and in the view of the Commission improve the information basis, as well as speeding up the priority assessment for further regulatory measures, and for applicants to obtain authorisation or derogations under the revised REACH.

It is unclear, as of today, who should be obliged to provide such advanced information, what specific data are to be provided and how any such requirement would relate to the REACH registration provisions. This is to be explored as part of another Commission study on increased information on uses and exposure for registration, and in the impact assessment for the REACH revision.

What is more, the possibility of initial and annual 'fees' linked to such notification for candidate-listed substances to cover resources required by Echa, and to incentivise substitution, is being considered by the Commission. Downstream users might have to provide proof of their notification compliance to the national enforcement authorities.

It should be noted that affected companies and industry bodies already provide use-related information voluntarily in response to the call for information on the possible socioeconomic consequences of the authorisation requirement – which is managed by Echa for the Commission – at the time of Echa's public consultation on its draft Annex XIV recommendation.

OUTLOOK

We should expect that the role of the candidate list as a pool of SVHCs to be prioritised for further regulatory action – and as a reporting trigger – will be maintained. This will likely be clarified beyond authorisation, and thus further enhanced.

However, there will be a need for clarity as to how the hazard classes for candidate listing will relate to the planned extension of hazard classes for restrictions following the generic approach to risk management under REACH Article 68(2). The hazard classes in both cases partly overlap. If restrictions based on an extended use of REACH Article 68(2) could be imposed without prior candidate listing (which is the case today), the predictability offered by the candidate list could be jeopardised.

Additional reporting duties associated with candidate listing could conflict with the Commission's objective to reduce the administrative burden on companies and authorities. This is expected to be further analysed as part of the Commission's impact assessment for the REACH revision.

Further assessments and discussions around the evolution of the candidate list under a renewed REACH are going to take place as part of the ongoing study for the Commission on revising the authorisation and restriction provisions, and the study on increased information on uses and exposure for registration. Interested stakeholders are advised to closely follow these studies and the discussions in Caracal (next meeting is on 27 January 2022), and look to participate in the relevant consultations and workshops. ■



Who is **BOSTIK**

KEY FACTS



€2 billion
Annual Sales per year



6,000+
Employees



4 Global
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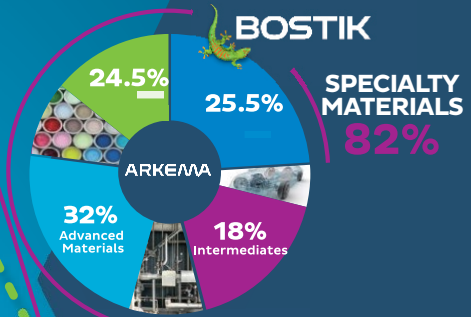
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Our adhesives are almost everywhere.

OUR EXPERTISE

- Developing bonding solutions for modern application challenges
- Innovating with customers through joint development
- Building strong and collaborative partnerships across the value chain



CHANGING TRENDS IN ADHESIVE MARKET TOWARDS SUSTAINABILITY



HARSH GUPTA
MANAGING DIRECTOR
H.B. FULLER INDIA, MIDDLE EAST
AND AFRICA

Adhesive producers are focusing on product innovation, reducing environmental impact of production processes, and improving sustainable performance of products through formulations

Adhesives play a critical role as an enabler and a must-have technology that makes the world, as we know it, work. They also help to lay the foundation of a new era of industrial design and manufacturing under resource constraints. Due to its innovation, versatility, and flexibility – not only in selecting technologies and raw materials – the industry now has many options that contribute positively to the way products are conceived and manufactured, reused, or recycled.

We are seeing a rise for greener products, as regulations around the handling of chemicals have become tighter and with governments setting up strict laws, like the single-use plastic ban. Natural-based articles are in high demand, and it's a trend set to continue apace globally. Solutions that support strong urbanization, smart cities, and the Internet of Things (IoT) also are in demand as they are part of many home appliances or vehicles that are being used today.

The green and sustainable segment of

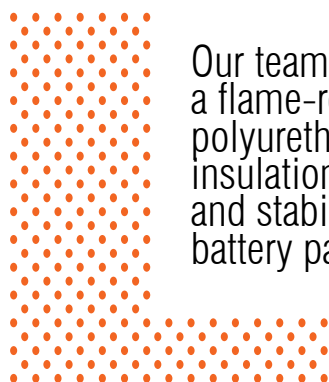
the market is projected to grow rapidly across the world, and we have seen a range of new, innovative sustainable solutions appearing in the marketplace in the past few years.

Sustainability is a megatrend that continues to gain steam, and manufacturers will only be successful if they manage to be adaptable and start embedding sustainability into everything they do and with everyone they work. Good environmental performance and business value can and should coexist in a competitive market. Companies that are already transforming their operating models and thoughtfully considering environmental impact as a pivotal force, will help drive their results in the best customers, suppliers, and people wanting to work with them.

While the world's growing population and increasing living standards boost the need for adhesives, public consciousness and overall climate action concerns encourage the development for greener, sustainable adhesives and sealants that make next-gen consumer and durable goods stronger, faster, lighter, safer, greener, and far better.

Therefore, the need for such adhesives has reached a completely new level. The most substantial contributions adhesive producers make in the realm of sustainability are through product innovation, reducing the environmental impact of production processes, and improving the sustainable performance of manufactured products through their formulations.

H.B. Fuller is also looking for alternative raw materials with less footprint and disposing materials without harming the planet in



Our team of chemists has formulated a flame-retardant and low-density polyurethane foam to provide thermal insulation to electric vehicles battery cells and stabilize the temperature inside the battery pack.

mind. For e.g. current products help customers reduce materials, reuse and allow recycling of corrugated boxes with little impact. And while our company is supporting the future of electric transportation and providing high-performing applications for everything from vehicle assembly, interior and exterior lighting, and interior trim, a key element of an electric vehicle is battery performance and safety. Our team of chemists has formulated a flame-retardant and low-density polyurethane foam to provide thermal insulation to electric vehicles battery cells and stabilize the temperature inside the battery pack.

We believe the focus right now is for the industry to create smart materials and systems that significantly reduce costs, improve efficiency, and make products more sustainable by helping manufacturers do more with less. That way, innovation must be at the centre of everything we do and a key driver of growth with the goal to improve operations, product applications, and finished goods. By focusing on this priority, our company continuously adds new technologies that help solve customers' bonding challenges, with the ever-increasing demand for environmental-friendly solutions that help packaging manufacturers reduce downstream waste, building and construction experts increase energy efficiency, and disposable goods designers create eco-conscious consumer products.

From increasing transparency to bio-based, biodegradable or compostable claims on the articles to widening country plans for recycling products, there are a number of sustainability-driven options for the adhesives industry.

The term bio-based adhesives generally refer to systems that contain certain percentages of raw materials from renewable resources. For instance, water-based adhesives, the first bio-based formulations we saw in the market, were conceived for generic applications, bringing advantages to segments like packaging, furniture and textile. However, with the fast technology advances, these adhesive solutions started being developed for other industries.

Currently, the packaging industry is one



that benefits the most from this type of formulation, but bio-based adhesives are no longer limited to water-based dispersions and emulsions – we also can find them in hot melt and pressure sensitive adhesive solutions.

When bio-based adhesives are optimized with raw materials that can be composted under specific conditions, they can be classified as biodegradable or compostable. These two terms are often used as synonyms, nonetheless, they are not exactly the same. In fact, the main difference is that biodegradable products break down naturally and return to nature whereas compostable requires specific settings to break down and provides earth with nutrients once the material has completely broken down. While all compostable material is biodegradable, not all biodegradable material is compostable.

Based on these approaches, we can certainly say adhesives are a key enabler for producing more sustainable products, and whether they are bio-based, compostable, or recyclable and repulpable, adhesives are likely to grow in popularity in near future since they support the global greener ecosystems. Also, not everything that is recyclable is, at the same time, compostable. So, it's quite important to understand the right adhesive requirement for the right application in each market. And here, scientists and regulatory experts play an important role as they need to be at the forefront of keeping track of the dynamic regulations that govern the tran-

sitioning into eco-friendlier substrates.

As mentioned, more and more, consumers are demanding that product manufacturers reduce their environmental footprint and use fewer hazardous chemicals and substances of very high concern (SVHCs) and contribute to biodegradability and the use of renewable materials. When thinking about next generation adhesive solutions, the goal is that adhesive makers will need to understand the full lifecycle - recyclability, bonding and debonding on demand and, at the end of every product life, use of renewable or bio-based raw materials, and alternative cure processes. High expectation is that materials need to be responsibly sourced, enhance energy efficiency, and enable recycling to create an efficient cradle to cradle loop and facilitate responsible innovation.

This is both an exciting and challenging period for our industry. Collaboration throughout the supply chain is vital if we are to achieve changes that improve the world for this generation of consumers and beyond. Being more sustainable can mean different things to different people. It could be easy to recycle or have a low carbon footprint or designed using circular economy principles. But most likely, it will be a combination of all these, in addition to complying with current and possible future regulations. The environmental challenges facing the world and the subsequent demand for low environmental impact products needs a multi-faceted and collaborative approach. ■



PLASTIC PELLET MARKET: OPPORTUNITIES, CHALLENGES, AND ADAPTATIONS

Despite the campaign to phase out single-use plastics, manufacturers will not have to slow down their entire production but they can find new opportunities by producing biodegradable plastics instead



YOGESH MALANI
MANAGING DIRECTOR
PREMIER TECH SYSTEMS AND
AUTOMATION INDIA

Plastic is one of the most common materials used in the production of products and packaging. It is lightweight and has a wide variety of textures and colours, making it ideal for various types of merchandise. Furthermore, plastic has ideal characteristics, being waterproof, thermal resistant, and electric resistant, all which make it a great replacement for other substances.

Plastic pellets are tiny plastic granules. The majority of consumer products today are made from plastic pellets which are melted down and remodelled into the required shape; this is why they are an incredibly important material for many industries, both in Thailand and around the world. Plastic pellets are indispensable in the production process, particularly for the production of medical equipment and electronic devices, which is growing rapidly. Thus, the plastic pellet market has great potential to grow and the average annual sales are also expected to soar.

Premier Tech, as a leading automatic bagging machine manufacturer, hopes to

shed some light on important industry insights, challenges, and how businesses can prepare themselves for the changes to come.

GROWTH FACTORS: CHALLENGES FOR THE PLASTIC INDUSTRY

The plastic market slowed down during the 2020 economic downturn following the widespread COVID-19 pandemic but the situation seems much more optimistic for 2021

so far. This upturn could be attributed to the lessons and preparations, the global business industry has taken

over the course of the year, that have allowed them to recover and even flourish. As a result, the sales of plastic products, as well as exports, are expected to grow at least 2-3 percent this year. Nevertheless, there are still many factors that may affect business growth which companies need to be aware of and find proper solutions.

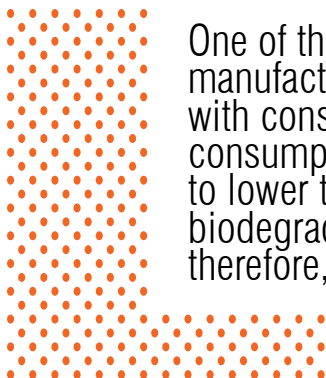
RAW MATERIALS FOR PLASTIC PELLET PRODUCTION

Plastics are produced from natural gas. They are by-product of the distillation of crude oil and the separation of natural gas. As a result, the price of crude oil, an exhausted resource, is subject to volatile price fluctuations which therefore directly impact the cost of plastic production.

DEMAND FOR PLASTIC PRODUCTS

Consumer behaviour and lifestyles have changed drastically in recent years. With the ongoing COVID-19 pandemic, some businesses have required more plastic for

One of the biggest challenges for plastic manufacturers is the eco-friendly trend with consumers trying to reduce their consumption of single-use plastics in order to lower their impact on the environment, biodegradable and reusable plastics, are therefore, in higher demand.



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their production than ever before. The rise of E-commerce has also resulted in the production of many new products. And in the food industry, there has also been high demand for plastic packaging.

ECO-FRIENDLY TREND AND GREEN PACKAGING

One of the biggest challenges for plastic manufacturers is the eco-friendly trend with consumers trying to reduce their consumption of single-use plastics in order to lower their impact on the environment, biodegradable and reusable plastics, are therefore, in higher demand. Additionally, many countries have enforced measures to ban or reduce the use of plastic. This directly affects the export industry and is something companies need to be aware of, and adapt to, accordingly.

CHANGING TRENDS: WHICH INDUSTRIES NEED MORE PLASTICS?

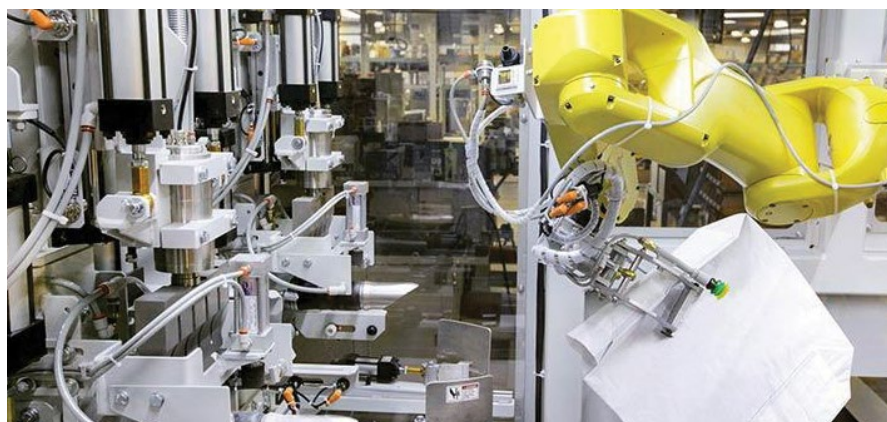
Consumer behaviour varies with changes in society and trends around the world. The trend for plastic use is ever-changing. In Thailand, specifically, there remains high demand for plastics in the following industries:

Medical equipment: As medical technology advances, there is higher demand for plastic in the production of protective equipment, healthcare equipment, and various tools, in order to support the growing number of patients in various medical services.

Consumer products: It is an ever-growing business group that requires a lot of plastic packaging for a variety of uses including cleaning supplies, cosmetics, snacks, ready meals, and sachets. The rise of delivery and takeaway businesses also means there has been an increase in plastic packaging, from boxes and bags to cutlery.

Automotive parts: The up-and-coming "eco car" trend is a potential opportunity for Thai manufacturers to export more car parts in the future.

Electronic parts: Smartphones, computers, and electrical appliances are constantly evolving. Plus, they are always in high demand throughout the world. As a result, the sales of plastic pellets to these companies is growing.



Construction: The expansion of infrastructure, as well as new construction projects in the private sector, have led to an increase in the use of plastic equipment. Additionally, many new building materials have been developed that focus on strength, toughness, durability, and being lightweight; all of which are the winning characteristics of plastic.



ADAPTING TO MEET THE CHALLENGES

Analyse the strengths of your own factory and adjust the production of plastic resin in line with the market trends.

Expand your customer base to include growing businesses that require a lot of plastic, and also businesses that use plastics to produce high-value products such as medical equipment, IT equipment, and car parts.

Despite the campaign to phase out single-use plastics, manufacturers will not have to slow down their entire production but they can find new opportunities by producing biodegradable plastics instead.

The most important step is to optimize production process and one can do so by reducing labour-related tasks and transitioning them to automated solutions. For example, the TTFS automatic bagging machine from Premier Tech has both a weighing scale and bagging machine. So, you can weigh the product and fill the bags at the same time. With the reduced need for human intervention during the process, workers can then be

trained and moved to other more beneficial tasks.

TIPS FOR SELECTING AN AUTOMATIC BAGGING MACHINE

Automatic bagging machines can play a major part for factory owners and manufacturers in transforming their business in line with changes in both the domestic and international market.

- The bagging speed should be more than 2,000 bags per hour.
- The machine should have an additional reel for quicker bag roll changing.
- The machine must be able to automatically cut bags to reduce labour and time.
- The machine should be compact and not take up a lot of space.
- It should suck the air out of the bag with ease.
- The machine must be able to be dismantled for cleaning to ensure the hygiene standards of the factory.

These are our basic tips for choosing an automatic bagging machine. The TTFS automatic bagging machine from Premier Tech doesn't just have all the necessary qualities, it is also highly efficient. Additionally, we know that after-sales service is just as important.

We are also a total solution provider and can help design custom-made machines that best suit your factory to effectively enhance your business performance. ■



OUR CAPEX TARGET FOR FY 21-24 IS RS. 4,500-5,000 CRORE

Exploring opportunities in sunrise sectors such as battery and electronic chemicals and planning our foray into industrial biotechnology



RAJENDRA V. GOGRI
CHAIRMAN AND MANAGING DIRECTOR
AARTI INDUSTRIES LIMITED

Key milestones achieved by Aarti Industries in the chemicals and pharmaceuticals businesses during FY 2021-22?

AIL's (Aarti Industries Limited) journey was profound and exemplary in FY 2021-22. With our integrated value chain, diversified product mix, strong technical capabilities, and robust track record, the company emerged as a global partner of choice.

Some major milestones achieved by Aarti Industries during FY 2021-22 are:

- The company was conferred with the FICCI Company of the Era Award for its immense contribution to the chemical industry in the past 25 years
- The company was conferred with a Gold Award in the 2021 EcoVadis CSR assessment, placing us among the top 5% of the companies assessed by EcoVadis. Our score improved from 60% in 2020 to 68% in 2021
- On the research and development front, we applied for 44 patents and were granted 11, out of which 8 were international patents
- The company was placed at 3rd position in the chemical sector (amongst 15 chemical companies) with an overall ESG score of 56. CRISIL evaluated independently Top 225 companies across 18 sectors based on their ESG assessment framework (as per information available in public domain) in FY21
- The company was awarded with the Responsible Care Logo post successful completion of RC Gap Assessment for self-imposed ethical commitment for



better EHS&S performance and responsible management of chemicals throughout their lifecycle

- On the business front, the company successfully raised Rs. 1,200 crore additional share capital via QIP
- To meet growth aspirations, the company onboarded around 1,500 bright talents and created various growth avenues for internal talent, thereby accomplishing 18% internal growth transitions in FY22 from 12% in FY21
- The company also commissioned a speciality intermediate plant at Dahej for which a 20 year contract agreement was signed. The company also launched API intermediates block at pharmaceutical manufacturing unit in Vapi
- The company's CHRO was conferred as the HR Leader of the Year at the Economic Times Human Capital Awards 2021

The objective behind the company's move to demerge its pharma business to Aarti Pharmed. What's a long term strategy to strengthen the company's position in pharma?

The pharmaceutical division has been growing consistently over the past few years. The revenues for the pharmaceutical business have grown at a CAGR of 20% over a period of 5 years from Rs. 426 crore in FY17 to Rs. 872 crore in FY21. To create an overall value for our shareholders, and also to enable management of the company to focus and adopt the relevant strategies necessary for promoting growth and expansion, the demerger is being carried out. The demerger of



Our long-term strategy is for enhancing the company's position in the pharmaceutical segment by focusing on adding new chemistries and value added products. We plan to add 50+ new products in the pharma division with a capex of Rs. 350 - 500 crore.

pharma undertaking will facilitate a focused approach to the growth opportunities into respective segments, also enabling the segment to take strategic calls to capture these opportunities to grow.

Our long-term strategy is for enhancing the company's position in the pharmaceutical segment by focusing on adding new chemistries and value added products. We plan to add 50+ new products in the pharma division with a Capex of Rs. 350 - 500 crore. Strengthening our manufacturing capability, we plan to increase our manufacturing capacity by 1,200 KL with installation of 240 reactors under 10 manufacturing blocks in the next 5 years.

? How will the newly operationalised Phase 2 Unit at Dahej SEZ help the company to diversify its agrochemical intermediates business?

The new chlorination unit at Jhagadia and specialty chemicals manufacturing unit at Dahej SEZ will cater to end use applications of polymer additives, agrochemicals, dyes pigments, and other speciality chemicals. The additional chlorination manufacturing capabilities will lead to growth in the company's market share in the international market, fur-



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ther strengthening its position as Top 3 manufacturers globally in terms of product range. This will also provide an opportunity for forward integration. The facility will be ramped up over a period of next 3-4 years with a potential to generate an EBITDA of US \$15 million.



For the Phase 2 unit at Dahej SEZ, we have already received proceeds of Rs. 630 crore as per the terms of the original contract. This unit has now been commissioned and we are planning to increase the capacity utilization to 80-90% in the next two years.

With this facility, the Phase 2 unit at Dahej SEZ operational, our existing capacity for the intermediate has been expanded by almost 30 times. This chemical intermediate goes into multiple agro-technical applications as a herbicide and biocide. We plan to supply the intermediate to multiple customers involved in the manufacturing of the technical applications. With the incremental sales of this intermediate, we expect an addition of approximately US \$40 million to the top line.

? How is Aarti Research and Technology Centre (ARTC) at Navi Mumbai developing new innovations thereby helping create a robust product pipeline?

Aarti Research and Technology Centre (ARTC) is a state-of-the-art research facility, which has been set up to accelerate the development of new products driving future

growth. Our R&D team has 200+ scientists for the chemical segment and has a strong analytical and process safety capabilities to support safe and efficient new product development. We are also working on setting up an engineering lab and an industrial biology

lab at ARTC in the coming year. In the past couple of years, a total of 5,304 experiments have been conducted at ARTC. ARTC has been recommended for continued certification for ISO 27001:2013 Standard.

The objective of this research centre is to develop the most optimal and cost-effective process for a given product, with a primary emphasis on process safety and environmental impact. This has led us to develop some process innovations in the last 2 years and we have filed for provisional patents for some of these innovations. Our strategy is to create chemistry and technology platforms and our value-chain approach has enabled us to create a robust product pipeline to drive growth in future. In addition to ARTC, we have three more Research & Development centres located at Vapi and Dombivali. Our advanced analytical and process safety services offerings are now available for broader industries to specifically facilitate MSMEs.

Q What are the focus areas of Aarti's ESG initiatives and its reflection on the company product portfolio?

The company has conducted its materiality assessment in FY 2020-21 by interacting with its internal and external stakeholders to identify the focus areas. The focus areas are: Energy and carbon emission; water and effluent; occupational health and safety; compliance; human rights; and business ethics.

ESG has provided us with significant opportunities to optimize and expand our product portfolio. Our product portfolio will gradually increase with the products manufactured from less hazardous processes or green chemistry having minimal impact on the environment.

Q On the R&D front, the company is planning 40+ products for chemicals and 50+ products for pharmaceuticals. What's your R&D plan for FY 2022-23?

In the chemical segment, our primary focus in FY23 is to develop and scale up products that form a part of our chlorotoluene val-

ue chain. We are developing capabilities in new chemistries such as photochlorination, ammoxidation and speciality fluorination. We are also working on some customer-specific projects that may reach the commercial stage in FY 2024-25. We are planning to invest more than Rs. 100 crore for Research & Development in the current financial year.

Q New verticals where you are focusing during FY 2022-23 and its impact?

For FY 2022-23, we are focussed



on the development and execution of the chlorotoluene value chain. At the same time, we are working on creating long-term partnerships with global companies to manufacture in India. We plan to do this by leveraging our sustainability track record, value chain & chemistry platforms, and global trends such as the growing relevance of the China + 1 model. We are exploring opportunities in sunrise sectors such as battery and electronic chemicals and planning our foray into industrial biotechnology.

Q What is the Capex forecast for FY 2022-23 with respect to Chemicals and Pharmaceuticals. Projects where you are investing?

Our Capex target for FY 21-24 has been Rs. 4,500 - 5,000 crore of which Rs. 1,200 crore has been utilized in FY 2021-22 and the rest is planned to be spent in the coming couple of years. Some key Capex initiatives for these two years: USFDA capacities expansion at Tarapur for API units; Commencement of manufacturing unit for unit for 3rd long term contract at Jhagadia; Capacity expansion for NCB manufacturing facility at Vapi; and Expansion cum asset upgradation for Acid Unit at Vapi.

The company is also undertaking several expansion, asset restoration, and sustainability initiatives across existing facilities. The company is also in the process of adding Chlorotoluene range and other value added products (40+ products for chemicals and 50+ products for pharma).

Q The company is taking quantum lead on sustainability as the focus is on 'Right chemistry for better tomorrow'. What are your FY 2022-23 plans for sustainability?

Our FY 2022-23 plans are focused on climate change issues. Aarti Industries is going for a quantum jump in reduction of its emissions through the use of renewables in its energy mix and other strategic initiatives. We are planning for more dual fired boilers (coal and biofuel). We have signed a contract for 13.5 Megawatts of hybrid renewable (solar and wind) sources of electricity. Through these initiatives, we will substantially reduce our carbon footprint.

We have planned several initiatives for enhancing the process safety across all our processes to make our operation intrinsically safe. We are also collaborating with business partners to imbibe ESG practices in their operations to ensure a sustainable supply chain. ■





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INTENSIFYING R&D TO CREATE NEW PRODUCTS, APPLICATIONS, AND PROCESS IMPROVEMENTS

The company has a cumulative of 172 patents and we have got 110 applications with various patent offices



DR. RICHARD LOBO
HEAD - INNOVATION AND CQH
(BUSINESS EXCELLENCE)
TATA CHEMICALS LIMITED

2022 global trends in specialty chemicals and basic chemistry and its impact on India?

Today, specialty chemicals is US \$800 billion and is growing with a CAGR of 5.7 percent over the last 5 years. This is expected to grow and the momentum will continue till it becomes a US \$1 trillion industry by 2025. Specialty chemicals industry is becoming an integral part of the larger global chemical sector. The chemical sector is presently US \$4 trillion and it was growing at a CAGR of 4 percent from 2004 to 2018 and will go from strength to strength in future. The global chemical sector is dominated by China with a market share of about 35 percent and is fol-

lowed by Europe and the United States with 20 percent and 15 percent respectively. So, India has a long way to go.

Currently, we have a market share of about 3 percent but we are an emerging player in global chemical sector. It is very heartening to see chemical sector leaders in India looking at specialty chemicals as a major vehicle for growth, particularly as we are planning to ramp up our product and capacity.

India is truly a rising star as we have done about US \$32 billion in turnover and specialty chemicals constitute about 1/5th of the chemical sector and are valued at close to US \$160 billion as of FY18. So, there is great scope for growth and great room for exponentially pushing the barriers. The industry is moving sharply from single digit to double digit growth in years to come. We are very optimistic about India, as we believe the inherent knowledge base, exposure in terms of low cost manufacturing base, and depth in science will be of great help. We also understand technology and R&D really well. The ability for us to use Indian frugal engineering, strong understanding of consumer connect, and back it up with the very large pool of labour which will bode well for India.

How is R&D into basic chemistry and specialty chemistry enabling Tata Chemicals to consistently set industry benchmarks?

Tata Chemicals has been a science based company ever since its incorporation

in 1949. So it has a 80 plus year long history. There is a mission of the company which says serving society through science and it guides us on our journey all through. At the very core remains our value system which keeps us grounded in areas we work on.

Currently, we are working on a few areas which include a prebiotic fibre to promote gut health. The other aspect is highly-dispersible silica through a green patented technology which will help improve the performance of tyres, help reduce the consumption of fuels and help build sustainability. We have been recognized by our peers along the way. We have been recipients of CII's India's top innovative company award consecutively three times in a row. We have recently won the quality innovation award at an international level.

As the head of innovation at Tata Chemicals, my team is focused on next generation science differentiated innovation, collaborating with the world's best academia or R&D labs. In this process, we build businesses which have a unique brand and value proposition.

Key R&D initiatives of Tata Chemicals and patents granted in FY 2021-22?

The company has a cumulative of 172 patents and we have got 110 applications with various patent offices. Eight patents have been granted in this financial year and we are focused on generating our intellectual capital besides patents also to international





We are also focused on biotechnology, molecular breeding and there has been a strong push within our R&D centres where we use ML and data analytics so that we are able to look into the future very strongly as a leader in R&D.

peer reviewed journals and also participation in international conferences as well as collaborating with the best in class.

From an R&D perspective, we have been focused on developing some very significant competencies and this is centred around areas like performance, advanced materials, and sustainable green chemistries. We have worked on nanotechnology in the past and to push the barriers of nanotech into new territories. We are also focused on biotechnology, molecular breeding and there has been a strong push within our R&D centres where we use Machine Learning (ML) and data analytics so that we are able to look into the future very strongly as a leader in R&D. There are a number of products that are born in the R&D centre over the years, like high dispersible silica.

We had a nano zinc oxide product for replacing harmful UV blockers, so that it could be used in paints and cosmetics. During the pandemic, we quickly pivoted and made a nano-zinc coated textile because of its inherent anti-microbial properties. It was used in personal protective equipment, facemasks during COVID-19 pandemic in order to protect the frontline workers.

Initiatives taken by the company to enhance a portfolio of value-added, green, and patented products to develop a new grade of silica?

The tyre industry has a sharp focus on technology innovation so that the tyres are more safe and much more sustainable. Now considering that 20-40 percent of the fuel



consumption in automobiles is because of the tyres itself, tyre manufacturing companies are now very strongly focusing on high performance tyres and environmentally sustainable solutions.

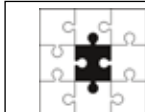
And highly dispersible silica is emerging as an excellent solution as tyre manufacturers are using it as a re-enforcement pillar. It offers higher reinforcement ability, improves fuel efficiency because it rolls down the resistance in tyres. On the other hand, if you look at traditional re-enforcement reagents like carbon black, they have got higher rolling efficiency, resulting in higher consumption of fuels. The highly dispersible silica is successfully reducing the use of carbon black in the tyre industry. India is one of the largest producers of tyres at the production of 192 million units which

was produced in 2019 and it is expected in the next 5 years that this will even grow more. Hence, there is a demand for more and more green tires in future.

At Tata Chemicals, we looked at the space and said can we start from waste. We began with rice husk and extracted silica and used a green chemistry route to make it highly dispersible silica grade which can go to the tyres. The possibilities are now quite endless and the next generation R&D that we need to look will allow us to work with various

applications to deliver a number of solutions. For example, the silica can reduce rolling resistance right up to 20 percent. This approximates to about 5-7 percent of fuel savings. Another aspect is when you put silica into it, it increases the lifespan of the tires.

Another example is we are all moving towards electric vehicles (EVs) and there is a demand for EVs for long range with lower emissions. So there is an even better need for tyres which will have a positive impact on rolling resistance so that the car will have absolutely no noise and will be more energy efficient and obviously, will have a lower impact on the environment. This is the area we are focusing on and with the collaborative approach along with automotive and tyre companies, there is a need for creating products that have long term sustainability.



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Q What is the quality of silica that you get from rice husk?

Rice husk ash is collected and goes into boilers as agri-waste fuel but the ability to now look at the same rice husk ash and ability to extract silica has become important. And the grade is excellent as we are able to extract silica that is matching properties, characteristics, and particle size as of commercially available synthetic silica and delivers excellent performance. So while highly dispersible silica by itself is the sustainable product in tyres, the fact that you are able to extract it from the rice husk ash which is an agri-waste itself makes it even more sustainable. And I think it is part of an R&D intensity which I would say is able to stretch along this value chain to deliver the value.

Q How has the company ensured that its ESG initiatives protect the environment, human health, and safety it is also reflected in its product portfolio?

ESG at Tata Chemicals is factored around three areas. First, shared values which are focused on long-term inclusive growth and relationship with all stakeholders. Second, is minimizing our footprint and working closely with our manufacturing units, the decisions we make in technology and long term sustainable growth. Third, focused on new products and R&D.

For example we have got a corporate structure on sustainability policy. We have signed up two science based target initiatives. We are among the very first companies in the chemistry sector to do that. We are committed to reducing our carbon footprint. We are aligned to the UN SDGs, we are focused on product stewardship.

From the factory point of view, all of this translates into key actions which are about not just looking at the environment but also ensuring that we promote a low carbon economy and reduce our environmental footprint. So our factories have got risk assessment and waste management mapping done. On our agri side we promote smart agriculture. There is a continuous improvement in the way we work on our waste material recycling of water and a number of carbon abatement initiatives for carbon deduction to achieve net zero at our various factories. We



also focus sharply on energy management through audits, improvement in operational efficiencies, shift to renewable energies and so on.

From an R&D standpoint, the focus we have taken right from inception is low carbon use in energy. For example we focus on the removal of hazardous material in the value chain or the fact that the raw material ingredient that we will focus on will come in from waste or can we focus on circular economy. For instance, in our factory in Mithapur, there is no waste that gets left out. All of it is converted into cement and an ability

to look at the value chain, and that waste element and create a circular economy around that is what our R&D and science and technology teams focus on. Finally, we also focus on those technologies that will help save the environment such as highly dispersible silica and agroponics, the next generation of agriculture.



Finally, we also focus on those technologies that will help save the environment such as highly dispersible silica and agroponics, the next generation of agriculture.

Q Projects spearheaded by Tata Chemicals R&D Centre, Mithapur to develop innovative solutions to resolve critical plant and production issues?

Our science and technology centre at Mithapur focuses on customer and critical plant issues. This unit has been working ever since the pioneering of iodization of the salt, the vacuum dried salt in India. The centre work on the use of waste effluent solids for the use of cement as a product. The centre constantly work on CO2 water based pulling because it is a water deficient region. Sea water for brine preparation so that we can use it for soda ash manufacturing. The efficient use of limestone, boiler, fly-ash, bromine de-

hydration, de-chlorination and a number of products. They are also working on the technology standpoint on highly efficient deep sea discharge or it could also be the plantation of mangroves. As a company we work with multiple institutions on natural carbon sinks to promote biodiversity. So, Mithapur unit focuses on delivering value.

Q How is the Tata Chemicals Innovation Centre, Pune making a difference to the food and fuel, energy and environment? Kindly share details on projects in the areas of food, nanotechnology, and biotechnology that are currently underway?

At the Tata Chemicals Innovation Centre, Pune, we continue to focus on developing cutting edge science. This is again linked to our mission to serve society with science. We have been looking at not just the current areas of performance materials, nutrition sciences, advanced materials, nanotechnology and biotechnology but we are also focused on seeding new capabilities of the future. We are looking at synthetic biology which is the simulation, gene synthesis, and over-expression of enzymes and bio-actives. We are focused on the agriculture sector on RJA technology which will help in crops. We are strengthening our gene editing technologies in our seeds division, improving our bio-active compounds in the medicinal plants under agroponics as I mentioned.

Looking at green chemistry solutions, pro-chemistries to name a few. In the future, we aim to intensify our R&D to create new products, applications and process improvements. We are looking at adopting Artificial Intelligence (AI) and Machine Learning (ML) which will help improve our R&D capabilities. We are already using Machine Learning for genomic prediction in Maize. Finally, we also aim to address issues that are critical to industry, not just the Tata Chemicals but the chemistry sector and chemical industry sector at large. We are focused on issues such as carbon dioxide emission, sustainability, hydrogen economy, circular economy, waste management and waste to wealth and waste to energy as well. These are the areas we are focusing on currently and in the future. ■

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DOUBLING EPOXY MANUFACTURING CAPACITY AND EXPANDING OVERSEAS OPERATIONS

The Indian specialty market is the world's fastest-growing and that represents the biggest opportunity for the industry



JAYANT V. DHOBLEY
BUSINESS HEAD AND CEO -
GLOBAL CHEMICALS,
FASHION YARN & INSULATORS
ADITYA BIRLA GROUP

? What are the growth drivers for India's specialty chemicals industry vis-à-vis the global market?

The Indian specialty chemicals industry currently comprises a fraction of the global market. We are talking of a domestic industry whose projected size by FY 2025 will be US \$64 billion against a trillion-dollar projected global industry. The demand for advanced materials like specialty chemicals tends to grow faster than the GDP, especially in consumption-based economies like ours, a 12% annual growth rate for the sector is not unreasonable if the GDP grows at 7-9%.

Over the past decades, India's end mar-

kets in electronics, industrial farming, and processed foods have not grown very fast, and due to this, the domestic industry largely developed as a vendor supplying molecules and intermediates to global players. However, the current broad-based economic growth creates opportunities for domestic players to go beyond their narrow focus on pharma APIs, agrochemical intermediates, dyes, pigments and coatings, and add new product lines across polymers, specialty materials, nutraceuticals, food & feed additives, etc.



? What have been the key growth and expansion milestones for Aditya Birla Chemicals in FY 2021-22?

As a group, we have a profitable chemical portfolio with a revenue of about US \$2 billion today. One of our recent milestones was the launch of our new chlor-alkali site at Balabhadrapuram in Andhra Pradesh. We also announced the doubling of our epoxy manufacturing capacity and expanding our overseas operations in inorganic phosphates and sulphites. We are committed to profitable growth across our business.

? What are the factors instrumental in Aditya Birla Chemicals' global leadership across diverse chemical segments?

For one, we got into the business quite early. The Aditya Birla Group was probably the first industrial house to expand outside

India, and the setting up of our operations in Thailand was a pioneering step. Incidentally, not many people know that Aditya Birla, was a chemical engineer from MIT, and he was at the forefront of setting up of our businesses in peroxides, sulphites, phosphates, and chlor-alkali.

Secondly, we always aimed to develop leadership positions in each of these businesses. We wanted to be – and are – India's largest chlor-alkali player. With-

in certain niche segments of phosphates and sulphites, like blends and value-added formulations, we are leaders as well. Our peroxide business enjoys market leadership in Southeast Asia, particularly in high-purity hydrogen peroxides used for electronic manufacturing. We have also continuously invested in products, formulations, and capacity expansion in epoxy business, which is arguably the world's fifth-largest today.

During Covid-19, ensuring public hygiene was the biggest priority, and we provided a robust platform to authorities and society at large to deal with the pandemic and beyond.

Clean and safe water is a large part of public health and hygiene, and chlorine has a big role to play. With strong chlor-alkali portfolio, we were able to supply vital chlorine-based products to municipal authorities, government bodies like the Namami Gange Programme team, as well as to private industries to tackle the hygiene challenge. In each of these cases, we didn't just supply the



We are bullish on epoxy, because of the growth in sectors like automotive, electronics, and construction. We are also creating the next generation of long-chain chlorinated paraffin wax plasticisers that have a better sustainability and toxicity profile.

products; we provided a full solution across the value chain. This is also required because the water quality across sources like rivers and wells varies widely, and hence the solution also varies.

Besides this, some of our customers in the chlorine value chain also developed pharma products for medical use during the pandemic.

Q Did you experience any fluctuation in demand due to Covid-19?

Yes, but the upside has been more than the downside. While there was a demand reduction for chlorine products used in the PVC industry due to the slump in construction, the demand for products related to water and sanitation, pharmaceuticals, and agrochemicals increased. Another area that was positively impacted was consumer electronics, because people were staying at home and using mobile phones and laptops much more, which drove up the demand for epoxy.

Q How distributed production centres enabled Aditya Birla Group to meet global demand?

Our chlor-alkali market is a domestic one, because it's not easy to transport caustic soda or chlorine over long distances. Our epoxy portfolio has customers across Asia, and we serve them through manufacturing units in India, Thailand, and Germany. These products find application in industries like wind energy, automotive coatings and composites, etc. The demand for phosphates and sulphites is completely global. We have a

nice portfolio of blends and formulations for 'feed and food', which are manufactured in Thailand and exported around the world.

In a nutshell, while we play in multiple global value chains, the Indian specialty market is the world's fastest-growing, and that represents the biggest opportunity for the industry.

Q What is the future of the Indian specialty industry and AB Chemicals' role in it?

The small size of the Indian specialty industry creates a huge runway for growth. For instance, Aditya Birla Chemicals is capitalising on the growth potential in the chlor-alkali value chain by adding manufacturing units for epichlorohydrin and chloromethane in Gujarat, and a monochloroacetic acid factory in Andhra Pradesh.

We are bullish on epoxy, because of the growth in sectors like automotive, electronics, and construction. The same goes for the food industry, which will demand more food additives, triggering demand for phosphates and sulphites. We are also reevaluating other products and chemistries to get into.

Q How are global sustainability trends affecting your business?

There are two parts to it. As a business we are shifting gradually to renewable power, because power is a big requirement for us. Whenever we set up a new plant,

we also look at how we can minimise our water footprint and move towards zero liquid discharge.

Simultaneously, we make products more sustainable across value chains. For instance, the strength-to-weight ratio of our epoxies makes them ideal for reducing fuel consumption (in conventional automobiles) and for electric cars.

In India, we face huge farm-to-table food wastages due to inefficient transport and storage. Additives that improve shelf-life extension form an important part of a sustainable future. Ditto for water. In a water-scarce country like India, maximising water potability through better treatment is very important in the global warming context.

Q What are your current priorities on the R&D and product innovation front?

We have some exciting products in the customer trial stage. The first is Recyclamine, a patented technology that allows epoxy thermosets which are non-recyclable to now be recovered, reused, and repurposed. Through this technology, we can facilitate end-of-life recycling and zero waste manufacturing thus moving closer towards a circular economy. This provides a paradigm shift in many industries that use epoxy based composites, minimizing ecological, environmental, and societal impacts of composite waste.

Second, we are creating the next generation of long-chain chlorinated paraffin wax plasticisers that have a better sustainability and toxicity profile. These are just a couple of recent examples.

Q What are the growth areas you are targeting in 2022 and beyond?

Our growth areas essentially align with the growth of the industry. India is seeing strong demand growth more or less across all sectors of the economy, which means that the growth is very broad based and independent of any particular end market or customer. That's good news for us and the entire industry. ■

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BROWNFIELD EXPANSION PROJECTS IN GUJARAT AND MAHARASHTRA WILL BE COMPLETED IN FY 22-23

Brownfield expansion projects in Gujarat and Maharashtra will be completed in FY 22-23. The company will also debottleneck and increase capacity by 10-15% of its synthetic rubber products



ABHIRAJ A. CHOKSEY
MANAGING DIRECTOR
APCOTEX INDUSTRIES LIMITED

? What are the global trends in the synthetic rubber and synthetic latex sector in FY 2022-23 and what will be its likely impact on India?

There are several important trends affecting the emulsion polymer industry (both synthetic rubber and latex). In the medium term, the focus for all companies and countries is on being self-sufficient (aatmanirbhar) with supply chain, given the uncertainties in many parts of the world due to Covid-19, escalating energy prices as well as shipping prices, and availability. In the medium to long term, the focus should be on environment

and sustainability which we all now realize are extremely critical. Apcotex has started its ESG journey with an objective to be carbon and water neutral over the next few years.

? Apcotex Industries is a leading manufacturer of synthetic rubber, synthetic latex, and emulsion polymers. What's the next set of products you are planning to manufacture?

Apcotex Industries is a leading manufacturer of synthetic rubber, synthetic latex, and emulsion polymers. What's the next set of products you are planning to manufacture?





India remains our strategic market and we have high market share in India across all our products but we still see many opportunities for growth in our country. We also export to more than 45 countries and 20-25% of our sales are outside India.



Apcotex is focused on specialty emulsion polymers for now since that is our core competence and we see enough opportunity in our current range of products and a few adjacencies. We continue to deepen and broaden our customer base in India and abroad. We continue to invest in new applications as well as new products which are within our expertise. Over the last few years we have added NBR, NBR-PVC polyblends, NBR powder, and now recently Nitrile latex for gloves.

Key milestones achieved by Apcotex Industries during FY 2021-22?

FY 2021-22 was our best year in terms of all financial metrics. India remains our strategic market and we have high market share in India across all our products (we believe we are #1 across most of our product categories) but we still see many opportunities

for growth in our country. We also export to more than 45 countries and 20-25% of our sales are outside India. Besides completing a slew of debottlenecking projects in FY 2021-22, we embarked on two major brownfield expansion projects in our plants in Gujarat and Maharashtra which will be completed in FY 2022-23.

What are Apcotex plans for FY 2022-23?

The largest Capex spend in the history of our company will happen in FY 2022-23. Besides more than doubling our synthetic latex capacities, we will also debottleneck and increase capacity by 10-15% for our synthetic rubber products. Two other big areas for us this year will be ESG and exploiting new digital technologies to improve both growth

and efficiency.

Is Apcotex undertaking any major R&D initiative in India to compete effectively against global players?

Over the last couple of decades, Apcotex has invested in R&D in not only our products but also process technology and application expertise. We have leveraged these strengths well to increase market share in India and increase sales outside India. We continue to invest in R&D and explore new products that fall within our core competence.

How is the company striking a balance between environment-friendly policies and sustainable growth? When are you planning to achieve Net Carbon Zero?

We believe environment-friendly policies and growth are not at odds against each other. On the contrary they are complementary. In the long run climate/environment sustainability is imperative for survival and having the right policies will be essential for growth. The world has learned the hard way and companies have to keep improving and adapt quickly. At Apcotex we have been practicing TPM for 15 years, we are certified for Responsible Care, ISO 14001 and OHSAS 18001. We are also working towards GreenCo certification this year.

Key CSR initiatives being undertaken by the company in FY 2022-23?

As a company we focus on health and education for our CSR initiatives. Our major CSR initiatives in the last few years have been around our Gujarat factory where we are working with NGOs (Edelgive and Uthaan) to improve health and sanitation. We have also contributed significantly towards paediatric cancer patients in Mumbai through an NGO called St. Jude. In the last two years, we have provided funds for COVID relief to several NGOs in both Maharashtra and Gujarat. ■

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TO BE AMONG THE TOP FIVE COMPANIES IN THE DOMESTIC MARKET IN BENZENE CHEMISTRY

Bodal is the most integrated dyestuffs company in India having three phase integration starting from basic chemicals, dye intermediates, and dyestuffs



ANKIT PATEL
EXECUTIVE DIRECTOR
BODAL CHEMICALS LIMITED

Q Bodal is the largest dye intermediates player in India with a 20-25 percent market share of India's total capacity. How do you plan to increase your market share?

Our company is a dyestuff integrated manufacturer that produces 25 dye intermediates. More than 40% of the capacities of these intermediates are captively used, resulting in a considerable cost advantage for dyestuff products. Given the positive outlook for dyestuff, we want to strategically improve our captive consumption of dye intermediates. As a result, the overall market share in dye intermediates will decrease in the coming years but we are expanding in basic chemicals i.e. Chlor-Alkali and Sulphuric Acid and specialty chemicals i.e. Benzene Downstream products.



Q Bodal is looking at both organic

and inorganic growth through new products and acquisitions. The company is entering into new products like Chlor-Alkali, Benzene, its derivatives, and others. How do you see these developments transforming Bodal?

We endeavour to move up the value chain and diversify our business from core dyestuff and dye intermediates into other specialty chemical products such as Benzene Derivatives and Chlor-Alkali products. Strong tailwinds and high demand aided the Indian Chlor-Alkali business. We purchased Mawana Sugars' Rajpura Punjab facility in the first quarter of fiscal year 2022. With revenue of Rs. 180 crore in 9M FY'22, the Chlor-Alkali business delivered a strong performance. We will manufacture Benzene Downstream products which are primarily used in pharma, specialty chemicals, and agrochemicals. As a result, our organization will offer a diverse product portfolio on a large scale to multiple end-use markets, resulting in a new version of our company.

Q How is Bodal Chemicals positioned both in the domestic and international market vis-a-vis its competitors?

Bodal is the most integrated dyestuffs company in India having 3 phase integration starting from basic chemicals, dye intermediates, and dyestuffs. In the domestic market, we have a 13 percent market share for dyestuffs and a 20 -25 percent market share for dye intermediates. Our global market share for dyestuff is near 3% and the market share for dye intermediates would be near 6%. We have significant capacity across a wide range of products to meet the needs of end-user

Dye Intermediates business will grow by additional Rs. 100-120 crore as we have commercialized Vinyl Sulphone's capacity expansion and SPS Processors unit. We anticipate significant growth in the Chlor-Alkali business since the upgrade activity is expected to be finished by the end of 2022.



industries. Although basic chemicals and Chlor-Alkali products would serve a regional market. We will be among the top five companies in the domestic market in benzene chemistry after Saykha's expansion.

Q The company exports its products to countries like China, Turkey, Europe, Indonesia, etc. Any plans for increasing the company's presence in these countries and strategies for achieving it?

We do business in over 45 countries and have a product portfolio of over 200 products. This diversification requires significant resources for managing the inventory of critical raw materials and finished products, as well as a lengthy transit time. In the event of a supply chain disruption, we prefer to preserve inventories and satisfy our clients' needs in a shorter timeframe. We already have trading and marketing subsidiaries in Turkey, China, Bangladesh, and Indonesia to build a stock point and expand into new geographies and markets. Based on the need to further grow market share, we may consider other countries for the same.

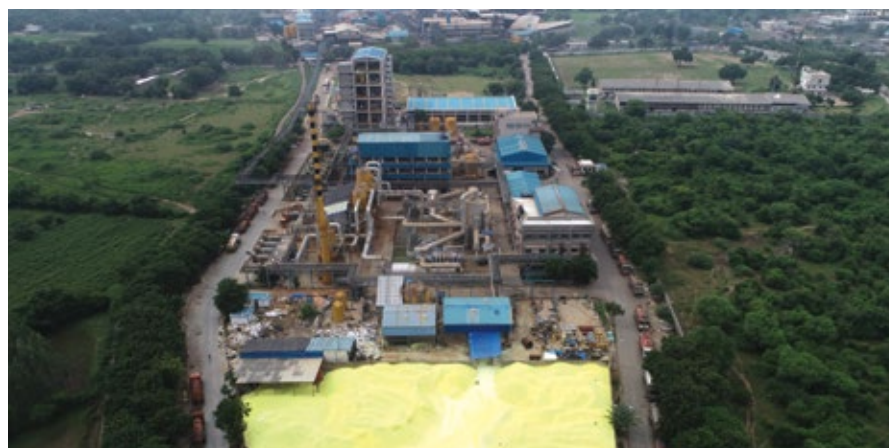


Q The company has a dedicated R&D lab focused on dyes & intermediates and specialty chemicals. What are the new products that the lab is developing?

We have a modern, well equipped R&D lab and three in-house R&D labs 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 evolved in chlorination, nitration, and now benzene chemistry.

Q In FY 2022-23, the company is planning a Capex of around Rs. 400 crore to finish greenfield projects and capacity expansion? Projects and products where you will be utilizing this Capex?

All planned Capex would be invested in



upgrading and expanding the Chlor-Alkali unit at Punjab and in the Saykha greenfield project for Benzene Derivatives and Sulphuric Acid products. The capacity of Sulphuric Acid and derivatives will be 340,000 tons per annum which will include Sulphuric Acid, Oleum 23, Oleum 65, Liquid SO₃, ChloroSulfonic Acid, Liquid SO₂, etc., We will also manufacture benzene based downstream products such as MCB, PNCB, ONCB, MNCB, DNCB and 2, 4 DNCB at same Saykha location.

Q It has been a good year for Bodal – Dyestuff expansion, 100% stake in Trion Chemicals, Vinyl Sulphone capacity commercialization, greenfield Saykha project, and newly acquired Chlor-Alkali products in Punjab. How will these affect your revenue and profitability in the future?

The primary goal of earlier investment has been to bring a long-term sustainable business model without losing the leadership in the legacy business. FY22 has been good for us, bringing better stability to the overall business. We foresee our business would be less volatile and more diversified in the coming years since we would be catering to a broad end-use application market with a wide product basket.

Q What is the company's strategy for increasing revenue and profit during FY 2022-23?

In FY23, the dyestuff business will grow marginally. Dye Intermediates business will grow by additional Rs. 100-120 crore as we have commercialized Vinyl Sulphone's capacity expansion and SPS Processors unit. We anticipate significant growth in the Chlor-Alkali business since the upgrade activity is expected to be finished by the end of this year. We foresee double-digit growth from the current level and improvement in profitability.

Q How is the company driving sustainability?

We have restructured our safety functions and enlarged their role as Environment, Health, Safety & Sustainability (EHSS) function. Reducing our environmental footprint, conserving natural resources and managing waste is the key to our circular economy approach and sustainability practices. Some of our Pollution Control Systems include Effluent Treatment Plant (ETP), Brine Treatment Plant (BTP), Multiple Effective Evaporator Plant (MEEP), and Effluent Spray Dryer Plant (ESDP). The company has undertaken various environment-friendly measures in its different units for promoting a better environment. The company has in place adequate pollution control equipment and all the equipment is in operation. We believe it is a continuous process and there is always room for improvement. ■

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FMC HAS BEEN PROVIDING INDIA'S FARMERS ACCESS TO WORLD-CLASS PRODUCT

The company is significantly investing in developing and offering a suite of crop solutions customised to benefit Indian farmers across multiple crops, supported by a best-in-class pipeline of products, and stewardship



RAVI ANNAVARAPU
PRESIDENT
FMC INDIA

Q Global trends in the crop protection and crop care business and how it will impact India?

The demand for crop protection products globally will continue to increase due to the decreasing arable land and urgent need for addressing food security. The world crop protection market including India has been undergoing transformation in response to the changing crop mix trends and regulations. Surging population and subsequently rising demand for food, feed, and biofuel has also been contributing towards growth. The enhanced consciousness for the environment is creating preference for safer and more sustainable crop protection solutions.

Q Key milestones achieved by FMC India in FY 2021-22?

FMC has emerged as one of the leaders in the crop protection industry in India riding on its innovative and industry leading products such as Coragen, Benevia, Authority NXT, Marshal etc. Apart from such high-performance products, FMC engages with more than two million farmers annually to empower them on sustainable agricultural best practices every year. The company has one of the strongest pipelines of products that are customized to offer differentiated solutions to Indian farmers for their present and future needs. Beyond business imperatives, FMC has also carried forward its commitment to making a difference to the lives of rural families by investing in four key areas: safe water and good health, good agricultural practices, science in agriculture, and empowering women in agriculture.

Q Globally, crop protection and crop care companies' focus is shifting away from being a products company to a solutions company. What's your strategy in India?

FMC corporation is a global leader committed to furthering sustainable agriculture through sustainable crop protection and crop nutrition solutions. FMC has been providing India's farmers access to world-class product technologies, in support of the country's aspiration to be the world's leading agricultural producer. We develop, market, and sell all major classes of crop protection chemicals - insecticides, herbicides, fungicides, and crop nutrition products. The company is significantly investing in developing and offering a suite of crop solutions customised to benefit Indian farmers across multiple crops, supported by a best-in-class pipeline of products and stewardship. 100% of our R&D investment is being dedicated to developing innovations that are sustainability advantaged.

The company aims to deliver products that not only help to maintain a safe and secure food supply, but with minimal impact on the planet. Additionally, we are venturing into technology solutions like Arc Precision Agriculture tools and drones, etc. to enable precision farming in the country.

Q What's the latest on the company's R&D initiatives? When are you planning to commercialize the new molecules?

FMC's R&D team of more than 800 scientists and associates are guiding one of



RESPONSIBLE CHEMISTRY FOR SUSTAINABLE FUTURE

Meghmani Finechem Limited (MFL), incorporated in 2007, is a **leading manufacturer of Chlor-Alkali and value-added derivatives**. The company has a state-of-the-art manufacturing facility in Gujarat, Dahej - a leading PCPIR region in the country. MFL's Dahej facility is a fully integrated and automated complex with well-established infrastructure and captive power plants. The company is **India's 4th largest manufacturer** of Caustic Soda Lye, Chlorine and Hydrogen and a leading manufacturer of Caustic Potash, Chloromethanes and Hydrogen Peroxide. MFL is also into Epichlorohydrin (ECH), **1st to manufacture in India**.



MFL is now expanding its product base to include products like Chlorinated Polyvinyl Chloride (CPVC RESIN) and Chlorotoluene & its value chain. The company has been awarded with the **Responsible Care** certificate.



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- Liquid Chlorine
- Hydrochloric Acid
- Sodium Hypochlorite
- Hydrogen Gas
- Caustic Potash (Flakes & Lye)
- Chloromethanes
- Hydrogen Peroxide

Epichlorohydrin (ECH)

Upcoming Projects

- Expansion of Chlor-Alkali capacity
- Chlorinated Polyvinyl Chloride (CPVC RESIN)
- Chlorotoluene and its value chain

Chlorine Helpline
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Powai, Mumbai - 400076.
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the most robust discovery and development pipelines in the agricultural industry. FMC also uses external collaborations, partnerships and investments to enhance the diversity of the research efforts. We have invested in – and partnered with – companies that complement our own efforts. Every year we reinvest 8% of our revenue towards R&D globally.

At FMC, we believe every product must meet the sustainability expectations of key stakeholders. We are guided by FMC's sustainability goals to dedicate 100 percent of R&D investments to develop more sustainable products.

We discover and synthesize new molecules with differentiated modes of action to control pests that may challenge growers. We focus on molecules that can meet stringent future regulatory requirements and criteria for a successful, competitive commercial product. We screen more than 60,000 compounds annually. FMC's global pipeline contains 35 new active ingredients (AIs) of which 20 are new modes of action Active Ingredients.

FMC has one of the global innovation centres in Hyderabad which focuses on creating solutions in keeping with local needs. FMC plans to launch more than 10 new products in the coming 3-5 years, which include many new modes of action chemistries across all segments such as Insect control, disease control, weed control, and plant health business.

Projects and products where the company is investing in FY 2022-23? What's the Capex plan for FY 2022-23?

As we just said, FMC India plans to launch more than 10 new products in the next 3-5 years. We recently launched a new research-based insecticide Corprima to support tomato and okra farmers across the country, which offers superior crop protection against fruit borers, one of the bigger pain points for Indian farmers.

We are also looking at launching 4-5 more new products through the course of this year to provide relevant solutions to Indian farmers.

We already have a significant manufacturing footprint in India and the company is committed to progressively invest in India. Aligned to the larger Make in India initiative, FMC continues to support manufacturing in

India for both Indian and global markets, including some high end innovations such as Isoflex at Panoli site. The company is continuously evaluating the Capex investment to augment site capacities and bring in new molecules manufacturing capabilities in India locations. We are fully committed to and invested in India.

What's your focus on new technologies like drones and others?

We deeply appreciate the proactive and favorable decisions taken by the Indian government to pave the way for early adoption of drones in agriculture. Globally, drones have proven their efficacy in fertilizing and protecting crops more efficiently. In 2022, we expect to see action on the ground with many commercial ventures making an effort to further enhance input use efficiency in agriculture. We are continuously conducting trials in the country and look forward to supporting farmers to apply crop protection solutions more effectively, efficiently and in a safe and judicious manner using drones. We look forward to having multiple label claim expansions using drones for our premium products across multiple crops approved during the year 2022-23.

FMC has been continuously investing in advancing novel technologies in agriculture. The company's unique technologies from its Precision Agriculture portfolio are designed to ensure the right crop protection products are applied exactly where and when they are needed to increase sustainability, as well as optimize yield quality and quantity while improving Return on investment for farmers. We plan to bring many of these technologies for the benefit of Indian farmers in near future.

FMC strategy is to have 50% women workforce by 2027 across all regions and job levels. How are you planning to achieve it in India?

FMC, being a global Company, has a diverse workforce and diverse Culture. Therefore, to achieve the target of having 50% women workforce by 2027 across all regions and job levels, the strategies need to be formed in abidance of law of the land and local conditions. Multiple initiatives are being undertaken at different touchpoints of

the 'employee lifecycle' to achieve our goal - All these initiatives, under Project 'Pratibha', include hiring women talents from leading campuses, encouraging women in science via the FMC Science Leadership Scholarship program at leading universities, and ensuring the right representation of women candidates is present during the hiring process. Additionally, FMC as an organization is working towards building capacity in the agriculture industry through various on-ground training, including more women in diverse roles across the company.

FMC has done pretty well on sustainability. Sustainability projects planned by FMC India in FY 2022-23?

Sustainability being one of our key focuses, FMC is committed to make agriculture and farming sustainable and towards this, FMC will continue to educate farmers on sustainable agronomic practices for growing crops with soil, water and crop protection stewardship, along with increased input use efficiency.

At manufacturing level, we are looking to further reduce our environmental footprints, having already achieved Zero Discharge status for our sites at Panoli, enhanced share of our energy requirement coming from renewable sources, addressing process efficiencies and recycling equivalent quantities of plastic that we use in packing our products. Apart from this we plan to further strengthen our engagement with farming communities through more intense product stewardship training, promoting concrete actions to promote diversity and inclusion.

FMC's efforts under Project Samarth, which deals with providing access to safe water to farming families, recently got recognition at the inaugural Water Sustainability Awards, hosted by TERI-IWA-UNDP jointly. FMC has been successfully running project Samarth across Uttar Pradesh and Punjab to provide safe and potable water to farmer communities. Last year we expanded the program to southern states including Andhra Pradesh, and Telangana. This year we will be expanding the project to Western India including Maharashtra, Madhya Pradesh, and Gujarat. We are committed to improving the living standards of the farming communities through this initiative. ■



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WE HAVE CONSISTENTLY EXPANDED OUR BUSINESS IN INDIA

Evonik's six innovation growth fields are: Sustainable nutrition, healthcare solutions, advanced food ingredients, membranes, cosmetic solutions, and additive manufacturing



VINOD PAREMAL
PRESIDENT AND
MANAGING DIRECTOR
EVONIK, INDIA REGION

2022 global trends in specialty chemicals and its implications on India?

It would definitely be the 'Sustainability Imperative'; more than a trend, it is a compelling need that has the entire industry pivot its axis across its research, production, and business operations. This is supported by adequate, and timely policy measures that complement industrial advancement across the value chain. Next would be the digitization of operations, from augmented human resource productivity to implementing AI to collect data on consumer behavioural patterns.

India is in a position of advantage as the market is geared up to boom over the next decade. The availability of a skilled talent pool will only add to this potential. The policy environment is also inclined to this growth, with acceleration programs that ease business and are fertile for infrastruc-



tural development. We're looking forward to the environment becoming more attractive for investments, along with a robust Performance Linked Incentive (PLI) scheme such that the ecosystem receives the support it commands.

Evonik India has played a key role in shaping up various industries in its four decades of existence in India? Key milestones achieved by the company in FY 2021-22?

Evonik has been contributing to various industries by offering innovative products over the years. Being a specialty chemical company, while we often contribute only small amounts of material, those contributions are precisely what make the difference. With this endeavor we have consistently expanded our business in India. In

2021, Evonik India has been able to supply to the industry despite COVID challenges and global supply chain issues. We have ensured continuous supply to essential industries like pharma, animal feed, agrochemicals, and FMCG in these challenging times with our strong resilience. The company focuses on - nutrition & care, specialty additives, smart materials, and performance materials.

The company focuses on - Nutrition & care, specialty additives, smart materials, and performance materials. How has Evonik India performed in FY 2021-22? What are the plans for FY 2022-23?

In 2021, most of our businesses grew beyond pre-COVID levels. We see growth in the overall Indian economy and momentum in relevant end-markets like paints & coatings, infrastructure, automotive, animal feed, pharmaceuticals, etc. We also need to be

Our six Application Technology Labs form the backbone of our customer-centric approach, because they support our local and regional customers with new formulation development, trouble shooting, product testing, application trials, and distributor training for technical knowhow.

cautious about developments in the global geo-political arena and the COVID situation around the world as that may affect supply chains for our businesses in India.

? **How are Evonik India's R&D centres at Mumbai and Dombivli and six Application Technology Labs contributing to India and the global market?**

These are critical to our long-term strategy for our Indian and global markets. Our Research Center India (RCI) in Mumbai is our global competence center for oral formulation development, and its state-of-the-art facility is designed to cater to industries ranging from pharmaceuticals, nutraceuticals, and food technology. Our R&D centre for catalysts supports fine chemicals, bulk chemicals, and edible oil industries, in addition to the pharmaceutical and food with its expertise in catalyst development for complex chemistry. Our six Application Technology Labs form the backbone of our customer-centric approach, because they support our local and regional customers with new formulation development, trouble shooting, product testing, application trials, and distributor training for technical know-how. Our business functions are founded on our mastery on research and innovation, and our strong customer-first approach.

? **Evonik puts a lot of thrust on sustainability? Key sustainability plans for the company in FY 2022-23?**



Evonik recently conducted a cross-functional sustainability analysis to assess and integrate sustainability topics into the company's portfolio and strategic management decisions. As per the report, 90 percent of products have a positive sustainability benefit, and over 30 per cent of its portfolio delivers superior sustainability benefits. This directly addresses customers' desire for sustainable products, and paved the way for our strategic targets for 2022 and beyond:

- 100 percent of all raw material suppliers where annual procurement volume is > €100 thousand to be covered by Together for Sustainability (TfS) assessments by year end 2025 (Status 2021-69%)
- Reduce greenhouse gas emissions - Absolute scope 1 and scope 2 emissions by 50% by 2025 (reference base 2008) (Status 2021-43%)
- Absolute scope 3 emissions from the upstream value chain – principally from the

raw material backpack by 15% by 2025 (reference base 2020)

- Reduce both absolute and specific energy consumption by 5% by 2025 (reference base 2020)
- Occupational health performance index ≥ 5
- Substantial increase in sales generated by next generation solutions (Status 2021 - 37%)
- Generate more than Euro 1 billion sales in our six innovation growth fields by 2025

Evonik's six innovation growth fields are: Sustainable nutrition, healthcare solutions, advanced food ingredients, membranes, cosmetic solutions and additive manufacturing.

? **Can you share your CSR initiatives for India? CSR Plans for FY 2022-23?**

We're deeply committed to improving the social environment in any way possible, and consciously reach out to support causes across the board, primarily in the realm of children's education, women empowerment, and healthcare. Recently, one of our projects even involved employees from the Asia Pacific contributing to a local NGO that utilized the aid to procure medical equipment for patients during the pandemic. Likewise, we have projects lined up by our partner trusts and foundations for the upcoming year, that will see us actively support infrastructure for schools, procurement of equipment and facilities for medical aid, and tools to help women and specially abled people live qualitatively better lives. ■



READY FOR AUTOMATION?

DCM SHRIRAM HAS BEEN IN 'INVESTMENT MODE' IN THE LAST FIVE YEARS

In FY 22 an investment of Rs. 2,400 crore has been approved by the board for its various expansions in chemicals business while Rs. 540 crore has been approved for expansion in sugar business



SHEKHAR KHANOLKAR
EXECUTIVE DIRECTOR & CEO
CHEMICALS
DCM SHRIRAM LIMITED

Q How has DCM Shriram performed in FY 2021-22 with special emphasis on chemicals and ethanol segment?

DCM Shriram Limited has had a satisfactory performance in FY 22. Post COVID, the push in the demand side has improved the financial performance and therefore the overall results.

Chloro-Vinyl business witnessed almost unidirectional increase in input costs especially energy prices. This was led by global factors such as increase in energy demand, supply constraints due to geopolitical factors, and adverse weather conditions. Freight costs are also adding to the cost push. While realisations have been good, long term focus remains on cost optimisation.

Q What is the Capex plan for DCM Shriram in FY 2022-23? Projects where you are investing? How will these Capex investments help the company both in terms of revenue and profitability?

The company has taken up aggressive growth plans in both its chemicals and sugar business over the last few years. In FY 22, an investment of Rs. 2,400 crore has been approved by the board for its various expansions in chemicals business while Rs. 540 crore has been approved for expansion in sugar business.

In the chemicals business, we are on the verge of completing our 120 MW power to support the current and future expansion at Bharuch.

We are also executing 150 TPD plant



ANUPAM RASAYAN INDIA LTD.



each for both Epichlorohydrin and Hydrogen Peroxide. Along with these, we are also commissioning a 90 TPD AIC13 plant. Part of it will come by May 2022 while balance by Mid FY23.

Overall DCM Shriram has been in “Investment Mode” in the last five years and going forward, we will continue to evaluate the opportunities based on long term value creation to the group and all stakeholders.

? **What's the automation and digitalization plan of DCM Shriram across chemical operational plants in FY 2022-23?**

We are working on formulating a detailed strategy for digitization, not only chemicals but across the group. In the chemicals business, we are working on a detailed plan to execute a function wise digitization strategy driven by global benchmarking as we work on SAP S4 HANA. Our core strategy in digitization will be long term value creation.

? **The company is planning a multi-purpose product R&D centre. What's the key R&D initiatives that the company is planning to undertake in this centre?**

We are looking at various formulations to support our current portfolio. The centre will be used to develop various grades of current product portfolio as per customer specifications and will also work as an incubation centre to develop new products/formulations within new and allied areas.

? **How is DCM Shriram balancing growth and sustainability? When is DCM Shriram planning to be net zero?**

At DCM Shriram Limited, we have been actively working to conserve water through our various sustainability initiatives and continue to sustain being a water positive company by undertaking various initiatives. We have built multiple water-harvesting structures in different locations, promoted water conservation, and embedded water conservation with an agri-skilling projects. This has recharged



We are looking at various formulations to support our current portfolio. The centre will be used to develop various grades of current product portfolio as per customer specifications and will also work as an incubation centre to develop new products/formulations within new and allied areas.



groundwater reserves, boosted the irrigated/cultivable areas, and crop production while ensuring year round availability of water.

The company has been continuously striving towards reducing GHG emissions, remaining water positive, maximising waste recycling and utilisation, maintaining safety and health at workplaces and enriching communities.

We firmly believe that carbon capturing technologies and a circular economy will be the business sustainability drivers for growth. The company is steadily increasing use of non-fossil fuels and renewable power along with measures towards waste recycling and enhancing water security. Biomass cogeneration capacity, hydrogen production, and usage of ethanol blending has been increasing year on year.

? **CSR projects planned for FY 2022-23 with respect to rural development, environmental sustainability, vocational skills, and preventive healthcare?**

At DCM Shriram Limited, we are committed to creating a social impact in the lives of communities around our manufacturing locations. We work with an integrated rural development approach working towards both infrastructure and softer aspects like behavioural change/IEC etc. We have long term ongoing programs across the thematic areas of sanitation, preventive healthcare, environment sustainability, education and livelihood. In FY 2022-23, also our focus will be on these CSR pillars with regular need assessments and baseline studies to help plan our CSR strategy accordingly. ■

CONTINUE TO INVEST IN CAPITAL/ASSETS TO EXPAND OUR CAPACITIES TO SUPPORT BUSINESS GROWTH

Our plans for 2022 include expanding our footprint into some new segments like electronics, technical textile, and consumer



VIKAS KULKARNI
MANAGING DIRECTOR,
BOSTIK INDIA

What are the global trends in the adhesive solutions segment and how do you compare it with India?

The global growth in the adhesive solutions segment is 3 - 4% while in India it is in double digits. This high growth market means there are many opportunities for us to expand our presence, especially surfing on global trends such as: Construction Market - Energy efficiency, premium and performing solution, increase of DIY activities in emerging regions; and Industrial Adhesives - lightweight equipment and increase durability and sustainability, higher demand in electronics and batteries.

As the adhesive solutions segment of Arkema, we are in a unique position to stay connected to emerging trends in a variety of sectors and seize the emerging opportunities. In all those markets, we have strengthened our technologies and offerings in the past years and we are well positioned in all of them to keep growing, in India and around the world.

What is the size of the adhesive solutions market globally in 2021 and forecast for 2022?

The global adhesives solutions market in 2021 is €60 billion and the forecast is that it will reach €63 billion in 2022. We expect growth for all segments, with particularly strong drive for the Durable Goods and Construction segments, and promising prospects for the Packaging and Hygiene industries.



What is the size of the Indian adhesive solutions market in 2021 and forecast for 2022? What is the market share of Bostik in India and how do you plan to increase your market share?

Market size in India for adhesives & sealants is estimated at Rs. 15,000 crore. Bostik is the third top global player in the adhesives industry. In India, we are comparatively smaller since we do not currently participate in many market segments. However, in segments in which Bostik participates, we are among the top three players.

We are investing to grow our position in the market by strengthening our technologies, especially in the wake of the Fixatti and Ashland acquisitions to support our growth. In addition to this, acquisitions made by Bostik in the engineering adhesives space, positions us very well with technologies required in electronics and automotive segments. We have a clear plan to foray into these segments as also into consumer adhesives in 2022.

Indian adhesive market is pegged at around Rs. 9,000 crore, expected to grow at 11% pa. The growth will vary across different segments. We see faster growth in Paper & Packaging, Hygiene, Automotive, and Energy and slightly lower growth in mature markets like Footwear and Construction.



We have some hero products in each of these segments that we will bring into India. We will continue to invest in our talent, as we have done in the last two years to get the best in class people available to the industry. We will continue to invest in capital/assets as needed to expand our capacities and build new ones to support business growth. We also continue to look out for inorganic growth and strategic alliances to accelerate our growth.

Size of Indian adhesive solutions market for:

BUILDING & CONSTRUCTION SEGMENT

Tile Adhesives Tiling market is estimated to be around Rs. 1,200 crore. Market is at a very nascent stage of growth as almost 90% of the market is still using traditional sand, cement, mortar methods of application. However, we are witnessing a shift and expect the market to grow at a CAGR at 13% as a result of penetration conversion from traditional methods to bagged tile adhesives. Apart from this, the other solutions we offer to the B&C segments are WP, Repair Products & Sealants. Each of these markets is quite large and poised to continue to grow at 8-10%.

INDUSTRIAL SOLUTIONS

The Indian adhesive market is estimated at around Rs. 9,000 crore, expected to grow at 11% per annum. The growth will vary across different segments. We see faster growth in Paper & Packaging, Hygiene, Automotive, and Energy and slightly lower growth in mature markets like Footwear and Construction. The Make in India campaign should give impetus to sectors like aerospace, defense, and electronics. Consumer adhesives is a huge market and it will continue to grow, benefiting from India's demographics.

We have started seeing a trend towards sustainability with many customers looking for recyclable, biodegradable, low VOC and solvent free products. We, at Bostik, are gearing ourselves up to be ready with solutions that will be needed by the customer in the future.

DISPOSABLE HYGIENE SEGMENT

The market size is about Rs. 500 crore. It will grow in double digits in next few years, through penetration as disposable incomes go up in both urban and rural India. Indus-



try is moving towards thin substrates to make end-products lighter. Bostik continues to innovate to meet changing needs for our customers.

? What are the new innovations that the company is working on in global R&D labs? Please elaborate?

As the adhesive solutions segment of Arkerma, we focus on creating innovative specialty adhesive solutions that contribute to a sustainable world. This means both: More sustainable adhesives, e.g. made out of recycled/bio sourced materials, which are themselves recyclable/compostable, which use less resources while they are produced, etc.; and smart adhesive solutions that help our customers reach their own sustainability goals, for instance by contributing to producing lighter and smaller objects, allowing better insulation to lower the carbon footprint of building, creating safer products, both for construction and hygiene; and enabling recyclability or compostability of packaging.

This, and more, is what our global R&D labs are working on, alongside our business teams, clients and partners – Bostik's culture of innovation is very much collaborative, even R&D at our lab is the result of a highly collaborative process.

? How has the performance of Bostik India been in 2021 and what are your plans for 2022?

We have seen a very good recovery in demand in the second half of 2021 across all our business units. Raw material inflation

has been a big challenge for the industry. The global supply chain disruption was another challenge to contend with. Overall, Bostik has been able to navigate these challenges quite well and continued to serve our customers.

We expect demand to continue to grow and some of the supply chain challenges to abate in 2022. Our plans for 2022 include expanding our footprint into some new segments like electronics, technical textile, and consumer. We will continue to innovate to meet changing customer requirements & bring the products that are sustainable to meet our own and customer's sustainability goals.

? Bostik has introduced a new series of GCR adhesive and sealant solutions called Silane-modified Sealant Products (SMPs) for the transport industry. Are you planning to launch these products in India?

We have launched the new GCR range to complement our existing top line products – SMP. The market is growing in India. SMP has low VOC and no Isocyanate making it environment friendly.

We cater to various applications in bus, metro and rail segments. As we launch the new Global Core range of products, we bring in the technology to address various other applications such as glazing, sheet metal bonding, and structural bonding. We have core experience on working with various OEMs across the globe and synergies will help us replicate here in India as well. With our wide range of sealants, we are also aiming at markets beyond transportation such as appliances and elevators. ■



LEVERAGING THE GROWTH OPPORTUNITY OFFERED BY THE INDIAN MARKET

Our current Capex – one at Jhagadia and the other at Tarapur is expected to become operational by the end of this financial year



UNNATHAN SHEKHAR
MANAGING DIRECTOR
GALAXY SURFACTANTS LIMITED

? **How do you see the evolving trends in Personal and Home Care products?**

Sustainability has become an important aspect of FMCG products amid a growing concern of climate change issues with consumers taking active steps in curbing their personal impact on the environment. Consumers can be seen moving to 'purpose-driven' buying of home and personal care products that advocate sensitivity to global issues. We can see global FMCG players also make a move towards greener products.

Consumers prefer products that offer sustainability as well as product functionality that seamlessly fit into their ever-changing lives. We have seen a boost in the sale of mass and massive beauty & personal care products. Amidst the volatile economic situation due to the pandemic, consumers also indulged in affordable luxuries through premium beauty products and therefore, the premium beauty segment has also performed well in the past year.

With the rise in numerous D2C brands, e-commerce remained a preferred medium of purchase for the consumers in India as well as abroad.

The pandemic has given homecare considerable boost due to a comprehensive shift towards disinfection and the sense of security consumers get from having a clean-living environment for themselves and their families.

Post-Covid consumer sentiments have

not changed drastically in home care. They are still looking for products that combat bacteria and microorganisms while also focusing on sustainability of homecare products by having natural ingredients. Products launched with anti-microbial claims have been steadily growing in APAC. In India specifically, there is a growing focus on hard surface cleaners and dishwashing products with anti-bacterial claims.

? **What is the growth mantra for Galaxy Surfactants in targeted segments – Performance Surfactants and Specialty Care products?**

Galaxy Surfactants has been consistently delivering growth both in the Performance Surfactants as well as Specialty Care products.

Our strategy has been to drive growth in the mature markets with Specialty Care products. The emerging markets remain important for Performance Surfactants. In today's fast changing environment, it is imperative that brands are quick in recognising and addressing consumer needs. Galaxy continuously strives to grow ahead of the market by anticipating consumer trends, focusing on path-breaking innovations, delivering value and offering customised solutions through its 'Consumer to Chemistry' approach.

Today's consumers are globally shifting towards sustainable products; aligning infrastructural needs with sustainability, innovation, application, regulatory, technology support and business development has always been our mantra.

Sustainable and innovative solutions are not just restricted to Specialty Care products but also relevant to Performance Surfactants. One such example is the low Dioxane variant of FAES, 'GalEcoSafe', developed by Galaxy



Surfactants Limited. GalEcoSafe is specially designed Fatty Alcohol Ether Sulphates with ultra-low 1,4-Dioxane levels that not only make end products compliant with the new US regulations but also make them safer for consumption.

Q Galaxy has a technologically advanced and well-equipped Innovation Centre for new products and application development. How is the company planning to leverage this facility?

The consumer is becoming increasingly aware of what they need and have clearer expectations of the brands they use. The change in consumer demands are quite rapid given the overall increase in the pace of information exchange due to the internet. Galaxy partners with various customers to provide tailor-made solutions for its consumers. We 'Customise with Care' for our customers and accordingly deliver innovations that power brands.

The amino acid-based surfactants or mild surfactants such as Sodium Cocoyl Glutamate and Sodium Cocoyl Glycinate are derived from basic amino acids and palm oil-based fatty acids are sought after ingredients for today's personal care formulations.

These surfactants are safe for the people and the planet and have been on the market for a while. Galaxy's award-winning green technology platform enables us to offer a range of amino acid surfactants which are manufactured using a green catalyst making not only the product green but also the process green.

We have also developed easy-to-use sulphate-free surfactant and sunscreen blends that provide great formulation ease and the required functionality for the customers who want to leverage on our four decades of expertise in making effective ingredients.

Q What are the new products that you are working on to diversify your innovation funnel?

Today's mantra is extensive collaboration with customers for end-product develop-



Galaxy continuously strives to grow ahead of the market by anticipating consumer trends, focusing on path-breaking innovations, delivering value and offering customised solutions through its 'Consumer to Chemistry' approach.

ment.

Non-toxic Preservatives - Galguard LipoG is 'non-toxic', biodegradable, nature-derived and safe ingredient for consumers and the planet. It is a multi-functional ingredient that can be used for rinse-off, leave-on and wet-wipes application. Its solid nature and flexibility with the particle's size makes it suitable for water-less or concentrated formulations.

With Galguard Tetra, our preservative technology uses Lipidated Glycines, Capryloyl Glycine and Undecylenoyl Glycine which are multifunctional cosmetic ingredients made by our unique patented green process.



Mild surfactants - In the field of green chemistry, Galaxy has done significant work on mild amino acid surfactant technology. With an aim to provide natural, green and sustainable cleansing solutions and as a responsibility towards the environment, Galaxy has come up with a unique mild and green amino acid-based surfactant system 'Galsoft GLI 21.' The product is a modern, ultra-mild sulfate-free cleanser. It is a combination of one of the mildest amino acid surfactants and is based on Galaxy's Green Amino Acid technology.

Galsoft SLL, a condensation product of lactic acid and lauric acid, is a mild and multifunctional molecule. It provides an excellent foam profile, improved emollience, moisturisation and sensorial properties in both rinse-off and leave-on formulations while being readily biodegradable. The ingredient can be used in skin care, hair care and baby care products. Galsoft SLL can also be

used to enhance the delivery of ingredients into personal care products such as creams, lotions, baby products, body cleansers, hair cleansers etc.

GalEcoSafe - GalEcoSafe range of surfactants are specially designed Fatty Alcohol Ether Sulphates with ultra-low 1,4-Dioxane levels. The low dioxane levels help to formulate Personal and Homecare products to comply with stringent and upcoming NY S4389B regulations. GalEcoSafe has 1,4-Dioxane content at 5 ppm max, making formulations safe while keeping them functional.

Galaxy Hearth - We have recently launched specialised homecare brand Galaxy Hearth focused particularly for the new normal world demands of consumers. Galaxy Hearth is also based on the fundamental premise of pioneering high sustainability enabling considerations of FMCG brands catering to homecare solutions.

The Hearth range comprises surfactants, wetting agents, viscosity builders, emulsifiers, preservatives, foam enhancers, pearlisers and many more such solutions. Combined with four decades of formulation expertise posed by Galaxy Surfactants, these ingredients are a perfect solution for all homecare manufacturing needs.

These products are the result of extensive collaboration with customers for end-product development.

Q How is Galaxy striking a balance between environment-friendly policies and sustainable growth? When is the company planning to achieve net-zero?

Gecko

Safe & Sustainable Food Packaging Inks

hubergroup

With Sustainability - a way of life, Galaxy has embarked on a journey of sustainable growth across all geographies of the operations. Galaxy is committed to integrating sustainability into its business and continues to improve sustainable performance and practices by adopting globally applicable management systems. Galaxy strives to minimize environmental impact by setting long term sustainability goals.

To enhance integrated thinking, decision making and actions that support long term value creation for Galaxy and all its stakeholders, we are focusing on better inclusion of ESG issues into our strategy and operational management through the process of materiality.

We have initiated interaction with suppliers for mutual value creation on sustainability aspects. We have engaged continuously with our supply chain partners to improve operational efficiency and integrate sustainability considerations into our value chain.

Galaxy's environmental performance are: Committed to the Science-Based Targets initiative (SBTi) for setting a highly ambitious target to transition to a low carbon economy; All Indian manufacturing units are zero liquid discharge; Gold Rating 2022, awarded by EcoVadis for Galaxy Group; Responsible Care logo for a period from February 2021 to January 2024; Assessment of risks and opportunities related to climate change using TCFD Recommendations; ESG Summit & Awards 2021 under the category of 'Best ESG Initiative to improve to access to clean water'; CDP Score – Supplier Engagement (A), Climate Change (B), Water (B-), and Forest (C); and Galaxy Surfactants Limited is now 1.4x water positive.

Galaxy's environmental targets are: Natural gas as main source of fuel; Renewable energy – 40 per cent as a source of electricity in India by 2026; Science based target at group level – committed to comply with the Paris Agreement; Net Water Positive and ZLD at Galaxy Chemicals, Egypt by 2023; 100 per cent waste circularity by 2030; and strong commitment towards product stewardship and life cycle assessment.

Working towards strong ESG (Environment, Social & Governance) parameters has been in the DNA of Galaxy. We firmly believe that sustainable growth, in the long run, can be achieved by striking the right balance



between both qualitative and quantitative aspects of the business. Galaxy's robust performance and strong presence worldwide is testimony of the fact that sustainability does not have to come at the cost of profitability. At Galaxy Surfactants growth is considered effective when it is inclusive.

Q What factors will drive current and long-term demand, especially in view of supply chain constraints amid continuing Covid-19 pandemic globally? What are your expectations for FY 2022-23?

Galaxy is strategically placed to cater to the home and personal care space. Given the current consumption patterns, demand has been steady. During the worst Covid waves also, the demand for essentials such as toothpaste, soaps, detergents remained stable. Over the past year challenges faced are majorly due to supply-led turmoil in terms of inbound and outbound logistics, steep freight rates, rising energy costs due to Russia - Ukraine conflict. The political instability in the European region is expected to at least continue till H1 of FY 2022-23. We therefore expect demand to remain higher than supply in the coming quarters.

Q What's the Capex plan for FY 2022-23 and projects and products where you are investing?

Galaxy has always been investing for the future. Our current Capex – one at Jhagadia, Gujarat, and the other at Tarapur, Maharashtra, are expected to become operational by the end of this financial year. These Capex are made for expanding capacities in our Specialty Care product range.

Q How is Galaxy Surfactants, India's largest manufacturer of Oleochemical based surfactants and Specialty Care products for Home and Personal Care industries (HPC), poised for increase in its market share with the emergence of biotechnology-based raw materials and surfactants?

Surfactants that are sustainably sourced, have a low environmental impact, are mild, natural and have low impurities, will dominate the future. These are the attributes of green and bio-surfactants and we have already established our position in green surfactants i.e., mild surfactants category. At Galaxy, bio-surfactants are at a development stage and we are progressing well on the same.

Q How is Galaxy Surfactants positioned in the domestic and international market vis-a-vis competition?

Galaxy's unique basket of offerings exclusively caters to the home and personal care space. This product range is effectively leveraged to address the requirements of customers in a comprehensive manner, especially in the Indian market.

Galaxy is an established player in surfactants and specialty care with global presence through its infrastructural capacities in India, Egypt, and the US. Galaxy's sourcing capabilities, value chain and customer centricity enables it to create its unique position in the international market. Hence, we believe that we are well-positioned to leverage the growth opportunity offered by the Indian market and meet the growing global demand of our leading customers. ■



EXPECTING 50% SALES GROWTH IN FY22

The company has announced a Capex of Rs. 315 crore for new products thereby looking at an addressable market of more than Rs. 3,000 crore



VINATI SARAF MUTREJA
MD & CEO
VINATI ORGANICS LIMITED

Q Vinati Organics is the world's largest manufacturer of IBB and ATBS. What's the next set of products where you are looking at global leadership and how?

We have announced a Capex of Rs. 250 crores in Veeral Organics Private Limited (VAPL), a 100% subsidiary of Vinati Organics Limited (VOL), for manufacturing of niche specialty chemicals. This Capex would give us 5-6 new products which would find its usage across various sectors like pharmaceuticals, perfumery, in applications such as monomer additive, and as a solvent for catalysts.

The company has also announced a Capex of approximately Rs. 65 crores towards a couple of niche specialty chemicals which will be intermediates in agrochemicals. The addressable market size of all these products is more than Rs. 3,000 crores and we expect total sales to be approximately Rs. 320 crores.

Q What's the update on VAPL merger with VOL?

Apart from this, the Board had given its approval for amalgamation of VAPL into VOL and we have filed the application with NCLT and are now awaiting their order.

VAPL is into manufacturing Antioxidants (AO). These Antioxidants are plastic additives which inhibit degradation of plastic. The acquisition of VAPL is a forward integration for VOL as Butyl Phenols will be the key raw materials in the manufacture of these AO's. After the acquisition, VOL will be the largest and the only integrated manufacturer of these AO's in India.

This acquisition will allow VOL to add a new revenue stream of specialty chemicals which have good growth potential both globally as well as domestically. The addressable market for VAPL is in excess of Rs. 10,000 crores and VAPL could generate sales exceeding Rs. 700 crores.

Q How has the company performed in terms of revenue and profit during FY 2021-22?

Overall we expect to clock 50% growth in sales in FY22 as compared to FY21 and expect the EBITDA margins to be in the range of 27 - 30%.

Q Are you planning to expand the manufacturing facility in Raigad and Lote? If yes, what's your expansion plan?

We are expanding our Butyl Phenol capacity by 15,000 MT at Lote which will feed our captive consumption towards manufacturing antioxidants.

Q How is the company striking a balance between environment-friendly policies and sustainable growth? When are you planning to achieve Net Carbon Zero?

Since inception, Vinati Organics Limited has always focused on being an environment friendly company. The collective intellectual capital of our people has enabled us to have Zero Discharge of effluents in both our plants. Both our plants are certified with ISO 9001:2015; ISO 14001:2015 and ISO 45001:2018.

Recently, we have commissioned a 6.5 MW solar power plant and now we are setting up another 7.5 MW solar power plant, in our efforts towards sustainable growth. ■

WE WANT TO USE INDIA AS A REGULATORY HUB FOR LATIN AMERICA, EUROPE, AND PARTS OF ASIA



SHISHER KUMRA
FOUNDER & EXECUTIVE DIRECTOR
GLOBAL PRODUCT COMPLIANCE (GPC)

We expect to face new Indian regulations in 2022 and we need to prepare ourselves for the industry and sensitize them on how they need to prepare to continue to do the business in a smooth way

? **How do you see the regulatory compliance scenario in the chemical sector?**

The story started in 2008 when European regulation called REACH was launched by the European Union (EU) and as a result there have been efforts by other countries who have also joined this regulatory regime on chemicals. These regulations are primarily based on environmental and human health protection scope.

The EU enacted REACH regulation wherein all chemicals placed in the European market need to be registered. After 2018, all manufacturers registered their chemicals which they wanted to place in the European market as there were penalties for non-compliance. The compliance started in Europe and was immediately followed by China, Korea, and several other countries. Now at least 8-10 countries have very extensive new types of chemical regulatory compliance requirements which is influencing many other countries for implementation. Many countries including India are also looking at regulatory compliance for the chemical sector.

? **Current trends in regulatory compliance and how is GPC planning to minimize it?**

Compliance is a sort of an issue and chemical manufacturers are concerned about

it since it results in cost. Somehow this is a new reality and they have to face and prepare accordingly otherwise exports could get affected drastically.

The chemical regulation has three main phases. First, inventory phase where one needs to know which chemicals can be placed in a particular country and one needs to have some estimation. Second, classification and labelling criteria has to be harmonized with the global system called UN Globally Harmonized System of Classification and Labeling of Chemicals (UNGHS). These two things

have to be in place in order to go to the setting up of a regulatory environment wherein companies need to register their chemicals so that the government can adequately control them. Considering these, a lot of countries have entered into the inventory phase. For e.g. Vietnam, Thailand, Philippines, and a lot of Latin American countries.

What has happened is that most of the large chemical economies have joined the global harmonized system of classification and in terms of regulations, many of them similar to REACH are being implemented across Europe, United Kingdom, Turkey, South Korea, China, and some countries of Latin America. Taiwan and Japan have their own set up in terms of requirements. There is a global development happening in the area



and more and more countries are coming up with their respective regulations.

Q GPC specializes in chemical regulations in different areas, sectors, and geographies. What's your plan for 2022 and how are you planning to execute it?

We are currently operating through 8-9 offices around the world which covers Australia, Europe, Korea, Turkey, United Kingdom, Taiwan, and China. We are also working closely with partners in Vietnam, Japan, North America, Canada, and Latin America. We expect to face new Indian regulations in 2022 and this is one core area where we need to prepare ourselves for the industry and sensitize them on how they need to prepare so that they can continue to do business in a smooth way. We will also do a lot of events and activities to promote this idea and make the industry understand what is required by them and how to prepare for these regulations. We are also looking into the Latin American market and maybe we will have certain developments which will help us to focus on Latin America.

Q The company has a good presence in Asia, Europe, and Australia but negligible presence in North America, South America, and Africa. How are you planning to increase your presence in South America and Africa?

We are working with various franchisee models now in various regions. We set up our own system and standard operating procedure for compliance besides all the requirements that need to be fulfilled by the service provider to take franchise from us. We will definitely look for franchisees in North America, Canada and certain parts of Africa with mutual interest and a win-win approach. There are various companies that work locally but want to support their clients globally, these companies can contact us. They may not operate directly but could align with us whenever they want to acquire global overview. That is a win-win format. We represent around 1,500 companies globally. Typically, the model is : we collaborate, cooperate, and network with various institutions and regional players. We look forward to doing more collaborative initiatives in future.



India had around five drafts of the regulation and there has been some opportunity for the industry to provide inputs to the draft regulation. That means a few inputs have been integrated in the bill and few of the main ones are yet to be addressed in the proposal.

Q In India, GPC acquired NFS Pvt. Ltd and is now planning diversification for gaining more market share. What are your plans for 2022?

We have taken a huge space within a SEZ in Nagpur and plan to move in a couple of months. The new facility will have capacity for around 200 people. Currently, we are close to 100 people and we plan to double our capacity in the next few years. This facility is primarily focused on servicing the Indian market.

70% of the GPC clientele is from India and we will be working closely with a lot of CROs and laboratories. We currently work with more than 10 lakh accredited labs. There are two primary goals of our collaboration. First, we help them to seek business opportunities from other parts of the world which they themselves are not able to. Second, we want to use India as a regulatory hub for Latin America, Europe, and parts of Asia.

Q Where does REACH regulation stand with respect to Europe and Asia and what are its implications for chemical manufacturers based in India?

More and more exporters are meeting the regulatory requirement outside India to be able to continue doing exports. It has definitely affected Indian industry, especially small scale industries that couldn't manage registrations because of cost reasons. This also led to industries suffering because of the compliance burden they had to face in Europe. But again Europe is a much larger destination for exporters and we don't see a similar level of effect in Korea as the exports from India are comparatively lower. In Turkey, Indian companies are more affected as they

are trying to do registrations. We are supporting more than 300 companies in Turkey for compliances. Same for the UK, because after Brexit, the country has become an independent entity. Since the country has its own equivalent of REACH, we are supporting close to 200 companies for compliance. Obviously, this is costly for companies as there are a lot of fees which need to be paid and also

S O U J A N Y A

there is the cost of equipment for data submission. It is an expensive affair for companies but unfortunately this is the new reality for manufacturers.

Q Points which need to be addressed in the draft Indian Chemical Management and Safety Regulations (ICMSR) for chemical manufacturers so that it is beneficial in the longer run?

India had around five drafts of the regulation and there has been some opportunity for the industry to provide inputs to the draft regulation. That means a few inputs have been integrated in the bill and few of the main ones are yet to be addressed in the proposal. For example, the one that proposes that within the first 18 months, the registration has to be done for the 750 chemicals listed in Schedule II. This is really not practical and there is very short time to prepare for registration within 18 months. Once the regulation comes, obviously the guidance document of the regulation has to be prepared by the government so that we know what to do and how to operate as per regulatory compliances. This will take another 6-8 months. Government also needs to set up their IT systems and this will also require some time. Therefore, it is only after that the registrations will start actually happening. That will be 8-10 months before

somebody will make a proposal and I think it is too tight. We have requested for an extension of at least 30 months and if not then at least 24 months after the start of regulation.

There are a couple of other issues identified in the regulation including the fee structure and penalty for non-compliance. Many times it is very difficult to estimate how many days it has been since non-compliance happened. This could affect several industries in an adverse way. Some non-compliances are mostly documentary and don't affect anybody's health and environment. Few of the other non-compliances could be extreme and result in an accident. So the fee structure or fine structure should be based on proportionality. Other than that it is a hybrid regulation which is very good for the industry because not all chemicals would be registered and registration is expensive. So, we assume around 80% of the chemicals would not require registration and only 20% of the hazardous chemicals would require to be registered. The Indian industry would benefit and at the same time, the government would achieve the regulatory objectives that they have set for themselves.

What is the price kept for the registration?

The registration fee for large industries could be up to Rs. 6 lakh depending on tonnage. For lower tonnage, it could be a lakh and for middle tonnage, it could be Rs. 2 lakh. For MSME, it could be Rs. 2.5 lakh.

What has been your experience with other geographies such as the European Union, UK, and US? How much time have they given to chemical companies for registration?

Europe has given a very long period of time, say 10 years for registering all the chemicals and they had various tonnage bands. The first band was up to 1,000 tonnes and required to be registered in approximately 2 years. In the next 4 years, 100-1,000 tonnes and the rest was below 100 tonnes by 2018. Hence, they had almost 10 years for all chemicals. Since they were first in line,



a lot of data was generated as a result. So whenever you are registering in these countries, you don't require so much time but

you need time to do a lot of administrative work. One needs to come to an agreement with other joint submission members. For e.g. Turkey has a very similar situation like India as they completed their pre-registration in December, 2020 after having given a 3 years period for registration. That is something we should be looking for.

We have the data and Turkey also has the data from Europe and we can use some of that data. But the documentation, preparation into the local IT system, and assessment based on Indian conditions. All these things will take some time and we need to cooperate with other joint submission members who would be part of registration.

Will there be a statutory body which will take care of new regulations?

The Indian National Chemical Authority has been proposed for managing the regulation. When we talk about the timelines, setting up the authority itself will take time. And then will start the guidance document and IT related activities. So, 18 months is really a very optimistic deadline for registration of chemicals.

What is the likely date for implementation of the regulatory body?

We are told that the draft is under legal scrutiny and some other departments are reviewing and commenting on it.

GPC has two labs. One is in Sweden and another in India. Any expansion plan for India lab facilities?

We have one lab in Sweden where we mostly do the in-vitro studies but without any animal use. We rather work on tissue based studies very exclusively in Europe. The lab in India is focused on chemical fingerprinting, an important aspect during registration. It involves identification of purity & structure and impurity profiling. Since it was very difficult for us to get the guidance from the dossier by the European Chemical Agency (ECA) and ask any other lab to do it, we had to develop our own SOPs. While it was not our primary objective to set up a lab in India at that time, we had to do it as we were not able to get the



services from the labs. In other studies that we are doing now, be it animal studies, toxicological studies, we have received very good collaboration with other labs.

? **If ICMS regulations get adapted, do you see any advancements in the lab?**

I think not only our lab but Indian infrastructure has to be such that every lab would require upgrading. There has to be a lot of CROs that may have to expand their facilities or new CROs will have to come up. There will be a huge demand for compliance related studies in India and CROs would need to gear up for addressing those require-



We are supporting more than 300 companies in Turkey for compliances. Same for the UK, because after Brexit, the country has become an independent entity. Since the country has its own equivalent of REACH, we are supporting close to 200 companies for compliance.

ments and need to be updated. For e.g. cosmetics industry completely bars animal testing whereas others continue to do it so collaboration is a way out in this regard.

? **What services is GPC offering on Restriction of Hazardous Substances and Services (ROHS) and sustainability?**

We follow the concept of circular economy that has come up in a lot of discussions now and the Indian government has several draft policy papers. We do work with circular economy labs which are a part of sustainability, the industry is expected to implement. We do work with the chemical industry on sustainability and are developing a sustainability

standard for compliance management. We aim to help our clients reach their sustainability goals.

On the ROHS part, it is an established field and there are many competent organizations that are working towards it. We do a lot of research work on ROHS regularly and have developed regulatory guidelines based on it. But that certainly is not the core of our business. The core of our business is chemicals, industrial chemicals, cosmetics, specialty chemicals and to some extent APIs and intermediates for pharmaceuticals and we are extensively into the medical device. These are the areas where we specifically work and maintain our core competency.

TATA CHEMICALS

? **Which services are offered by GPC for the petrochemical sector?**

Petrochemical sector is also supported by us within REACH type of regulation. We help them to do the chemical analysis and assessment of their chemicals. We also check whether chemicals have any other new regulatory demands in other countries. We do regulatory applicability assessment of chemicals for a lot of clients. We also help them with pre-notification and pre-registration into relevant countries. A few times we need to provide new services as per the demands of clients such as due diligence of their suppliers and buyers. We ensure that things are smoother for our clients in the public and private sectors.

The Indian food processing industry is having a robust double-digit growth. We plan to grow in line with a continued solution-based approach, leveraging Brenntag's global knowledge and local application expertise with application development centres.

At Brenntag, we apply a customer segment approach - offering the right technological and commercial expertise and specific value proposition. Furthermore, Brenntag India continues to invest in human capital and build a great workplace culture. In fact, we have been again certified as a Great Place to Work. ■



MAINTAINING HIGHER GROWTH MOMENTUM ON INTERNATIONAL ORDERS



NIRAJ MORE
MANAGING DIRECTOR
GRAUER & WEIL (INDIA) LIMITED

We have been able to cater to the requirements of the industry, and the tie up has helped us in bagging large supply contracts against all multinational companies

? **What is the size of global and India market for surface finishing for FY 2022-23?**

The global metal finishing market is estimated to be roughly around US \$90.97 billion. The metal finishing market is projected to grow at a CAGR of over 4% over the next 5 years. The India metal treatment chemical market is expected to grow at a CAGR of 5.68% to reach US \$378.4 million by the end of 2023. The prominent application includes automotive OEM & component industry followed by metalworking, electrical & electronic, and industrial machinery.

? **How has been the company's performance in FY 2021-22 what's the forecast for FY 2022-23?**

FY 2021-22 has been a challenging year. There has been a slowdown in auto manufacturing due to significant supply chain disruptions in chips worldwide; creating muted downstream demand for chemicals. Commodity prices were very volatile throughout

the year and spiked in the second half of the financial year. The result of all this had been a significant inflation impact which, our organization, using all possible means managed to circumvent and still managed to achieve growth over last year. Until December 2021, the YTD growth is 45% for the entire group.

• Performance of chemicals division in FY 2021-22 and plans for FY 2022-23?

Until December 2021, the YTD growth is 42% in the chemicals division. With our current efforts towards introducing new chemical processes which are free from hazardous chemicals, we expect to bag good orders this year and maintain a healthy growth in FY 2022-23.

• Performance of the engineering division in FY 2021-22 and plans for FY 2022-23?

Until December 2021, the YTD growth is more than double in the engineering division. With the effort towards developing new export markets in FY 2021-22, we hope to see some more orders coming in from international customers which should help us in maintaining a healthy growth in FY 2022-23.

We are also working on introducing some new purification systems in our lines which will help reduce waste effluent generation from our plants, thus reducing the total water consumption.

• Performance of paints division in FY 2021-22 and plans for FY 2022-23?

Until December 2021, the YTD growth



Growel's paints business has tied up with Transocean Netherland for HPC and marine coating. We have been able to cater to the requirements of this industry and the tie up has helped us in bagging large supply contracts against all multinational companies.

is 34% in the paints division. With our new development in under water cure paints and high-performance for the defence sector, we expect to have a good year ahead.

? The company has collaborated with NoF Metal Coatings Group and Transocean Coatings. How do you see these collaborations helping your clients? Any plans for new collaborations?

We have a long-standing relationship with Japan's number one Zinc Aluminium Flake Coating manufacturers NOF Metal Coatings Asia Pacific Co. Ltd. Zinc Flake coatings provide outstanding protection to metallic surfaces against corrosion. The coating is known by the name 'Geomet' and contains inorganic silver-grey deposits essentially comprising Zinc and Aluminium flakes, uniformly distributed on the entire substrate.

The Geomet process is well established, superior in technology, and environment-friendly. It is used in many industries throughout the world, such as automobiles, windmills, engineering, electricals & electronics, white goods, mining, railways, process industry, and defence.

Growel's Paints business has tied up with Transocean Netherland for HPC and marine coating. We have been able to cater to the requirements of this industry and the tie up has helped us in bagging large supply contracts against all multinational companies.

? You have a world class R&D centre which focuses on technology leadership. What are the new innovations and solutions that the company is working on in the surface finishing field?

Chemical Business: We all are aware that application of coatings (either by electrodeposition or electroless) utilizes several chemical processes. Some of these chemicals are hazardous.

In addition, there are some new restrictions coming in force from the developed countries while using these chemicals. To address this issue our major focus is to de-



velop processes which are free from hazardous chemicals.

Some of the newly developed processes are: Cyanide Free Process; Hexavalent Chrome Free Process; and ROHS Compliant Electroless Nickel.

Cyanide Free Process:



a. Alkaline non cyanide free zinc plating: Traditional process for zinc plating involves sodium cyanide. Our new process is free from cyanide. It involves sodium zincate electrolyte with quaternary ammonium copolymer which acts as a grain refiner. Therefore, we get sustainable zinc deposits with excellent brightness & throwing power.

b. Alkaline cyanide free copper: Utilisation of cyanide copper as strike coat in decorative finishing involving copper-nickel-chrome for several applications e.g. plating on plastics on faucets, hardware etc, is very much well known & also, established. We have successfully established non cyanide alkaline copper & therefore, our clients could avoid using poisonous cyanides at this working domain.

c. Non cyanide Silver: Our recent launch in the cyanide free drive is decorative cyanide free silver plating. We have established this process from plating on bus bars & also, on artificial jewellery components in India.

Hexavalent Chrome Free process:

a. Hexavalent Chrome free passivates using trivalent chrome: Now, client gets relief to refrain

in using carcinogenic hexavalent chrome-based passivation process. It is now possible for them to switch over to trivalent chrome based passivates. Trivalent chrome-based processes are not known to be carcinogenic & hence, these are allowed in the industry for usage. Utilizing these new processes, it is now feasible for users to conform to the ROHS, WEEE, ELV, REACH directives.

b. Decorative Chrome plating utilising trivalent chrome-based electrolyte: Our developed products involving trivalent chrome based electrolyte replaces the traditional & edge old hexavalent chrome based solutions. Therefore, users now can eliminate the hex chrome in the chrome plating space as well.

ROHS Compliant Electroless Nickel:

Electroless nickel plating process utilising lead, cadmium is well known. But, usage of lead, cadmium etc are very much restricted. We have come up with lead & cadmium free options through our new launches. These new processes involve some alternative stabilizers & brighteners to make the corresponding system to enable to get desired stability, brightness & also, corrosion resistance. Some of these processes even surpasses the traditional process in terms of much higher bath life & therefore, it gives client conformance with newer directives and also, improving the overall system performance through lower chemical consumptions which eventually reduces cost of plating and also, environment footprint.

Several coatings are developed to enhance the overall service life of the processed components. This provides the user to extend the part changing schedules & therefore, reduces overall environment footprint. Some of these processes are: Zinc alloys - Zinc Nickel - Alkaline, Acidic, Tin Zinc, Zinc Iron etc.; Post Passivation Sealers for Zinc & Zinc alloys; and Electroless Nickel Composite coatings - Electroless Ni-PTFE, Ni-Diamond increases wear resistance.

Paints Business: We have developed underwater cure paints and other high-performance paints for Brahmos, battle tanks, underground buried pipelines. We have also developed food grade epoxy paints which are approved by NSF USA and WRAS UK. ■



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DEVELOPING PRODUCTS FOR THE INDUSTRIAL COATINGS SEGMENT



SURESH KALRA
MANAGING DIRECTOR
HUBERGROUP INDIA AND HEAD OF RBU
(REGIONAL BUSINESS UNIT) ASIA

The company is developing products including raw materials such as radiation curing oligomers, polyesters, and polyurethane resins to further expand its chemical business

? **What are the global trends in the printing solutions business in 2022 and its impact on India?**

Globally, the packaging market is growing in areas of rigid carton, folding carton, and flexible packaging. The market has rapidly moved towards sustainable packaging, and we can see growth in monolayer flexible laminates and paper as well as boards. Similar trends are visible in India.

There has been a decline in the publication industry (newspapers, periodicals, and magazines) globally. In India, the publication market is expected to have minimal growth due to the rising literacy level and comparatively less penetration of digital/electronic media in smaller cities.

? **What are the key milestones achieved by hubergroup India in FY 2021-22? Factors which will drive growth in India?**

hubergroup continues to focus on developing safe and sustainable products. For example: HYDRO-X Water Barrier Coating, which was launched in 2021 and received the IFCA Star Award in the category 'Enviro Friendly Product'.

The company has further invested in launching cobalt drier free, mineral oil-free, low migration low odour (MGA brand) products. In January 2022, hubergroup has, for instance, launched a series called MGA CONTACT, which is a sheet-fed offset ink for direct food contact.

Government bodies are moving towards more stringent regulatory norms to be in line with global guidelines. We can foresee tolu-

ene being banned over time. This will lead to more good manufacturing practices and strict compliance.

Last year, the continued Covid scenario led to global raw material shortages and disruptions in the supply chain. Thanks to its backward integration, hubergroup was able to manage its production well through its raw material production plant in India.

? **hubergroup's manufacturing is spread across three production sites - Silvassa, Daman, and Vapi? What is the cumulative production capacity?**

hubergroup India combined production installed capacity at Vapi (two plants) is 207,000 metric tons per annum (MTPA), Silvassa is 92,800 MTPA and Daman is 25,750 MTPA.

? **hubergroup India produces raw materials such as pigments, resins, and additives. Annual production capacities of raw materials and key customers in these segments?**

At Vapi, we produce raw materials such as resins (ketonic, polyamide, and offset resins), pigments (dry pigments and alkali blue flush & powder), concentrates and acrylates. These are both produced for the division hubergroup Print Solutions as well as sold to leading ink manufacturing companies (worldwide and regional).

Factories have production capacity of 203,000 MTPA for printing inks, 71,050 MTPA for resins and varnishes, 46,500 MTPA for pigments and flush colours, and Press Chemicals 5,000 MTPA.

Q As the largest producer of Alkali blue, what's your market share at the national level and how do you plan to increase it?

Alkali Blue is primarily used in the news-print (web ink) business. This is now declining. However, as the usage of Alkali Blue is increasing in sheet-fed, we expect it to grow with the expanding packaging market.

Q Recently, hubergroup increased price in print solutions for all global regions. What will be its impact in the Asia region?

Price increase is inevitable as raw materials, logistics, and despatches costs have risen. This has impacted the whole printing industry as we see price increases in paper, plates, film chemicals, and also inks & adhesives.

As the market leader, hubergroup has taken the lead in increasing the prices taking the customers along by making them aware of the ground realities. Customers have taken this positively and are cooperating. There is no severe impact on business share as the entire printing industry has also increased their prices.

Considering the current situation of the market and customers, hubergroup has not yet passed on the full cost burden.

Q In the past, hubergroup India has innovated products such as liquid and UV inks. Going forward, the key R&D initiatives the company is planning to undertake in India?

hubergroup offers environmentally friendly, safe, and sustainable inks for packaging, both in the flexible and folding cartons segment. We have made our plants GMP compliant and had many of our products certified by the Cradle to Cradle Products Innovation Institute. Thus, hubergroup offers printing inks with full Cradle to Cradle certification for water- as well as solvent-based flexo and gravure printing as well as for offset printing. This makes the ink specialist one of



the companies with the broadest portfolio of sustainable printing inks.

To further expand our chemical business, hubergroup is developing products beyond the existing printing business. This includes raw materials such as radiation curing oligomers, polyesters, and polyurethane resins for the industrial coatings segment.

Q What is your Capex plan for FY 2022-23? What's the automation and digitalization plan across operational plants?

hubergroup India is a highly backward integrated manufacturing company with sufficient capacities to meet market demand, hence there is no major Capex planning other than routine Capex in FY 2022-23. All our plants have a high level of automation and to some good extent, are already digitized. However, hubergroup remains proactive to adopt new technologies.

Q CSR plans for hubergroup India in FY 2022-23?

At hubergroup, we are committed to give back to the regions where we operate. We support various community programs in and around Vapi especially in the interior or rural areas where primary education has to be implemented at grass root level. The company will continue its activities in the areas of health and education by expanding its collaborations with regional NGOs, industrial

associations, and government bodies.

Q What would be huber's strategy in Asia for the next phase of growth?

hubergroup has announced its Chemicals division to expand beyond the printing ink business. The Print Solutions division will focus even more on sustainable products for better environment and food safety.

Q How does hubergroup India balance growth and sustainability in the current scenario?

We have taken a further step to make our business as environmentally friendly as possible and to ensure sustainability along the value chain. At our production site in Vapi, we have put a Multi Effect Evaporator (MEE) into operation that enables us to reuse a large share of our reject water with very low energy consumption. And as mentioned earlier, our plants are GMP certified and we produce mineral oil-free & toluene-free inks.

Q What is hubergroup plans for FY 2022-23? New verticals which you are focusing on and its impact?

In 2020, hubergroup has announced its Chemicals division. This is a new vertical from the existing Print Solutions division. Going forward the group will utilise its spare production capacities to manufacture and market products that go beyond the printing industry. ■

CONFIDENT TO ACHIEVE 40%+ GROWTH OVER THE CURRENT FISCAL

RIECO Industries is planning in its kitty material separation technologies like sieving and custom-made robotic applications that are evolving in FY 2022-23



VIKAS BHATIA
MANAGING DIRECTOR
RIECO INDUSTRIES LIMITED

How has the performance and notable achievements of RIECO Industries been in FY 2021-22? What's your USP?

Despite the ongoing pandemic situation, FY 2021-22 was an exceptional year for RIECO Industries. We have added several large ticket orders from new customers both domestically and internationally. In the past 12 months, we have launched 10+ new products. Our USP is clearly determined by the fact that we are a 45+ year-old company with a very talented team and our customer-centric solutions enhance the functionality and quality of the product. We were also acknowledged as a leader in innovation for FY 2021-22 by TPCI.

Growth shown by the company in FY 2021-22 vis-à-vis FY 2020-21?

Not only has there been an exponential increase in orders placed but also in the realm of innovation. Last year we launched 10+ products. RACAM, our newest product, is an ACM with a unique chamber in chamber design and an HMI interface with SCADA/IoT.

We are confident to carry growth in FY23 with a huge order in the beginning of this year and we are confident to achieve more than 40% growth over the current financial year. We are also intending to introduce and develop new products in the industry. We anticipate that international sales will account for 20 - 25 percent of total sales this year.

International orders bagged by RIECO in FY 2021-22? Countries where you have a direct presence?

We have direct presence in the Middle

East, Southeast Asia, Nigeria, and Kazakhstan. We have majorly supplied our solutions to Sri Lanka, Bangladesh, and Nepal in the current fiscal and are looking to expand more in Southeast Asia. We've also delivered a large number of orders to the Middle East, which is a key petrochemical industry. In addition, we are participating at various global expos and conferences, as well as expanding our digital reach.

RIECO is a leading player in powder and bulk solid technology. What have been some notable deployments in FY 2021-22?

We have provided solutions for chemicals that are hazardous to handle for big chemical players such as HUL, Henkel, Pidilite, Aarti Industries, etc.

The company is providing Annual Maintenance Contract (AMC) to all its clients. How are you enhancing after sales services for your clients in FY2022-23?

The AMC vertical has been rebranded to Value Added Services (VAS), where we offer a variety of solutions to ensure that the equipment is kept in excellent functional condition and yields/output are maximum. We have started vendor managed inventory storage at the customer's location to improve spare part availability.

What product launches are planned by RIECO Industries in FY 2022-23?

RIECO Industries provides solutions considering all fundamental aspects. In FY



RIECO Industries has always been environment conscious, and our competency lies in designing energy efficient and sustainable solutions. The company focuses on solutions which elevate productivity and energy efficiency.



2022-23, the company is planning in its kitty material separation technologies like sieving and custom-made robotic applications that are evolving.

? How do you see the role of Industrial IoT and Artificial Intelligence(AI) in the chemicals and petrochemicals sector? Are you also planning to provide these modules along with the existing solutions?

We at RIECO believe that the future is digital, and we have always taken steps in this direction. IoT (Internet of Things) will

help optimize the performance of systems/ solutions deployed by the company.

? Sustainability is picking up in the Chemical and Petrochemicals vertical. Is RIECO planning for a sustainability division and planning to provide a complete solution?

RIECO Industries has always been environment conscious, and our competency lies in designing energy efficient and sustainable solutions. The company focuses on solutions which elevate productivity and energy efficiency. The company also integrates sustainability right in the design and manufacturing stage.

? Orders bagged by RIECO in pneumatic conveying systems in the Chemicals and Petrochemicals vertical in FY 2021-22?

RIECO Industries has bagged projects across chemical and petrochemical vertical which includes some prestigious names like Rallis India, Tata chemicals, GHCL, Atul Limited, UPL, Hikal Limited, Privi Life Sciences, Elementis Speciality Chemicals, Saint Gobain, etc. ■

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Petrochemicals



Continuing with Higher
Growth Trajectory



INDIA'S PETROCHEMICAL INDUSTRY SET TO CHART A NEW GROWTH TRAJECTORY

Backed by big ticket investments into infrastructure development, the industry is setting the stage for a long-term fruitful journey ahead

India's petrochemical industry is poised for a sweeping transformation through 2030. The change is propelled by a significant expansion of its intermediates' production capacity, and growing focus on reducing the sector's carbon and environmental footprint by both industry as well as policy makers. With its high demand growth, India is projected to contribute to more than 10 percent of the incremental global growth in petrochemicals over the next decade.

Given its significant import dependence, India could potentially need more than 15 world-scale petrochemicals assets by 2035 to meet domestic demand. Presently, there are eleven naphtha or dual feed cracker complexes in operation with combined ethylene capacity of about 7.05 million tonnes per annum. In addition, there are six aromatic complexes in operation with a combined Xylene capacity of about 5.5 million tonnes. Demand for plastics in India is expected to reach 24 million tonnes by 2022-23 and 35 million tonnes by 2027-28.

The Indian market is seeing a surge in petrochemical capacities from domestic companies that have traditionally dominated the market such as Reliance and Indian Oil Corporation Limited (IOCL) which currently account for almost 70% of production. With slowing growth and diminishing margins in the core oil and gas business, petrochemicals are a logical extension for these players. While Reliance and IOCL have expanded their petrochemicals production in the past couple of years, HPCL-Mittal Energy Limited (HMEL) is expected to quadruple its petrochemicals capacity over the next couple of years.

New domestic players such as ONGC Petro additions Limited (OPaL) and Deepak Phenolics are recent entrants in the petrochemical space. In the next three to five years, HPCL Rajasthan Refinery Limited (HRRL) and Bharat Petroleum Corporation Limited (BPCL) will join the list with their refinery-integrated petrochemicals assets. Over the past three years, global firms such as Saudi Aramco, Rosneft (Nayara), BASF, and Borealis have announced plans to invest in Indian petrochemicals manufacturing. Importantly, the mammoth 18 million metric ton (MMT) West Coast refinery is being planned as a joint venture between the Abu Dhabi National Oil Company (ADNOC), Saudi Aramco, IOCL, BPCL, and HPCL. This venture could significantly alter the face of the Indian petrochemicals landscape.

CHANGE IS INEVITABLE

As petrochemical production displaces transport fuels as the main consumer of crude oil, refinery assets will be converted into chemical and petrochemical hubs. With petrochemicals now accounting for 40 to 80 percent of new refining assets, the evolution of new crude-to-chemicals technologies is accelerating the shift of oil and gas majors away from refining. India's petrochemical capacity is projected to grow by more than 30 percent in the 2017-2025 period. The number of domestic refineries with linked petrochemical capacity is expected to grow from 12 (out of 22) in 2010 to 19 (out of 24) in 2030. In addition, new refinery expansion projects and greenfield refineries are being built with an integrated petrochemical con-

figuration, with HRRL, HMEL, and the West Coast refinery being notable examples in this category.

Given the strong underlying demand trends, the sector is now witnessing a significant investment boom, with several multibillion-dollar assets either already on stream or expected within the next few years. Projects like HMEL in Bhatinda and HPCL in Barmer are expected to be completed by 2021-22 and 2022-23, respectively.

Nayara's mega petrochemical project in Vadinar is expected to be completed by 2024-25. And several other projects are likely to be commissioned beyond that. These investments, which include public and private projects in various stages of implementation and pipeline, will make petrochemicals the biggest driver of India's crude oil demand growth.

India's petrochemical players have mostly evolved their portfolios from legacy refinery setups to drive higher net realization. As a result, the focus has been on basic commodity chemicals where technology licenses have been readily available. Capacity expansions are expected for polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), and polyvinyl chloride (PVC), monoethylene glycol, elastomers and styrene, among others.

Historically, given India's net surplus and limited gas production, naphtha has been the dominant feedstock for Indian producers. The large proportion of India's petrochemicals capacity continues to be refinery integrated due to limited feedstock availability. The massive push towards circular economy, driven by fast changing consumer preferences and regulators, has made petrochemical producers focus substantially on embedding sustainable practices across their business. Players can reduce conversion costs by 5 to

10 percent by embracing digital operations including digitalization of equipment data combined with analytics.

TRENDS SHAPING THE LANDSCAPE

The enhanced pace of partnership and mergers and acquisitions (M&A) opportunities in the Indian petrochemicals market can potentially shift the dynamics of competition in the industry, with India emerging as the next horizon for global giants to unlock a new frontier for growth. Global oil and gas and chemical giants are targeting big-ticket investments in established domestic companies to mark their entry into India. As an example, Saudi Aramco recently signed a memorandum of understanding to evaluate up to a 20 percent equity stake in Reliance's oil-to-chemicals business, valued at around \$15 billion.

Strategic partnerships are emerging between global and domestic players, creating a win-win situation for both. Recently Russian petrochemicals company, Sibur formed a joint venture with Reliance for production of butyl rubbers. Similarly, Adani, Borealis, BASF, and ADNOC are evaluating a joint venture for a propane dehydrogenation (PDH) plant for acrylates, oxo alcohols, and PP production. In addition, Indian public sector undertakings (PSUs), Saudi Aramco, and ADNOC are evaluating setting up a West Coast refinery and petrochemicals complex with a total investment of \$45 billion and petrochemicals capacity of 18 MMT. Finally, global players are also targeting niche manufacturers to diversify downstream. For example, DSM India acquired SRF Limited's engineering plastics business.

Existing players and new entrants are analyzing and responding to the product-level demand-supply scenarios. For example, BPCL is entering the propylene oxide (PO) chain with a petrochemicals expansion in its Kochi refinery. The joint venture between BASF, Adani, ADNOC, and Borealis is targeting the deficit in acrylics and oxo alcohols



The coming decade in India's petrochemicals market is likely to be characterized by substantial opportunities and significant disruptions. Investing in the right molecular chains and evolving a robust product portfolio will differentiate players in the long term.



within the propylene chain. However, overall, there is still significant room for new or incumbent players to invest in other petrochemicals derivatives such as glycols, polyurethanes, and rubbers.

Reliance has installed an off-gas cracker complex of about 1.5 MMT with the capability to use both propane and ethane as feedstock. The company has invested in setting up an end-to-end supply chain for importing and storing ethane from the US. Additionally, greenfield petrochemicals units in India are increasingly adopting mixed feed in their assets.

OPaL has flexibility in its cracker configuration to process a wide basket of feedstocks such as naphtha, ethane, and propane. HPCL's HRRL project will also include a dual-feed steam cracker unit for its petrochemical production.

WAY FORWARD

The coming decade in India's petrochemicals market is likely to be characterized by substantial opportunities and significant disruptions. Investing in the right molecular chains and evolving a robust product portfolio will differentiate players in the long term. Niche petrochemicals and specialty players that depend on large petrochemical facilities for feedstock need to reevaluate availability of intermediates and building blocks amid rising domestic petrochemical capacities.

This would allow them to identify opportunities for upstream integration or expansion

of their portfolio offerings.

Petrochemical players will need to carefully assess market dynamics, capability requirements, business model fit, the competition landscape, and potential disruptions before making strategic long-term bets. The players focusing on commodity products will need to identify downstream derivatives for their next wave of growth, while ensuring healthy returns and synergies from their existing asset base.

New entrants can enter one of the white spaces in downstream petrochemicals products or expand into competitive segments with a better value proposition. For example, new players can enter into C4 and aromatics chains, which have abundant feedstock supply but limited downstream derivatives production; for example, polycarbonates, linear alkyl benzene, and butyl rubber.

The petrochemicals sector is projected to emerge as the primary driver of growth for the global oil and gas sector, accounting for more than a third of incremental oil and gas demand by 2030. To enable transformation, the petrochemicals landscape needs to overcome uncertainties such as trade restrictions, and growing environmental headwinds emerging from the circular economy mega trend and rising bans on single-use plastics. In the longer run, the operational excellence and cost competitiveness are likely to emerge as significant drivers of success for Indian petrochemical players. ■



CARBON DIOXIDE REFINERIES OF FUTURE AND NET ZERO GOAL

The utilization of CO₂ as a feedstock for producing chemicals not only contributes to alleviating global climate changes caused by the increasing CO₂ emissions but also provides a grand challenge in exploring new concepts and opportunities for catalytic and industrial development



PROF. GANAPATI D. YADAV
EMERITUS PROFESSOR OF EMINENCE
AND FORMER VICE CHANCELLOR
INSTITUTE OF CHEMICAL TECHNOLOGY
MUMBAI

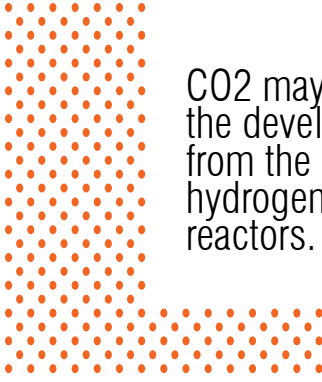
The refiners in the future will use carbon dioxide as a raw material for making fuels, chemicals, and polymers/materials, and not ubiquitous crude oil. A liability now will be an asset tomorrow! The sustainability of the current generation's high lifestyle requires a huge amount of energy which is primarily satisfied by the fossil resources: oil, natural gas, and coal.

The concentration of carbon dioxide in the atmosphere has increased from 280 ppm before the industrial revolution to 410 ppm in January 2020 to 419.8 now. The increased atmospheric CO₂ concentration is arguably one of the primary causes of accelerated climate change and global warming. This supply chain from fossil feedstock cannot sustain forever as all these energy sources will diminish within three centuries. From the economic point of view, importing fossil fuel from foreign countries worth billions of dollars is a waste of foreign exchange. The Russia-Ukraine war has given a severe jolt to all oil-dependent economies.

The government of India wants to reduce import of oil by developing new technologies including renewable resources such as solar, wind, hydro, coal to fuels and chemicals, 2G ethanol, biodiesel, etc. India accounts for more than a quarter of net global primary energy demand growth between 2017-2040 according to BP Energy; 42% of this new energy demand is met through coal, meaning CO₂ emissions roughly double by 2040.

The Paris Agreement is meant to reduce the risk and impact of global warming by adopting two long term temperature goals, i.e., to check the global average temperature rise well below 2 °C above pre-industrial level, and to take more deliberate actions to limit the rise in temperature to 1.5 °C above pre-industrial levels. To achieve this goal a 20/20/20 strategy was adopted, meaning thereby, 20% decrease in CO₂ emission, rise in renewable energy market share by 20%, and 20% increase in efficiency of current technology. For meeting a target of 400 GW solar power, an investment of US \$500 billion is needed.

Reducing CO₂ concentration in the atmosphere while meeting the energy demands of an increasing population is a formidable task for countries like India and requires long term planning and implementation of CO₂ mitigation strategies. Reduction of CO₂ production by shifting from fossil to renewable fuels, CO₂ capture and storage (CCS), and CO₂ capture and utilization (CCU) are the possible areas for systematic control and reduction of atmospheric CO₂. Carbon Capture and



CO₂ may become the future of oil through the development of synthetic fuels starting from the mixtures of carbon dioxide and hydrogen with specific catalytic chemical reactors.

Utilization and Storage (CCUS) is one of the key areas that can achieve CO2 emission targets while simultaneously contributing to the production of energy, fuels, and chemicals to sustain the increasing demands.

In the CCU concept, carbon dioxide is captured and separated from emission gases and then converted into valuable products. Thus, CO2 may become the future of oil through the development of synthetic fuels starting from the mixtures of carbon dioxide and hydrogen with specific catalytic chemical reactors. In that way CO2 appears as one of the possibilities for high level energy storage, including the network regulation from renewable energy production.

But, in every case, new catalytic processes and chemical plants are needed to develop this future industry. Flue gases from fossil fuel-based electricity-generating units are the major concentrated CO2 sources in India. If CO2 is to be separated, as much as 100 MW of a typical 500-MW coal-fired power plant would be necessary for today's CO2 capture processes based on the alkanolamines absorption technologies. Therefore, it would be highly desirable if the flue gas mixtures are used for carbon dioxide conversion but without its pre-separation.

Therefore, carbon dioxide conversion and utilization should be an integral part of CO2 management.

As an economical, safe, and renewable carbon source, CO2 turns out to be an attractive C1 chemical building block for making organic chemicals, materials, and carbohydrates (e.g., foods). The utilization of CO2 as a feedstock for producing chemicals not only contributes to alleviating global climate changes caused by the increasing CO2 emissions, but also provides a grand challenge in exploring new concepts and opportunities for catalytic and industrial development. CO2 can be catalytically converted to methane, methanol, dimethyl ether, liquid hydrocar-

bons, formic acid, gaseous hydrocarbons, urea, organic carbonates, etc. Methanol can be produced from methane either through steam reforming (SR) or direct partial oxidation (DPOM) or dry reforming (DR) with carbon dioxide.

The author is working in collaboration with the ONGC Energy Centre on green hydrogen production and CO2 conversion technologies having obtained several patents. And SR and DPOM are comparably economical, although SR is at a rather developed stage of technological maturation and expectedly has greater thermodynamic and carbon efficiencies compared to DPOM. Nevertheless, the economical use of methane as feedstock to produce methanol lays strong foundations for the future methanol economy.



Godavari
Biorefineries Ltd

liquid hydrocarbon requires high temperature (250-450 °C) and pressure (20-40 bar), but the conversion is low due to difficulty in the activation of CO2. Various catalysts need to be actively investigated to enhance CO2 conversion and to control selectivity toward specific target products.

The hydrogen production technologies are called grey, blue and green depending respectively on the source such as natural gas (with no carbon capture), natural gas or biomass with advanced carbon capture and low GHG, and electrolysis of water. The estimated costs are given in Table 1.

ESTIMATED COST FOR DIFFERENT TYPES OF HYDROGEN

Brown	Grey	Blue	Green
Coal	Natural gas	Natural gas	Renewable electricity
Gasification No CCS	Steam methane reforming No CCS	Advanced gas reforming CCS	Electrolysis
Highest GHG emissions (19 tCO ₂ /tH ₂)	High GHG emissions (11 tCO ₂ /tH ₂)	Low GHG emissions (0.2 tCO ₂ /tH ₂)	Potential for zero GHG emissions
\$1.2 to \$2.1 per kg H ₂	\$1 – \$2.1 per kg H ₂	\$1.5 – \$2.9 per kg H ₂	\$3 – \$7.5 per kg H ₂

Note: GHG – greenhouse gas; CCS – carbon capture and storage; tCO₂/tH₂ – tonne of carbon dioxide per tonne of hydrogen. Source: IEA, The Future of Hydrogen, Karuzawa, Japan, June 2019.

Methanol can be converted into a host of valuable chemicals including olefins in promotion of the so-called methanol economy, a concept advocated by the NITI Aayog. Dimethyl ether (DME) has many fascinating attributes as a fuel which can be produced from carbon dioxide using innovative catalysts, reactors, and separators. DME is the cleanest high-efficiency compression ignition fuel as a substitute for diesel. DME's autoignition property and high-octane number (55 to 60) are advantageous and allow DME to be used as a propane and butane substitute in LPG as a cooking fuel and the well-established LPG industry infrastructure can be used for DME.

The CO2 conversion into gaseous or liq-

According to the Hydrogen Council and McKinsey report large scale renewable hydrogen production costs are expected to fall faster to lower than USD 2.3 per kilogram and the low-carbon hydrogen can break even with grey hydrogen between 2028 to 2034 at a cost of about US \$35-50 per ton of carbon dioxide equivalent. The US Department of Energy has stated that a price of around US \$2.5 will be the most economical for the hydrogen economy.

In fact, hydrogen will play an important role in all these chemicals. Hydrogen is regarded as an energy carrier, and it can only be produced by using energy from other sources. The ICT, in collaboration with

OEC has developed a novel Cu-Cl cycle for thermochemical hydrogen production. This closed loop Cu-Cl cycle is a green and zero discharge process capable of producing hydrogen on a large scale. The hydrogen produced by this promising process can be utilized in the hydrogenation of carbon dioxide to fuels and chemicals (Figure 1).

CARBON DIOXIDE REFINERY CONCEPT AND PROCESSES DEVELOPED BY THE AUTHOR'S LAB

Steel making releases more than 3 bil-

lion metric tons of CO₂ each year, having the biggest climate impact. To help limit global warming, the steel industry will need to shrink its carbon footprint significantly. Thus, hydrogen can substitute fossil fuels in some carbon intensive industrial processes, such as steel, chemical, and allied industries. It can present solutions for difficult

to abate parts of the transport system, in addition to what can be accomplished through electrification and other renewable and low-carbon fuels. Biogas, typically containing 50-75% methane and 25-50% carbon dioxide is produced by anaerobic fermentation from almost all types of biomass, including wet biomass, (which is not usable for most other biofuels), vegetable and animal livestock waste, manure, harvest surplus, oil resi-



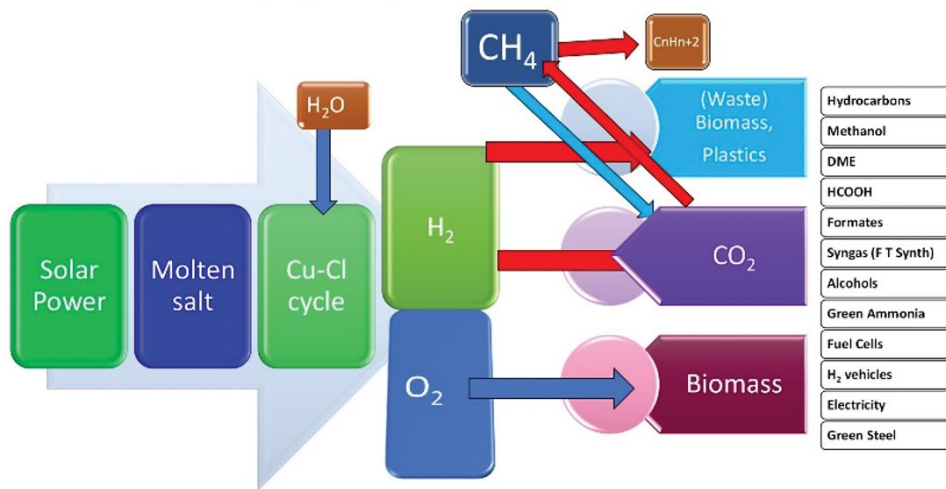
like fossil natural gas, having a methane concentration of 90% or greater, by which it becomes possible to distribute the gas to customers

via the existing gas grid within existing appliances.

Furthermore, it is very promising to use biogas containing carbon dioxide as the co-reactant for methane conversion in the so-called dry reforming process, since carbon dioxide can provide extra carbon atoms for methane conversion, while carbon dioxide

also serves as a better oxidant, compared to oxygen or air. The co-feed of carbon dioxide will also increase the methane conversion and the yield of objective products. In addition to syngas, gaseous hydrocarbons (C₂ to C₄), liquid hydrocarbons (C₅ to C₁₁+) and oxygenates can be produced in methane conversion with the co-feed of carbon dioxide. The liquid hydrocarbons are highly branched, representing a high-octane number, while oxygenates mainly consist of a series of alcohols and acids. It is also important to note that carbon should not be used as a source of fuel but for making chemicals and materials and all non-carbon sources of energy such as solar, wind, geothermal, tidal, and nuclear and above all hydrogen from

PARIS AGREEMENT 2015: NET ZERO GOAL
 Green Hydrogen, CO₂ Refineries & ICT Mumbai's Contribution



Projected cost of hydrogen by ICT-OEC Process: ~ 1 USD/kg

@ G.D. Yadav

water splitting will meet the requirements of the Paris Agreement.

Plastics refining is greenhouse-gas intensive. Carbon dioxide emissions from ethylene production are projected to expand by 34% between 2015 and 2030.

Plastics refining is greenhouse-gas intensive. Carbon dioxide emissions from ethylene production are projected to expand by 34% between 2015 and 2030.

Plastics refining is greenhouse-gas intensive. Carbon dioxide emissions from ethylene production are projected to expand by 34% between 2015 and 2030. For instance, polyvinylchloride (PVC) is a widely used thermoplastic polymer due to its stability, affordability, and workability. It is a versatile general plastic widely used in construction, civil material, and many other consumer goods. PVC polymer is highly polar and thus has a good insulation property, but it is inferior to non-polar polymers like polypropylene (PP) and polyethylene (PE). PVC, PE and PP are commonly used in piping, water sanity, and medical industries, etc. whereas PP is extremely thermal resistant and can tolerate much higher temperatures than PVC. These polymers contribute to carbon footprint and global warming.



Plastics refining is greenhouse-gas intensive. Carbon dioxide emissions from ethylene production are projected to expand by 34% between 2015 and 2030.

PVC is shown to have higher energy consumption and CO₂ gas emission that shows 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. PVC can improve its production scale but also reduce global warming. Among all three types of polymers, PVC has more energy consumption and CO₂ gas emission. Thus, it has a more contribution to global warming in comparison to other types of polymers. It was also revealed that recycling and non-recycling products have the same quality of products.

Worldwide, about 40% of plastics are used as packaging. Typically, packaging is meant for a single use (SUP), so there is a fast turnaround to disposal. The packaging can be handled in three different ways: landfill, incineration, or recycling. Waste incineration has the biggest climate impact of the three options. As per the CIEL report, U.S. emissions from plastics incineration in 2015 were 5.9 million metric tons of CO₂ equivalent whereas the World Energy Council



predicts that if plastics production and incineration increase as anticipated, GHG will increase to 49 million metric tons by 2030 and 91 million metric tons by 2050.

Landfilling has a much lower climate impact than incineration. But the location of landfills can be associated with similar environmental injustices. Recycling is a different ball game with an entirely different set of problems. Compared to the low costs of virgin materials, recycled plastics are high cost with low commercial value. This makes recycling profitable only rarely, so it requires considerable government subsidies. However, so called chemical recycling of polymers including depolymerization and hydrogenation.

Ellen MacArthur Foundation suggests that only 2% of plastics are recycled into products with similar functionality. Another 8% are "downcycled" to something of lower quality. The rest of plastic is landfilled, goes into the environment, or incinerated. Eventually, cutting emissions associated with plastics may require an all-of-the-above strategy: reducing waste, retaining materials by refurbishing or remanufacturing, and recycling. Chemical recycling

comprises three mechanisms by which the polymer is purified from plastics without changing its molecular structure, is depolymerised into its monomer building blocks, which in turn can be repolymerised, and is converted into chemical building blocks and can thus be used to produce new polymers.

Hydrogen and methane production from styrofoam waste using an atmospheric-pressure microwave plasma reactor is reported. Polymer upcycling such as SUP conversion into new products is all now worthy of practice. If government-established recycling targets are to be attained, the relationships between consumers, municipalities, and petrochemical production must be enhanced. After all, public opinion is moved by media images of an endangered 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.

Carbon dioxide refineries are not far away to be seen and to be believed. Net zero should happen much before 2050 during the lifetime of many readers. ■





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EXPANDING TO MAKE 600,000 LITRES OF ETHANOL PER DAY

The company plans to continue to expand in the business of making specialty chemicals in a wide range of end use applications



SAMIR S. SOMAIYA
CHAIRMAN & MANAGING DIRECTOR
GODAVARI BIOREFINERIES LIMITED

How will biofuel, bio-CNG, and bio-electricity impact India and its economy in the long run?

The current geopolitical turmoil has dramatically increased costs of food and fuel. In addition, the entire world faces climate change. India must address its energy security and finally being an agrarian nation with millions of small farmers, India needs to provide meaningful livelihoods to its population. This can be met with farmers growing crops for food and fuel.

Renewable energy can help address these three challenges. India has an abundance of sunlight. This sunlight can help us generate solar power, but also help the crops we grow be a source of energy. Renewable energy, as opposed to energy derived from fossil fuels, helps combat and mitigate climate change.

Sugarcane is one such crop. India makes more sugarcane than it needs for sugar. The government has recognized this sugarcane surplus as a source of energy. Energy from sugarcane comes to us in three forms - ethanol as a biofuel, bio-CNG, and bio-electricity. All three have tremendous potential to meet our energy needs for mobility as well as home needs.

The government of India in June 2021

has articulated an aggressive and excellent roadmap for ethanol blending. That report is very comprehensive and very well articulates the steps that need to be taken to take this opportunity forward. In fact, the government has advanced the target date for 20% ethanol blending from 2030 to 2025. The government is also encouraging the conversion of grain to ethanol, knowing fully well, that the total ethanol demand will exceed 15 billion litres (across all applications in 2025). Of these 15 billion litres, 10 billion will be used as a fuel.

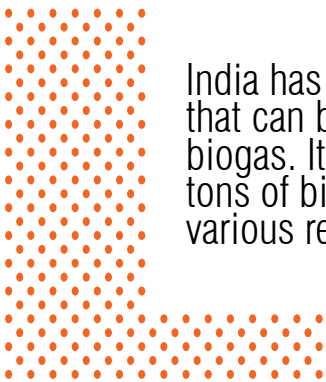
The future will still require higher ethanol blending and energy self-sufficiency. The government is already piloting E100 as a fuel, and is asking the automobile manufacturers to make flex fuel cars.

India has many other sources of biomass that can be used to generate compressed biogas. It is estimated that over 62 million tons of biogas can be produced from various renewable sources. Through the SATAT programme, the government has set an aggressive target to produce 25 million tons of biogas by 2025 meeting 40% of India's gas requirement.

Every sugar mill makes surplus electricity as it generates steam to meet its process needs. This electricity is exported to the grid, and can be used to meet the growing power needs of the country, and be a source for mobility as cars move towards electric vehicles.

Every sugar mill generates electricity as a co-product by using efficient high pressure boilers and turbines. Each sugar mill can export about 30 kwh/ton crushed of electricity while crushing cane (excluding saved bagasse). 320 million tons of cane will mean 9.6 million mwh of electricity. An electric car can give a mileage of about 7 km/kwh. This equates to about 67 billion km of distance traveled.

Petrol gives on average 10 km/l. This translates to 6.7 billion litres of petrol saved



India has many other sources of biomass that can be used to generate compressed biogas. It is estimated that over 62 million tons of biogas can be produced from various renewable sources.

(to put this number in context, India consumed 42 billion litres of petrol in 2019).

The combination of these will go a long way in addressing India's energy security, mitigate climate change and improve farmer incomes. Further, it will also make India stronger in the context of geopolitical, climate and energy shocks.

Q Will India reach 20% Ethanol blending by 2025 and introduce E20 fuel by 2023? How will this result in transformation of biorefineries and rural economy?

India will reach 20% blending by 2025. There are large investments happening to convert sugarcane syrup and/or B molasses to ethanol. Simultaneously, there are investments in setting up grain based ethanol facilities.

With these initiatives, the country is poised to achieve a 20% blend by 2025. With the manufacture of flex fuel cars, and the imperative of energy security especially in the face of global supply shocks, there is a greater consensus on implementing green and sustainable sources of energy and biomaterials.

This will provide an option to agribusinesses to make foods and fuels. This will lead to a stability of revenue streams and consequently farmer incomes. To give an example, earlier, sugarcane was used only to make sugar. Surplus production of cane weighed heavily on the sugar market, leading to surpluses, lower selling prices and sales,



cane arrears, and then lower cane production – amplifying surpluses and deficits. The Biofuel market provides a 'sink' for production and stability to the markets and to farmer incomes.

This will lead to the setting up of industry in rural areas and will translate to rural prosperity.

Q What's the present yearly capacity of Ethanol for Godavari Biorefineries? Are you further expanding your ethanol capacity?

Godavari has always been at the forefront of making ethanol from sugarcane. The company rapidly increased its ethanol capacity from 200,000 litres per day to its current ethanol capacity of 400,000 litres per day. We are currently expanding to make 600,000 litres per day from the coming sugarcane crushing season.

Next year, we further plan to add a bolt on capacity for adding grain as a feedstock giving us greater flexibility and resilience in our ethanol capacity.

Q The company is planning to jump into Ethanol based Specialty Chemicals for Pharma Intermediates and Agro Intermediates. Any development on this front?

The company is already in the business of ethanol based specialty chemicals. Chemicals comprised almost 35% of our business in the year ended March 2021. The company plans to continue to expand in the business of making specialty chemicals in a wide range of end use applications, including pharmaceuti-



cal intermediates, agrochemicals, coatings, and more.

Q What's your approach to sustainability and plans for achieving net zero? Sustainability initiatives that will improve resource and product sustainability for the company?

The company fundamentally believes in using renewable resources to make fuels, energy, biochemicals, biomaterials and other products. Sugarcane and ethanol are used to make all the products listed above. The company believes in the concept of a cascading and circular biorefinery.

In addition, the company is also working with farmers to use drip irrigation, inter-cropping, remote sensing, soil testing, bio-fertilizers, and traditional agro-ecology practices like Panchagavya and Jeevamrut to reduce the carbon footprint, improve soil health, improve farm yields and incomes.

Q What is the latest development regarding your R&D facilities?

The company has three R&D facilities outside Mumbai and at each of its manufacturing locations. The company has R&D facilities from laboratory to pilot plant facilities. Godavari believes in co-creating end-use applications with collaborators and customers. Since these research programmes are developed internally, these facilities are needed to optimize reaction conditions, yields and scale up. ■

OUR COMBINED CAPEX FOR FY 2022-23 WOULD EXCEED RS. 6,000 CRORE

We have a very aggressive Capex plan as we are implementing major projects, namely the Paradip Numaligarh Pipeline, capacity augmentation from 3 to 9 million tonnes, building the Indo Bangla Product Pipeline and investing in biorefinery



BHASKAR JYOTI PHUKAN
MANAGING DIRECTOR
NUMALIGARH REFINERY LIMITED

? What are the current trends in the petrochemicals sector and how will it impact India?

We have witnessed a global disruption in supply chain logistics and because of that petrochemical commodity prices are running very high. Irrespective of petrochemical products that industries are using, be it polypropylene or polyethylene, the prices are running very high for the producers on a temporary basis. It may sound very good but in the long term this is not sustainable.

We have witnessed how crude prices are moving and petrochemicals cannot be totally divorced from that reality. Probably, it will get resolved when the product production comes back to the normal stream and logistic issues are resolved. Production mainly comes out of China, and perhaps because they are on lockdown, like other commodities petrochemical products have a supply deficit both driven by the production outages and also logistic constraints. However, the high prices are temporary and the gains by producers would not be sustainable.

? Key milestones achieved by Numaligarh Refinery in FY 2021-22 and what is the forecast for FY 2022-23?

We have not closed our accounts until now and therefore the numbers are not final but the only thing that I can tell you at this stage is that our revenues will be very good. It will be upwards of Rs. 20,000 crore. So, the top line is okay and profitability figures will also be impressive and is likely to surpass what we have achieved last year.

We have been extremely efficient with energy use so we will clock all time better and we could clock the highest production of wax. One major achievement for us as a PSU company is that we have been declared as the highest procuring entity on the GeM platform as we have been aggressively using the government's e-market place.

? Capex plans for FY 2022-23 and new products where you are focusing? How will it impact Numaligarh Refinery and what are the plans related to automation and digitalization across plants?

We have a very aggressive Capex plan as we are implementing major projects, namely the Paradip Numaligarh Pipeline, capacity augmentation from 3 to 9 million tonnes. That means we are building a 6 million tonne refinery inside our premises. Also, we are building the Indo Bangla Product Pipeline and are also investing in the biorefinery that is coming up just adjacent to our refinery at Numaligarh. Our combined Capex for FY 2022-23 would exceed Rs. 6,000 crore. So it is a process and in FY 2021-22, we have spent in excess of Rs. 3,000 crore. So that means we have to spend around Rs. 32,000 crore in the next four years.

That's what we are aspiring for so that we can complete all the projects on hand. As far as product diversification is concerned, our immediate goal is to implement the polypropylene plan which has been approved by the board. Till the time, the refinery would diversify into wax production which we would like



to keep at the highest. We also have some variants of kerosene, MTO, and wash oil. So these are small variants that we will continue to produce. We will also market some amount of nitrogen that we produce in our plant. Our diversification mainly will happen once we implement the petrochemical projects.

❓ What are your plans with respect to automation and digitization?

We have embarked upon a very ambitious automation and digitization process. We have initiated a project through a cloud shared model called IEEDMS (Integrated Electronic Engineering Data Management System). We have different vendors and consultants on the same platform. Once the files are created, then finally we do a 3D model, and subsequently the structural design can be shared across all stakeholders. We have hired some space on AWS cloud so that all stakeholders can access the files. This speeds up the approval process and eliminates the requirement to move paper from one place to another. This is a major initiative and it did require an onboarding of all the stakeholders who are using these papers. It was a herculean task

but we are through with it. Both consultants and vendors are happy as they will benefit in terms of the approval process as well as the accuracy of the documents that we maintain and at the end of the day all our project documents will be digitized. So this is one major initiative that we are undertaking.

Second, we have implemented something called E-logbook as every process plan is required to maintain log books at different places, namely the field locations. The control room where people who are operating the plant through the DCS are also required to maintain a log book. We have digitized all these log books in a manner that when an operator goes to an equipment, particularly instrumentation gauge or pressure transmitter, he can acquire the data by scanning the QR code through a mobile device and these are intrinsically safe.

One of the major inputs, coming out from the historian software is fed by the DCS software as different plants operate differently. CSS and DCS dumps the data into some history and the E-logbook package picks up the data and then our console officers put their

comments and inputs. This data visibility is also available across the organization so that people who matter can review.

Third, we are implementing it in the reliability space and that is AIMS (Assets Integrity Management System) and RCM (Reliability Centered Maintenance). These are very standard solutions to increase the reliability and the operation availability of the plant.

❓ Numaligarh Refinery has also tied up with AspenTech for maximizing refinery capacity and achieving operational efficiency across different units?

We actually operate different suites provided by AspenTech. We are using a solution called ATOMS that helps us in reconciliation of the stocks i.e. what is going out from the units and what is getting stored in the tanks. We get those recorded without having to rely on the manual documentation. So we get those things quickly and we can take corrective action if required. Then we use a simulation software called ISIS. We are using the entire suite and we have benefited from their

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usage and we will continue with that even in future.

Q You have got a go ahead for the polypropylene project worth Rs. 6,555 crore? What is your plan of action?

We have got the licensor on board and in this case it is LUMMUS. So, we are getting technology from LUMMUS for converting propylene to polypropylene. Maybe going forward, we have to engage one engineering consultant which we will do in due course of time and then parallelly we have to apply for environmental clearance. The process is on and we will obviously start when we get the okay from concerned authorities. As of now, we have only engaged the licensor and they will do the front end engineering, whatever basic engineering is required so that the activity will start when required.

Q With this diversification, what all products would you be planning as of now?

As of now, we will only remain in the polypropylene space, different grades of course. And interchangeability of different grades based on the market acceptability. We will have different grades but again we

will confine ourselves within the commodity space of the petrochemical chain. So once we move forward, we will see what else we can do.

Q When do you plan to commercialize?

Assuming that the Ministry of Environment, Forest and Climate Change is happy with one season data which they should be because our baseline data is quite recent. If that be the case, we can expect the clearance to come sometime in the middle of next year or beginning of the first quarter of next year. So when the zero debt starts, I think we should be able to finish up it in 36 months.

Q What is your market share nationally and by when are you planning to triple your capacities?

We are a very tiny refinery and our national refining capacity is 249 as we process around 2.6 MMTPA which is just 1% of national refining capacity. While we are tiny in the context of India but not in the North East we are definitely a big player. So, one need not only see the size of the refinery but how efficient they are. We are quite efficient that way. So once we have the capacity, we intend

to be both efficient and reasonably big to have a lot of product diversification. That is the way forward for us.

Q As a part of Hydrocarbon vision 2030 for North East India, what is the role that you foresee for Numaligarh Refinery?

If you go through the Hydrocarbon Vision Document 2030, a large number of projects hinge on our expansion, be it IGL which is on their execution way. Be it the product pipeline going from Numaligarh to Siliguri, a 1.72 million pipeline getting augmented over there. Our Bangladesh export will majorly depend upon our ability to supply to them, which again is dependent on our expansion. We have an aggressive plan to go towards Manipur also in future, maybe that pipeline will also come and depending upon our success. So major link projects are coming up based on what Numaligarh will look like in 2025.

Q You have also signed an agreement with Indradhanush Gas Grid in 2021. How will this agreement help you in the long run?

This agreement will secure natural gas for us as they are a major transporter. GAIL will terminate their pipeline at Guwahati and beyond Guwahati is the responsibility of IGL to carry natural gas to all eight state capitals of North East. They have a very robust natural gas grid and we play a devoted role being an anchor customer, so we will consume around 2.5 Mmscfd of gas. So that is a very large quantity if you consider the entire initial consumption of North East. I am sure once the gas grid is connected, a lot of industries will come and the story of the FPJ pipeline will gradually get replicated even in the North East.

So the North East will have access to energy and a lot of ancillary and small industries will grow hinging on the energy availability.

Q You are also setting up a biorefinery. Could you elaborate on it?

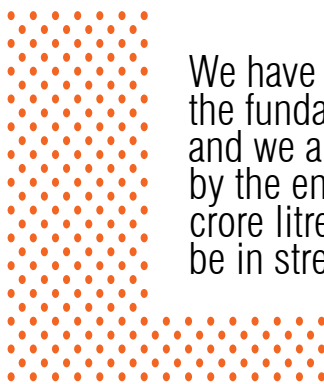
Currently, our biorefinery is getting constructed and we are almost 70% through. This is based on bamboo as feedstock as opposed



to other biorefineries based on sugarcane or broken rice that is called 1G. We are also in 2G space but we are unique in the sense that our feedstock is bamboo as opposed to rice straw in other places. As you are aware that bamboo has a lot of cellulose, we will isolate the cellulose further hydrolyzed in presence of this enzyme, called enzymic hydrolysis, to convert it to glucose, and finally glucose to ethanol by fermentation. And in the process, we will also produce something called furfural and acetic acid. Furfural is a good platform chemical and it will be a way of producing either furfuryl alcohol which is a very good binding substance or its product to produce a wood binding agent for refractory material. Since India imports it, that will directly go for import substitution. We are also trying to open up production of some biodegradable plastic by using furfural as the base material. We have collaborated with IIT Guwahati where the fundamental process is getting developed and we are trying to put up a pilot plant maybe by the end of next year. We plan to produce 6 crore litres of ethanol per annum and should be in stream by December this year.

Q How is your company striking a balance between sustainability and growth? Sustainability projects planned for FY 2022-23?

There is no escape from sustainability these days, and carbon dioxide emission is one of the key areas that we are looking at very closely. Apart from water consumption, freshwater consumption is another thing that we are looking at very seriously. Year on year, we have been able to reduce freshwater consumption. We have a permission to consume fresh water of 1,200 cubic meter per hour but we are managing only 700 by aggressive recycling of water. We want to take it to another level by tying up with NEIST Jorhat, a leading research laboratory. The goal is to separate phenol from the waste water so that that waste water can be recycled into our hydrocracker plant because hydrocracker needs a lot of that injection water during



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the separation process. We are also trying to pursue green hydrogen and have already floated a tender for supplying an electrolyzer capacity of 2.4 KTP roughly about 300 Kg per hour. We have invested in a grid connectivity with 220 KV substation coming up and we intend to source green power to power our electrolyzer. So, from an electrolyzer we will produce green hydrogen to the extent that it will reduce our own steam based hydrogen production process, eventually reducing our carbon dioxide emissions.

Q What are the CSR initiatives you would be undertaking this year?

There are nine areas of our CSR initiatives but the major focus is on health and education.

We will continue to invest in health besides our continuous efforts in education. We are already running a nursing school with 100% absorption and are taking around 40 students per year. But going forward, we are trying to upgrade that nursing school with additional 50 seats and to a three year course. That is our commitment to the society and the health sector. We have heavily invested in skill development as well and we will continue our efforts on these fronts.

Q Where do you see Numaligarh refinery in the next five years?

We want to remain nimble as we do not know what lies in the future. There can be two scenarios, one a very aggressive de-

mand destruction scenario where you have to hasten the migration from auto fuel to chemical. So, we will like to keep our options open and at the same time, we also want to be a very major player in the policy initiatives like exports to Bangladesh and Myanmar. We are at an advantage because we are contiguous to both the countries and we are also connected very well by the riverways. Since riverways are being revived, we definitely will play a key role in Bangladesh. Export both in terms of petrochemical as well as petroleum products because we have four sites. We have a vision that Bangladesh's transition from the energy sector will be a little slower than India's because they are not blessed with too much sunlight and solar cannot be an option for it.

For a longer time, they will have to depend on hydrocarbons because wind energy is also not very great, though they have a shallow sea. Windmills are pretty costly and Bangladesh is not there today. Therefore, our bet is that while there may be a demand destruction very rapid in India in the advent of EV coming very aggressively. Even if that destruction is very drastic, we have a market in Bangladesh and Myanmar to sustain us for some time. But even if that does not happen, we should be nimble enough to migrate to certain chemicals.

We have identified the portfolio and will take action in due course of time. ■

The Shift to Hydrogen Is On. Are You Ready?

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INDIA NEEDS FOURTEEN CRACKER UNITS BY 2040

BCPL has envisaged Capex of Rs. 157 crore during 2022-23, out of which Rs. 100 crore shall be towards setting up of two new projects, Butene-1 and HPG (2nd stage) plants with capacity 10 KTPA and 52 KTPA respectively



REEP HAZARIKA
MANAGING DIRECTOR
BRAHMAPUTRA CRACKER &
POLYMER LIMITED (BCPL)

? What are the global trends in the petrochemicals sector in 2022 and how would explain its impact on India?

The global petrochemicals market size was valued at US \$536.1 billion in 2020 and is expected to expand at a compound annual growth rate (CAGR) of 6.4% in terms of revenue from 2021 to 2028. The International Energy Agency (IEA) has forecasted that the petrochemical sector will account for one-third of oil demand growth by 2030 and will be nearly half in 2050. It has been estimated that production of key plastics will more than double between 2010 and 2050. As per the recent study, Asia-Pacific, Middle East, and the US are the three demand centres of the petrochemicals market. Therefore, these three regions are investing heavily to boost petrochemical processing capacity to satisfy demand.

Post 2016, after the dip in oil price, all Middle East Nations started to invest in new downstream processing plants, especially in the production of petrochemicals to mitigate reliance on oil export revenues and diversify their product portfolios. Ethane remains the

dominant feedstock in North America and the Middle East while Naphtha is most favoured in China and Europe. Therefore, China is expected to shift the ethylene production technology to crude-oil-based naphtha instead of relying on coal-to-olefins and methanol-to-olefins routes due to environmental regulations and other issues. Again, Naphtha percentage in the Western European cracker feedstock supply is gradually decreasing as the newer units have shifted to the lighter feeds. Therefore, since 2014-15, C4 chemicals and aromatics markets are riding on increased demand. Taking this advantage, China has built many units that will convert crude-oil-to-chemicals with a focus to produce aromatics, primarily paraxylene, benzene etc.

If we consider the Indian scenario, the growth of the petrochemical sector is always more than the GDP growth of the country. The average estimated growth for the next 5 to 7 years is about 9.3% against the world average of 5.2%. To meet the growing demand of petrochemicals, India needs five cracker units by 2025 and 14 units by 2040.

According to media report, India's domestic ethylene capacity has increased from 4 MTPA in 2014 to 7.4 MTPA in 2021. Given the strong underlying demand trends, India's petrochemical sector is now witnessing a significant investment boom, with several multibillion-dollar assets. The 18 million metric ton (MMT) in West Coast refinery, which is a joint venture between Abu Dhabi National Oil Company (ADNOC), Saudi Aramco, IOCL, BPCL, and HPCL, is an example of the Indian's commitment to satisfy demand and mitigate imports.

? What are the key milestones achieved by BCPL in FY 2021-22? How has the company's revenue and profit performance been during FY 2021-22 and what is forecast for FY 2022-23?

In FY 2021-22, the company has geared

The nameplate capacity of BCPL is 280 KMT and its market share is about 3% in terms of national polymer production capacity. At 100% design capacity, BCPL can produce 220 KTA of Poly Ethylene and 60KTA of Polypropylene with 43.7 KTA of Hydrogenated Pyrolysis gasoline and 9.3 KTA of Fuel oil as by-products.



up the pace after being hit by the pandemic on a global front. Although the world economy has slowed down and the same has hit hard on us, BCPL was still able to achieve 100% capacity utilization during the FY 2021-22.

Coming to the company's revenue and profit performance, the revenue and profit for the year 2020-21 was around Rs. 2,902 crores and Rs. 740 crores respectively. Similarly, trends of revenue and profits are expected in the FY 2021-22 and FY 2022-23, although the same would be driven by feed-stock costs and the polymer market demand.

Q What is BCPL's Capex plans for FY 2022-23? New products where you are focusing and how it will impact BCPL? What are your plans related to automation and digitalization across all BCPL's plants?

BCPL has envisaged Capex of Rs. 157 crores during 2022-23, out of which Rs. 100 crores shall be towards setting up of two new projects, Butene-1 and HPG (2nd stage) plants with capacity 10 KTPA and 52 KTPA respectively which is a part of expansion of the business.

BCPL is a relatively new petrochemical complex commissioned six years back in 2016. Therefore, the latest state-of-the-art technology was used in our process plants. SAP has been in operation since 2017 and the Plant Maintenance (PM) module is going to be implemented soon. Modules like Laboratory Quality Management System (LQMS) are already in operation and several others have been developed in house for ease of office operations. BCPL is always in the forefront to update its software and hardware systems to keep pace with the latest technological advancements.

Q Which products are planned for diversification by BCPL and by when? When are you doubling BCPL's capacity?

Detailed study is being carried out for exploring the diversification as well as capacity enhancement of the petrochemical complex.

The study on capacity enhancement of major units of BCPL are going on and the results are expected in FY 2022-23. Recent-



ly, a MoU was signed with Shyama Prasad Mukherjee Port, Kolkata (SMPK) for streamlining logistic chain for movement of feed-stock like Naphtha via railway or via NW-2 by setting up of tankage facility at Haldia Dock Complex. These will provide BCPL additional cushion in addition to the domestic market to imported feed from the international market as and when required.



Q What is the BCPL's group refining/processing capacity per annum at the end FY 2021-22 and what's your share nationally? How are you planning to increase market share?

The nameplate capacity of BCPL is 280 KMT and its market share is about 3% in terms of national polymer production capacity.

It is a matter of pride that the products of BCPL are being consumed 100% in its targeted markets and as such the worth of increasing the market share is already fetching good results. However, the same is being explored for its market in the North East region for better consumption by increasing awareness among the youths for its scope in wider utility and hence making profits. Development of downstream industries are being targeted and involvement of prospective buyers are increased.

Q As a part of Hydrocarbon Vision 2030 for North East India, what role BCPL will play in increasing feed-

stock to boost polymer business?

BCPL is running with the dual feed cracker and predominantly getting natural gas from upstream companies like OIL, ONGC, and some private players and Naphtha from refineries. Even though BCPL is not directly linked with Hydrocarbon Vision 2030 for North East (NE) India, BCPL is one of the major gas consumers in the NE region. BCPL is making collaborating efforts to help achieve the objective of Hydrocarbon Vision 2030 for North East by strategizing its expansion plan to bridge the gap between demand and supply of gas in the NE region.

Q How much is the annual processing capacity of BCPL's Petrochemical Complex at Lepetkata in Assam where Polymers are being produced after processing the feedstock? Any plans of scaling it up?

At 100% design capacity, BCPL can produce 220 KTA of Poly Ethylene and 60KTA of Polypropylene with 43.7 KTA of Hydrogenated Pyrolysis gasoline and 9.3 KTA of Fuel oil as by-products.

BCPL has all geared up for expanding its annual production capacity. Detailed study is being done in consultation with the Process Licensors to carry out the debottlenecking of the existing plants. As demand for petrochemicals is expected to go up in the next few decades, therefore the prospects for expansion are quite promising for BCPL. BCPL has initiated dialogues with the upstream oil companies for the availability of feedstock to plan the expansion of



the plant. Feasibility to undertake the expansion exercise are also being conducted.

LLDPE/HDPE Swing unit at BCPL's Petrochemical Complex produces 2,20,000 TPA of polymer grade Ethylene and 60,000 TPA of polymer grade of Propylene. Any plans of scaling it up?

As already mentioned above, the feasibility study is being carried out to undertake the expansion activity. Based on the feasibility study report further action will be taken up.

How much is the annual processing capacity of Gas dehydration and compressor at GDU Duliajan where feed natural gas is processed from Oil India Limited? Any plans of scaling it up?

The present processing capacity of GDU Duliajan is 6 MMSCM per day. With the forecast of gas availability of OIL, BCPL is already carrying out a detailed study on De-bottlenecking/capacity expansion.

How much is the annual processing capacity of Lakwa Natural Gas Sweetening Unit Cum C2+ Hydrocarbon

Recovery Unit where feed natural gas supplied by ONGC is processed? Any plans of scaling it up?

The design of the annual gas handling capacity of BCPL Lakwa Unit is 333 MMSCMD to produce 28,000 TPA of C2+. Rich gas has been recently explored by private companies in several blocks of Assam basin including Charaideo and Golaghat regions which is relatively near to BCPL Lakwa unit. BCPL has entered into an MoU with Assam Gas Company for supply of rich gas to Lakwa plant. Apart from that, discussion is on with the upstream companies to infuse additional gas to Lakwa plant.

What is the strategy adopted by the company for marketing its products through GAIL and others?

BCPL has entered into a marketing agreement with GAIL for a period of ten years for marketing of BCPL products. Through this agreement, BCPL has been able to utilize the well-established polymer network of GAIL for establishing its brand across the length and breadth of the country. BCPL has been able to

use the technical expertise of GAIL Polymer Technology Centre (GPTC) for improving and upgrading product quality. BCPL polymer products have been well established in the domestic as well as international market and are being used for quite a number of critical applications in various sectors.

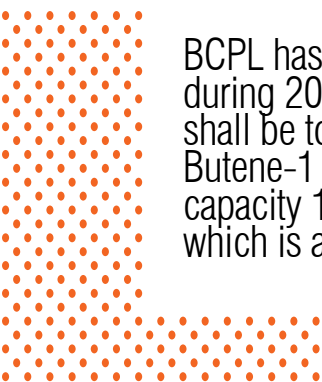
How is the company striking a balance between sustainability and growth? Sustainability projects planned to be undertaken in FY 2022-23?

BCPL faced several challenges in the initial phase of operation and stabilization of the petrochemical unit. BCPL has taken initiative to control its emission by selecting state-of-the-art clean technologies which are producing fewer pollutants and all parameters are maintained well under prescribed limits of the statutory body. Waste reduction is also part of BCPL's environment care and it has achieved 15% wastewater reduction in the last FY 2021-22. BCPL is also working on CO2 emission reduction by capturing and supplying to upstream majors like OIL for sequestration in oil enhancement projects which will pave the way for strong checks on CO2 emission.

The issue of feedstock availability and sustainability was very well handled by BCPL to run the plant at more than 100% capacity for the last four years. Purchasing of Butene-1 via spot purchase is an assiduous step in this regard. Several MoUs have been signed recently with small oil/gas producing companies as well as with some government bodies to ascertain BCPL's feedstock availability as well as streamlining the logistics part.

CSR initiatives to be undertaken by the company in FY2022-23?

We have entered into the CSR regime from the FY 2020-21, wherein we have taken up projects of around Rs. 11.5 crore. In the year FY 2021-22 we have taken up projects of around Rs. 19.1 crores. The execution time of some of these projects are spreading between one to three years. We are mainly concentrating our CSR activities in and around our Unit operating areas. In FY 2022-23, the projects are being finalized and we will be spending around Rs. 20 crores for CSR activities. ■



BCPL has envisaged Capex of Rs. 157 crore during 2022-23, out of which Rs. 100 crore shall be towards setting up of two new projects, Butene-1 and HPG (2nd stage) plants with capacity 10 KTPA and 52 KTPA respectively which is a part of expansion of the business.

Indian **CHEMICAL** News

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EXPANDING PETROCHEMICAL BASKET THROUGH RESEARCH AND DEVELOPMENT



S. BHARATHAN
EXECUTIVE DIRECTOR - R&D
HPCL

HPGRDC is working in developing novel polyolefins like polyethylene, polypropylene, drag reducing polymers, value addition of the C4 & C5 refinery stream into high reactive polyisobutylene & DCPD hydrocarbon resin

Established across a vast range of modern products, petrochemicals are part of the fabric of our societies. Clothing, tyres, digital devices, packaging, detergents, and countless other everyday items are made from petrochemicals. Petrochemical feedstock accounts for 12% of global oil demand, a share that is expected to increase driven by increasing demand for plastics, fertilizers and other products. Petrochemical industry also includes various types of polymers and elastomers and is now an integral part of the refining industry. It is highly capital and energy intensive as well as dependent on demography of the area in terms of feedstock availability. In spite of that, it is the one of the fastest growing industries and the companies with secured feedstock have competitive advantage, therefore, hold the commanding position. The following chart exhibits the projection of various thermoplastics which form the major part of petrochemical basket:

However, the industry's landscape is being shaped by shifts in end-market demand,

changes in feedstock dynamics, overcapacity, increasing regulatory focus, and a growing push toward sustainability.

In addition, the recent upsurge of global trade restrictions has not only changed the manufacturing dynamics but also severely affected the business scenario. The environmental concern with respect to generation of CO₂ from refinery and petrochemical processes as well as from other chemical industries leading to global warming has put forward many challenges to the existing industry. Therefore, the industry is seeking answers to mitigate these challenges and these are one of the prime concerns of the existing chemical and petrochemical industry. In addition, it is worth mentioning that for an industry to sustain and survive it has become pertinent for it to diversify its product portfolio depending upon the constantly changing market scenario which is forcing all the industrial houses especially the one engaged in the manufacturing of petrochemicals.

It is now well understood by various industries whether struggling for sustainable growth or to drive the diversification in terms of expanding their product basket and to meet such external threats as mentioned above; the companies have invested heavily in the Research and Development (R&D) programs to maintain a leading position. R&D is the striking feature of the innovation process. It is a pool of human resources that has been built up gradually depending upon the priorities of various research programs with clear objectives and defining the deliverables.

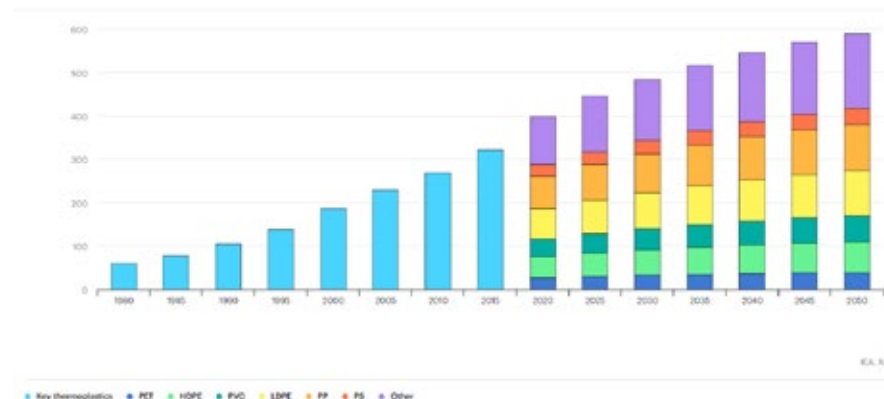


The production of MEG without producing by-products such as DEG and TEG is one of the best examples of R&D efforts to address the problem of maximizing the specific consumption of ethylene in MEG manufacturing process.

Many products which are now ubiquitous and universal, such as Polyolefin, Polyvinyl Chloride (PVC), Nylon, Polycarbonate, Synthetic Rubbers, and many more to quote would never have existed without the concerted efforts made in Research and Development programs. The various industrial houses which invested in such research projects generated enormous revenue which motivated them to invest further in R&D programs to produce new products in future.

R&D has a direct link with market developments which has led to innovations where more efficient processes have been developed along with new catalyst systems. It can be seen that various new and efficient catalysts in terms of efficiency/conversions and selectivity have been developed in 20th and 21st centuries leading to production of on purpose products with less energy cost and curtailing the by-products which were the part of conventional process. The production of Mono ethylene glycol (MEG) without producing by-products such as Di-Ethylene Glycol (DEG) and Tri-Ethylene glycol (TEG) is one of the best examples of R&D efforts to address the problem of maximizing the specific consumption of ethylene in MEG manufacturing process. Similarly, after the technological developments reached a stage of maturity in the 1980's, new processes appeared on the horizon which were more efficient and less energy intensive as a result of R&D developments carried out in that field. The conventional production of MMA from isobutylene has now been replaced with ethylene as the starting raw material which is relatively much cost effective as compared to isobutylene.

Another example of R&D efforts to meet the challenge emerging from replacing the Naphtha as feedstock to Ethane resulting in a shortage of propylene monomer. This situation forced the companies to produce propylene by dehydrogenation process from propane which was not earlier existing on the horizon of the petrochemical industry. It has been envisaged that propylene shortage will further increase, since naphtha is now being



replaced by LPG as the feedstocks in the steam cracker. In the transportation sector the demand of gasoline and diesel is expected to reduce with the advent of vehicles which will run on batteries; which will result in more heavier feedstock (for e.g. kerosene) moving towards petchem production.

S O U J A N Y A

The new technologies improved better utilization of feedstocks and consumed less energy to produce various petrochemicals. In the area of production of commodity polymers such as PE and PP, the single capacity has been enhanced to 600 KTA and new lines are claimed to be much more cost effective in terms of operating costs.

R&D efforts to expand the product portfolio of a petrochemical company also bears another dimension of R&D which is known as strategic research. It was soon realized that R&D efforts put up for diversification of product portfolio helped the companies in general and especially petrochemical companies in particular to formulate their own R&D strategies depending upon their product portfolios. There have been two types of research strategies adopted by companies known as short-term and long-term. Whereas the long-term research work is related to opportunity generation linked with future diversification strategies thereby increasing their product portfolio; short-term is linked with incre-

mental benefits derived for the current business, mainly for cost reduction so as to remain competitive in the market and maintain the current status of operating technology. As a result of these two strategies adopted by various companies it can be seen that new products and technological processes appeared in the market and the companies involved in the research generated much more revenue. HPCL has set up its prestigious 'HP Green R&D Center' (HPGRDC) at Bengaluru, India with an objective to develop innovative & path breaking technologies & products. To align with the above plans of HPCL in the area of petrochemicals, HP Green R&D Centre (HPGRDC) has established a Petrochemical & Polymer Research Laboratory with the major objectives of developing alternative indigenous cost-effective catalysts, polymerization processes specialty polymers & high value products. Currently HPGRDC is working in developing novel polyolefins like Polyethylene, Polypropylene, Drag reducing polymers, value addition of the C4 & C5 refinery stream into high reactive poly-isobutylene & DCPD hydrocarbon resin. HPGRDC is working on the sustainable polymers from carbon dioxide to polycarbonate based on the dimethyl carbonate & Diphenyl carbonate as chemical sources. ■

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Energy



Navigating Sustainability
Roadblocks



INDIA SETS OFF ON THE MISSION HYDROGEN

Redefining its roadmap to achieve hydrogen economy, country is making rapid strides in setting up infrastructure and favorable policies

Hydrogen first became a strategic area of interest for Indian policymakers way back in 2006 when the Ministry of New and Renewable Energy (MNRE) launched Hydrogen and Fuel Cell Roadmap. After a long gap of 10 years, the MNRE in 2016 laid out a comprehensive plan for increasing R&D activity including significant funding for different electrolyzer technologies. Since then there have been considerable efforts to establish a hydrogen economy in India, both by the public as well as private companies.

While hydrogen is already used extensively in India, it is mainly as an industrial feedstock in the creation of ammonia-based fertilizers. Most hydrogen in India is produced through reforming methane (CH₄), resulting in significant carbon dioxide emissions. There is the potential to capture these emissions using carbon capture and storage (CCS) technology, although this is relatively underdeveloped in India.

Along with electricity prices, the other important factor for reducing the costs of green hydrogen is the capital cost of electrolyzers. These are expected to continue to fall with a scale-up in deployment, as most electrolyzers today are manufactured on a rela-


tively small scale. This provides India with an opportunity to develop a manufacturing hub here, taking advantage of competitive labour costs and a technically proficient workforce.

Hydrogen can provide a supplementary role to renewables and batteries, in a transition to a carbon neutral economy. Early demand markets for hydrogen include fuel cells for trucking, balancing supply and demand in the power sector and replacing fossil fuels in industry.

By 2050, nearly 80% of India's hydrogen is projected to be green, produced by renewable electricity and electrolysis. While grey hydrogen production technologies are mature, many green hydrogen technologies are still at a stage of emergence, whereby markets are still developing and manufacturers are engaged in experimentalist learning.

Green hydrogen may become the most competitive route for hydrogen production by around 2030. This may be driven by potential cost declines in key production technologies and in clean energy technologies such as solar PV and wind turbines.

The Indian corporate sector is taking significant steps in the direction of accelerating the production of hydrogen. Indian Oil Corporation plans to build the country's first green hydrogen plant at its Mathura refinery. NTPC plans to use electricity generated from its upcoming renewable energy projects to generate green hydrogen on a commercial scale. Indian Oil, Larsen & Toubro (L&T) and ReNew Power have signed a binding term sheet for the formation of a joint venture (JV) company to develop the nascent green hydrogen sector in India. Additionally, IndianOil and L&T have signed a binding term sheet to form a JV with equity participation to manufacture and sell Electrolyzers used in



the new green hydrogen policy provides for the waiver of InterState transmission charges for a period of 25 years and a banking provision of up to 30 days, which will help reduce the cost of green hydrogen significantly.

the production of Green Hydrogen.

Both these JVs aim to enable the nation's 'Aatmanirbhar Bharat' mission to rapidly build, expand and bring in economies of scale to make green hydrogen a cost-effective energy carrier and a chemical feedstock for many sectors. The planned JVs aim to enable India's transition from a grey hydrogen economy to a greener economy that increasingly manufactures hydrogen via electrolysis powered by renewable energy.

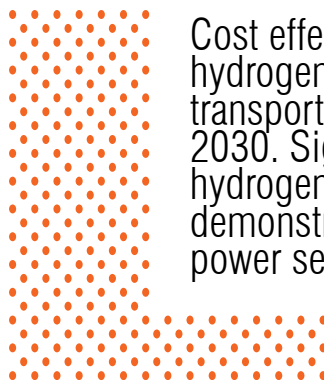
L&T has signed a pact with Norway based electrolyzer technology manufacturer to set up a gigawatt scale manufacturing unit for alkaline water electrolysis unit in India. Adani is targeting to become one of the largest green hydrogen producers in the world. It plans to invest US\$ 20 billion in renewable energy generation over the next decade and is keen to use it for producing green hydrogen. HPCL is setting up a green hydrogen project of 370 TPA (2.6 MW) capacity at Visakh Refinery by January, 2023.

EVOLVING POLICY

The central government in February 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 environmentally friendly version of the element. For countries like India, with its ever-increasing oil and gas import bill, green hydrogen can also help provide crucial energy security by reducing the overall dependence on imported fossil fuels. 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% of the element produced in the country (around 5 MMT) will be green, as per the draft National Hydrogen Mission guidelines.

To help decarbonize Indian industry, the new green hydrogen policy provides for the waiver of InterState transmission charges for a period of 25 years and a banking provision of up to 30 days, which will help reduce the cost of green hydrogen significantly. This will, therefore, push the replacement of grey hydrogen with green. The Ministry of Power has also provided a single-window-clearance portal for all clearances and open access on priority to green hydrogen projects.

The Government of India plans to introduce a PLI scheme for electrolyzers to pro-



Cost effective deployment of low carbon hydrogen technologies across the transport, industry and power sectors by 2030. Significant increases in existing hydrogen R&D spending, to support demonstration projects in the steel and power sectors.

TATA CHEMICALS

mote green hydrogen production in India at an outlay of US\$ 2 billion. In line with the government's plan to export green hydrogen and green ammonia, a detailed in-depth analysis to assess the potential needs to be undertaken. The cost of infrastructure and safety concerns would also need to be addressed. Various leading industry players have also made ambitious announcements across the hydrogen value chain.

WAY FORWARD

The paradigm shift in the energy landscape is inevitable and hydrogen could play a significant role in helping India in achieving its ambitious targets of decarbonisation, reduce dependence on fossil fuel imports and improve energy security.

In terms of the investment requirements, if India is to deploy green hydrogen as a clean energy solution for key sectors, including transport, industry and power, by 2050, this would require significant investment in electrolyzers. India should focus public money for R&D and technology development to try and be on the global frontier in each part of the value chain of green hydrogen, with the objective of lowering costs and increasing deployment.

This requires a coordinated push from the supply-side, with increased investment and R&D commitments by government and industry, as well as demand-side support in the form of guaranteed markets, enabled by government procurement, subsidy schemes or regulations on fossil fuel alternatives.

To ensure success, significant commitments under a National Mission, along with effective public-private partnerships, are required; there would be little point in a sub-optimal effort that fails to

mobilize sufficient resources.

With a renewable energy target of 500GW for 2030 and net zero by 2070, India could become a hydrogen hub as it is a promising opportunity. Industry experts are hopeful that green hydrogen will play a huge role in non-abate sectors but we are first exploring the low hanging fruits. They are looking in phases at replacing grey hydrogen as a feedstock and carrier. For a developing country like India, affordability is a huge factor. Therefore, while targets are there, we need to redefine the clear roadmap.

By 2050, nearly 80% of India's hydrogen is projected to be green, produced by renewable electricity and electrolysis. Green hydrogen may become the most competitive route for hydrogen production by around 2030. This may be driven by potential cost declines in key production technologies and in clean energy technologies such as solar PV and wind turbines.

There is a need for a Make in India policy support to maximise domestic manufacturing content across all parts of the value chain, including joint ventures with multinational companies. Apart from that we need policies to create a guaranteed market for hydrogen technologies, where they are not yet at cost parity with fossil-fuel equivalents, for example in the steel sector.

While many players are looking at pilots in railways and steel, there is equally the need to create an ecosystem for development of green hydrogen and its consumption. For India to make a transition to hydrogen technologies as well as creating manufacturing hubs will require a clear roadmap. A bouquet of measures including regulations and R&D will become major components of this roadmap. ■

THE WINDS OF CHANGE: GREEN HYDROGEN IN THE CHEMICAL INDUSTRY



DEEPAK MAHURKAR
PARTNER
PWC INDIA

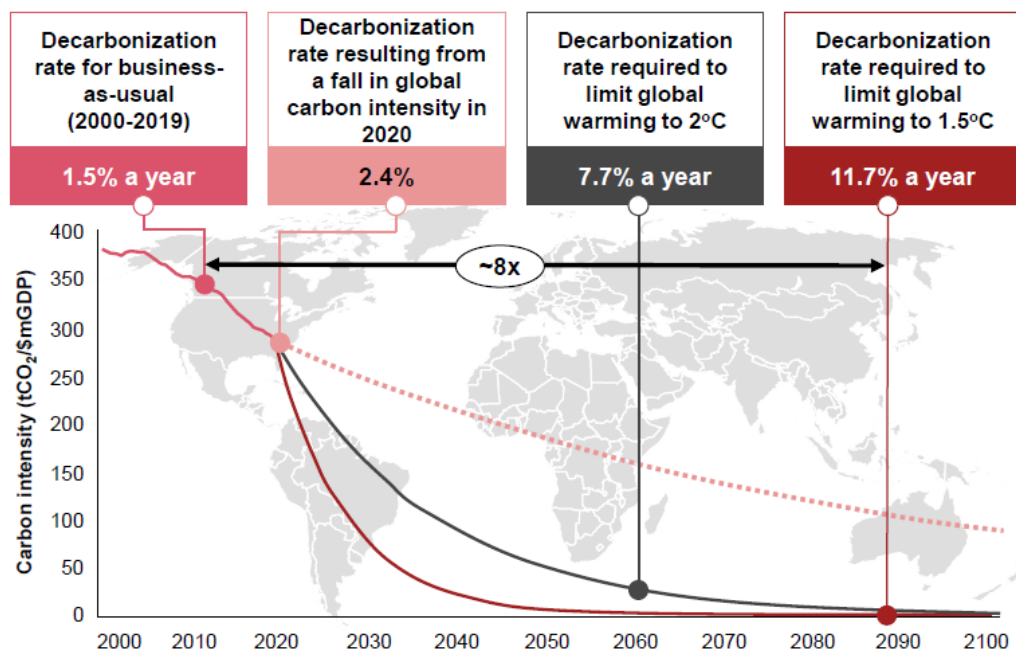


NIKHIL KALANE
PRINCIPAL CONSULTANT
PWC INDIA

The previous few decades have witnessed an ever-increasing drive towards promoting sustainable energy sources to protect the environment, ensure supply security and promote energy independence.

Corporates, nations, and international agencies across the world are driving initiatives committed to Paris Agreement on Climate Change and COP 26 eliminating net greenhouse gas (GHG) emissions by mid-century. While India aims to become a net zero nation by 2070, EU and China aim to reach net zero by 2050 and 2060 respectively. To achieve the Paris Agreement's goal of limiting global warming to 1.5 °C, eight times increase in global decarbonization rate is required.¹

This trend is affecting the chemical industry due to its energy intensive nature and dependence on hydrocarbons as major feedstock contributing to the GHG emissions. At the same time, customers and end-consumers are demanding suppliers to ensure that their products and services do not add to the problem. IEA points out that the technologies for achieving 75% of the required emissions cuts by 2050 are not commercially available today.²



This challenge calls for new strategies & instruments and a need for a root-and-branch transformation. At the same time, it also opens a set of opportunities for the chemical sector to position itself as a key partner in the sustainability-driven transformations of its customers' industries. Chemical companies that prepare early to comply with rigorous environmental, social, and governance (ESG) standards will have an advantage in the long term. This can only be achieved by unleashing far-reaching innovation within the chemical industry and its value chain, and by implementing ESG-driven innovation strategies. One such strategy is to utilize Hydrogen for

energy decarbonization and as green feedstock for chemical industry.

HYDROGEN AS AN ENABLER TO DECARBONIZATION

Although efficiency increase & electrification are most effective ways to reduce GHG emissions, certain applications have no real alternative to H₂. For example, coking coal free steel production via Direct Reduced Iron (DRI) route, chemical industry (feedstock), transport (long haul aviation, maritime shipping), long term storage for seasonal power generation, etc. As a result, the blue and green variants of hydrogen are gaining prominence and are being considered as the ultimate solution for deep decarbonization in various hard-to-abate and hard-to-electrify sectors.

Hydrogen is primarily produced via steam methane reforming of natural gas or naphtha. This hydrogen is termed as Grey. The same Grey hydrogen is termed Blue if CO₂ emitted in the process is captured. On the other hand, Green hydrogen is produced by splitting the water molecule via electrolysis using energy generated from renewable sources such as solar energy, wind energy etc. resulting in zero CO₂ emissions. The advances in electrolysis technology and the falling cost of renewable energy have paved the way for mass production of green hydrogen.

HYDROGEN AS A CRUCIAL FEEDSTOCK FOR THE CHEMICAL INDUSTRY

Hydrogen is an important feedstock for the chemical industry having application in manufacturing of methanol, ammonia & its fertilizers, petrochemicals, and chemical process industries. Methanol, ammonia and ammonia-based fertilizers accounts for over 50% of the total hydrogen demand in India.

Methanol is primarily used as a chemical intermediate and tops the list of the largest

imported chemicals with imports of close to 1,500 kilo tonnes (kT). Hydrogen is an important raw material for manufacturing methanol which is at present produced from natural gas or coal in the form of synthesis gas. As India lacks the availability of cheap natural gas, abundant availability of coal seems to be a favorable option for manufacturing methanol.

Imported technologies have proven expensive and thus development of indigenous technology to monetize high ash content coal is the way forward. Government is aiming to increase the coal to methanol capacities which will utilize the low-cost domestic coal. The domestic coal-based technologies are believed to have cost advantage over green hydrogen-based methanol technologies. Demand for hydrogen in methanol production will increase from 47 kT in 2020 to 8,000 kT in 2050 assuming that the present import share will reverse from 80% today to 20% by 2050 with policy support from the government with an aim to reduce energy imports.

Ammonia is another important chemical manufactured using hydrogen and nitrogen having application in fertilizers, explosives, plastics, fibers and chemical production processes. It is manufactured using the widely established Haber-Bosch process utilizing nitrogen from the air and hydrogen coming from the steam methane reforming of natural gas. The demand for ammonia in the fertilizers sector alone was ~20,000 kT in 2020 which would have required about 3,500 kT of hydrogen.³ With the growth in the fertilizers sector, the demand for ammonia is expected to be ~41,000 kT in 2050 requiring ~7,500 kT of hydrogen in 2050.⁴

The present grey hydrogen consumption in the methanol and ammonia production together reflects to 33,000 and 138,000 kT of CO₂ emissions in 2020 and 2050 respectively. Moreover, the dependence on natural gas can reduce from ~650 billion cubic feet (bcf) in 2020 to ~1,560 bcf in 2050.⁵ Substituting grey hydrogen with green can help reduce a CO₂ emission significantly and reduce natural gas imports. NITI Aayog's 'Methanol Economy' programme is aimed at converting coal reserves to methanol, reducing GHG

emissions and reducing India's oil import bill on the other hand India's Green Hydrogen Policy is aimed to facilitate the transition from fossil fuel/ fossil-based feedstocks to Green Hydrogen/ Green Ammonia.⁶

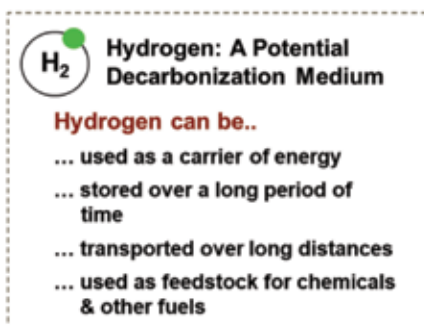
OPPORTUNITY IN GREEN AMMONIA MANUFACTURING

Apart from its crucial role in the domestic agricultural produce, ammonia is highest cited and the most viable carrier of green hydrogen under consideration today. Green ammonia as a hydrogen carrier will be the future of energy transition. However, hydrogen produced via green ammonia cracking will have very specific applications driven by the need rather than the costs. For the fertilizers sector alone, green ammonia as a decarbonization instrument can help reduce 69,000 kT of CO₂ and ~1,560 bcf of natural gas import dependence in 2050 and thus, domestic manufacturing of green ammonia is a tremendous opportunity for India.

On the other hand, India is one of the exporters of ammonia shipping to countries like UAE, Singapore, Qatar, Saudi, Malaysia, Sri Lanka, etc. Given India's established exports market of the order of 20 kT (anhydrous and aqueous forms together), green ammonia exports is also a potential opportunity if the manufacturing costs are kept under control.

India recently established a Green Hydrogen policy to facilitate the transition from fossil fuel/ fossil-based feedstocks to Green Hydrogen/ Green Ammonia both as energy carriers and feedstocks for different sectors. Attractive benefits and initiatives such as open access for sourcing renewable energy (RE), banking of RE, proposal to set up manufacturing zones allowing green hydrogen/ ammonia production, permission to use RE parks for green hydrogen/ ammonia production, storage infrastructure near ports, dedicated portal for statutory clearances & permissions are being provided by the government.⁷

The states of Rajasthan, Gujarat, Andhra Pradesh and Tamil Nadu show a good RE potential in context with solar and wind energy generation potential. The RE potential of these states can be leveraged along with the green hydrogen policy to establish India as a



manufacturing hub for green ammonia. It is estimated that a 100 kilo tonnes per annum (kTpa) green ammonia plant will require ~1,050 MWh of renewable electricity input. Such capacity plants will cost USD 100–150 million including a PEM electrolyzer having 65% efficiency. Hybrid RE (solar wind) along with Battery Energy Storage System (BESS) banking models can be evaluated as a source of electricity for operating these plants. While the profitability of such projects will primarily depend on the cost of green hydrogen, investors are eyeing this opportunity with due sensitivity to financial viability.

To cater to the demand of over 40,000 kT of ammonia for fertilizer production in 2050 a total of 400 green ammonia plants having 100 kTpa capacity each will be required. An investment of USD 42 billion and a renewable energy of 420 GWh is estimated for setting up these plants based on PEM electrolyser technology.

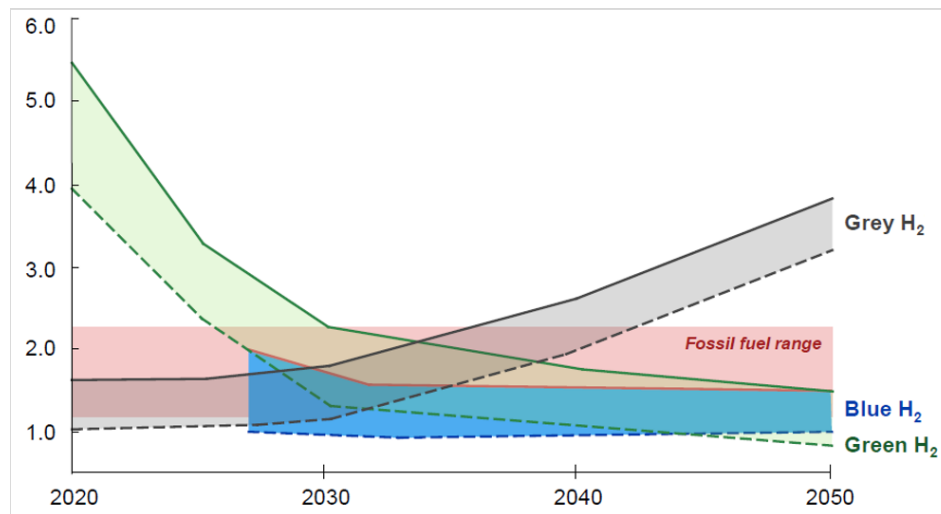
CIP Esbjerg PtX Hydrogen Project (159 kTpa capacity, Denmark)⁸, Hydrogen to Humber Saltend Project (125 kTpa capacity, UK)⁹, FUREC Hydrogen Project (Capacity 60 kTpa, Netherlands)¹⁰ are some of the large projects focused on low carbon hydrogen-based ammonia production.

Although, green hydrogen holds potential as an enabler to decarbonization and feedstock for ammonia production, its actual implementation will be majorly governed by the cost of green hydrogen and technological advances in electrolyzers. The storage and transportation infrastructure for ammonia already exists, thanks to the fertilizers market. It is also a safer gas to transport given its low density, lower flammability, and ease in liquefaction.

COST OF GREEN HYDROGEN

Today, green H₂ is expensive but has potential to become economical by 2030 given expected cost optimization of CAPEX and Renewable Energy Sources (RES) generation. The cost is expected to decline ~60% by 2030 from the current levels of USD 4–5.5 per kg. Three main factors driving the cost decline are 11:

- Electrolyser CAPEX costs are expected to decline with a 12% learning rate



- LCOE of renewables is decreasing and can reach ~14–17 USD/MWh in regions with high solar and wind potential
- Utilization levels continue to increase driven by centralization of production, design optimization and better mix of renewables

FUTURE BUSINESS MODELS

The future of clean energy business models based on green hydrogen will be a combination of the following archetypes:

- Operators of large-scale integrated RES power and green hydrogen production sites in best cost regions
- Originator and trader of hydrogen and certificates
- Operator of liquid hydrogen terminals, ships, hydrogen pipelines or large underground storage facilities
- Clean hydrogen solution provider to industrial companies, airports, ports (including blue hydrogen)
- Provider of local integrated hydrogen production, storage and usage
- Operator of hydrogen fueling stations

CONCLUSION

Green hydrogen can be claimed as a sustainable and a climate safe alternative over grey hydrogen. Moreover, it can ensure India's energy security and reduction in current account deficits at the same time. Although the present levelized cost of green hydrogen is higher compared to grey hydrogen, technological advances and falling renew-

able power costs will narrow the gap in coming years.

Green hydrogen forms a cornerstone of the shift away from fossil fuels and its steady offtake in the ammonia production can prove to be a pragmatic starting point in enabling India's hydrogen mission. ■

(The views expressed within this article are personal opinions of the author)

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ACCELERATING ENERGY TRANSITION THROUGH BIOECONOMY



SHISHIR JOSHIPURA
CEO AND MANAGING DIRECTOR
PRAJ INDUSTRIES LIMITED

As the campaign for Race to Zero catches steam post COP 26 Glasgow summit, harnessing the bioeconomy has emerged as a promising solution to achieve carbon neutrality

Economic growth refers to an increase in the productive capacity of an economy as a result of which the economy is capable of producing additional quantities of goods and services. One of the major pillars that drives the economic growth of any country is industrialization. Industrialization enables agricultural, commercial, and transportation advancements, as well as all other economic activities. Energy is a major source of industrialization. Rapid industrialization is indeed eradicating poverty, improving healthcare services, and standard of living, but taking a huge toll on the environment.

At the global level, this is manifest in the concern expressed about the environmental damage incurred as the global production base is expanded in order to meet ever-increasing energy demand. Increased fossil-based energy usage leads to visible pollution like smog and hazardous fumes as well as invisible pollution including greenhouse gas emissions. These are irreversibly damaging the planet. It is a serious apprehension whether economic growth through increased energy consumption is achieved at the cost of the right to survival of the future generation. Hence, there is a dire need to adopt responsible industrialization, through a circular bioeconomy approach.

ENERGY LANDSCAPE

The global energy landscape continues to be dominated by fossil fuels. Over 73% of human-caused greenhouse gas emissions are attributable to energy consumption. According to the International Energy Agency (IEA) estimates oil, coal, and natural gas ac-

count for approximately 81.3% of the global energy mix. Biofuels and waste streams account for 9.3% whereas nuclear, hydropower, and other sources account for 9.4% respectively in the overall energy mix.

NEED AND DRIVERS

The economic and population growth have led to an increase in energy demand. The consumption of fossil fuels leads to an increase in greenhouse gas (GHG) emissions causing global warming also impacting human health. Climate extremes such as heatwaves, devastating floods and droughts, threats to food and water security, population shifts, and the loss of lives and livelihoods are becoming more frequent and severe. This has precipitated immediate climate action initiatives on war-footing to cut-down carbon dioxide emissions to half by 2030. One of the very promising solutions is moving away from fossil fuels and adopting low-carbon energy derived from renewable sources.

According to the World Economic forum's Global Risk Report, 2022, 5 out of the top 10 risks are related to the environment. These include climate action failure, extreme weather, biodiversity loss, human environmental damage, and natural resources crisis.

The COP26 summit at Glasgow last year stressed the importance of achieving net-zero emissions and gave a clarion call to contain global warming to 1.5°C.

INDIAN PERSPECTIVE

India has announced achieving a net-zero target by 2070. By the year 2030, India plans to reduce one billion tonnes of carbon

emission and achieve 50% of its energy requirements from renewable energy.

In India, the National Biofuels Policy-2018 (NBP-18) lays down concrete goals to move towards self-sufficiency in energy generation while also conserving the environment. NBP-18 aims to reduce the dependency on mineral oil imports by 40% by the end of 2030.

The Policy entails increasing domestic production of mineral oil, expanding access to non-traditional/renewable energy resources, enforcing stringent guidelines for energy efficiency, and also providing consumers with cost-effective alternatives. In 2020-21, India's net petroleum imports totalled 185 MT at a cost of US \$551 billion. A roadmap for Ethanol Blended Petrol (EBP) program under the policy directs the blending of 20% ethanol with gasoline by 2023 which would save Rs. 30,000 crores of foreign exchange per year for India.

With the inclusion of surplus grains as a feedstock for ethanol production in 2020 and government supporting policies like Sustainable Alternative Towards Affordable Transportation (SATAT), the future of ethanol blending programs has been fortified. Thus, the goal for the E20 blending target has advanced to 2023 from 2030. Several other benefits include increased energy security, decreased carbon emissions, improved air quality, self-sufficiency, the use of damaged food grains, increased farmer incomes, job creation, and increased investment opportunities.

BIOENERGY AND BIOECONOMY

Bioeconomy in simple terms is a knowledge economy that uses renewable natural resources to produce food, energy, products, and services. Bioeconomy utilizes biological resources, available in abundance to generate wealth from waste. Using bio-based products facilitates carbon recycling with no or minimal addition of new carbon in the atmosphere thereby curbing and decarbonizing the emissions.

When considered in the context of the bioeconomy as a whole, bioenergy is a significant sector with a global footprint. Bio-residues generated by other bioeconomy sectors are frequently used as raw material in bioenergy conversion processes. Socio-economic inequalities in less developed areas



The emergence of a new carbohydrate economy in the 21st century is being fuelled by a convergence of economic, technological, political, and resource developments. Renewable liquid biofuels produced by exploiting polysaccharides will eventually displace significant amounts of fossil fuels.

can be reduced by the development of bioenergy projects in rural areas close to biomass feedstock.

Solid biofuels, which include firewood, processed firewood like charcoal, forest and agricultural residues, and dung, are one of the world's most diverse energy sources. Liquid biofuels are the most convenient and cost-effective means of transporting energy to distant areas. Ethanol and methanol being the simplest of alcohols have begun to emerge under the oil's dominance as sustainable biofuels. Their potential to be renewable and to recycle waste thereby serving environmental and socioeconomic benefits has brought the duo to the forefront in bioenergy.

Bioeconomy resonates perfectly well with the bigger objectives of sustainable growth and environmental conservation. It encompasses as many as 11 of the 17 Sustainable Development Goals (SDGs) released by UNFCCC. What is more, is that it also facilitates the fulfilment of Nationally Determined Contributions (NDCs) as committed in the landmark COP 26 climate change summit held in Glasgow. As the campaign for Race to Zero catches steam post COP 26 Glasgow summit, harnessing the bioeconomy has emerged as a promising solution to achieve carbon neutrality.

CARBOHYDRATES: A SUSTAINABLE ALTERNATIVE

Carbohydrate-based bio-inspired sustainable materials are gaining interest in the chemical industry as a strategy for producing new materials with unique properties from waste resources. Exploiting natural polysaccharides such as cellulose, hemicellulose, and starch is crucial to reducing reliance on fossil fuels and advancing the circular econ-

omy. The emergence of a new carbohydrate economy in the twenty-first century is being fuelled by a convergence of economic, technological, political, and resource developments. Renewable liquid biofuels produced by exploiting these polysaccharides will eventually displace significant amounts of fossil fuels in the coming years.

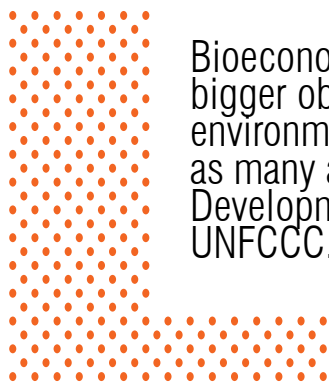
DECARBONIZING THE TRANSPORTATION SECTOR

The transportation sector is the second-largest emitter of GHGs after industry, its decarbonization is not a matter of choice but an imperative as climate action.

The Bio-Mobility* platform offers innovative technology solutions to produce low-carbon transportation biofuels across all modes of transportation. Biofuels are produced from biomass. Biomass is one of the abundant and renewable energy feedstocks available in India. Biofuels are a sustainable and adaptable alternative as they can be easily incorporated into today's energy mix. Little or no engine modifications are required in the already available engines and hence, biofuels usage is gaining traction today.

India's stride in the bioeconomy in recent times has caught the imagination of the world and undoubtedly the government's progressive strategic interventions have played a big role in it.

One of the unique aspects of India's growth story in biofuels is its strong capability in developing and deploying home-grown innovative technology solutions. These not only continuously improve the techno-commercial viability of established solutions deployed in greenfield and/or brownfield projects but also the introduction of innovative solutions that act as a game-changer.



Bioeconomy resonates perfectly well with the bigger objectives of sustainable growth and environmental conservation. It encompasses as many as 11 of the 17 Sustainable Development Goals (SDGs) released by UNFCCC.

there is an urgent need for it like never in the past.

Bioenergy has a bright future ahead of it, as only a small fraction of its potential has been realized thus far. Bioenergy is a strong catalyst for the development of local and regional circular bioeconomy.

As per the popular proverb, 'We do not inherit the Earth from our ancestors, we borrow it from our children,' which states that we need to act if we want to pass on a world with a healthy environment to future generations.

ENERGY TRANSITION: AN IMPERATIVE

The threat of climate change is the biggest danger mankind is facing and its ill effects in the form of climate disasters are taking a toll on the economy and lives. The latest Intergovernmental Panel on Climate Change (IPCC) report released on 4th April, 2022 has renewed warning for immediate climate action to avert the crisis.

Transitioning to cleaner, greener energy sources from existing fossil-based energy isn't a matter of choice anymore and in fact,

*Bio-Mobility is a registered trademark for a platform of technologies for production of low-carbon transportation fuels, developed by Praj Industries- A leading industrial biotechnology company. It encompasses established solutions such as 1st generation bioethanol, biodiesel and fast emerging advanced biofuel solutions such as 2nd generation bioethanol, sustainable aviation fuel (SAF), compressed biogas (CBG), bio-hydrogen, marine biofuels, etc. ■

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CHANGING MATRIX OF INDIAN GAS SECTOR

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 ramp up in the production from KG Basin blocks of RIL-BP and ONGC



PRASHANT VASISHT
VICE PRESIDENT & CO-GROUP HEAD –
CORPORATE RATINGS
ICRA LIMITED

The domestic consumption of gas grew at a CAGR of 3.7% from 130.7 mmscmd in FY2016 to 154.1 mmscmd in FY2020 though there was a slight dip in consumption in FY2021, owing to the impact of the Covid-19 pandemic. However, domestic production has not kept pace with the growing consumption leading to increasing dependence on imported LNG, the share of which in the total gas consumption rose from 41% in FY2016 to 52% in FY2020.

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 ramp up in the production from KG Basin blocks of RIL-BP and ONGC.

The domestic gas consumption is expected to grow by 9% in FY2023 to 181 mmscmd and 4% in FY2024 to 188.4 mmscmd. Though the share of LNG in the total gas consumption would reduce over the medium term, nevertheless the dependence remains high.

To incentivise higher production of domestic gas, the Government of India has provided marketing and pricing freedom for coal bed methane producers. The government has also provided marketing and pricing freedom (subject to a price ceiling) to players operating in deep water, ultra-deep water, and high pressure-high temperature areas, that were yet to commence commercial production as on January 1, 2016. Accordingly, most new gas fields being brought to production have marketing and pricing freedom. Recent price discoveries for RIL and Vedanta's gas have been in the range of US \$19-24/mmbtu.

Historically, gas has traded at a discount to crude on an energy equivalent basis. However, since the middle of 2021, gas prices decoupled from that correlation and have traded at massive premiums to crude. This is on account of the shift to gas by several large economies to replace dirtier fuels like coal or nuclear power over the last several years. The catalysts for the sharp run-up in prices were low inventories in Europe and Asia, odd weather patterns requiring higher heating/cooling, weak generation by renewable sources such as wind, weak hydroelectric power generation due to droughts and planned and unplanned outages at several plants.

Nevertheless, the larger issue is that there could be a structural shortage of LNG capacity, given the net zero commitments that different governments are making and under investments by global upstream companies due to environmental, social and governance (ESG) goals. Accordingly, gas is expected to continue to trade at a premium to crude going forward and there are limited prospects for softening of the market in CY2022.

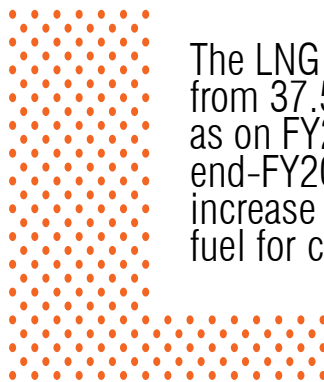
Domestic gas prices have been notified at US \$6.1/mmbtu for H1 FY2023 and have more than doubled from the gas price of US \$2.9/mmbtu for H2 FY2022. The increase follows the run-up in gas prices at various international hubs. This price rise is likely to increase the government of India's fertiliser subsidy by Rs. 6,800 - 7,500 crore for FY2023. For US \$1/mmbtu increase in domestic gas prices, assuming that the CGD (City Gas Distribution) players maintain their current absolute contribution margins in Rs./

kg and Rs/scm terms, the CGD players could increase CNG price and PNG (domestic) prices by Rs. 4.5-4.7/kg and Rs. 2.5-2.7/scm respectively in Delhi. However, the price revision should have limited impact on the sector's competitiveness, since the benefit for end consumers from conversion economics perspective remains intact due to increase in prices of alternative fuels. Given the continued high prices at international hubs, prices of domestic gas are expected to be revised upwards in the subsequent revision as well.

The Government of India has pushed for setting up of trunk pipelines connecting the East and North-East through budgetary support in the form of viability gap funding for Urja Ganga and Indradhanush pipelines. Apart from this, the Petroleum and Natural Gas Regulatory Board (PNGRB) conducted bidding rounds from between 9 - 11th April 2018 to September 2021, wherein CGD licences were given to enable increase in coverage from 20% of the population of the country till round 8 to 95% by round 11. Accordingly, large parts of the country will for the first time get an option to use gas. Millions of new consumers are expected to be added over the next few years, using natural gas as auto and cooking fuel, thereby boosting demand for gas.

There are several LNG terminals that are being set up including at Jaigarh, Charra, Dhamra etc. along with recently commissioned terminals at Mundra and Ennore, which would increase competition in the market and allow greater choice to consumers. The LNG terminal capacity would increase from 37.5 million metric tonnes per annum as on FY2022 end to 66.5 MMTPA as on end-FY2025. New terminals would also increase options for using LNG directly as a fuel for commercial vehicles. The terminals being set up on the East Coast would also improve economics for using gas for consumers on the East as historically terminals have been concentrated on the West.

The high prices of spot and term LNG



The LNG terminal capacity would increase from 37.5 million metric tonnes per annum as on FY2022 end to 66.5 MMTPA as on end-FY2025. New terminals would also increase options for using LNG directly as a fuel for commercial vehicles

have led to a decline in the capacity utilisations of all LNG terminals. New LNG terminals may take longer to scale up volumes and accordingly their returns could be impacted. Marketing margins for gas marketers would be compressed or spot and short-term gas sales but are expected to widen for Henry Hub-linked gas. The volumes for gas pipeline operators would be dampened as the industry switches to liquid fuel wherever possible, owing to higher prices of gas vis-a-vis liquid fuels on an energy equivalent basis.

As domestic gas prices are expected to rise substantially in the next revision, the CGD entities may have to pass on the price increases in a graded manner, leading to some lag in full pass-through of costs and accordingly put pressure on margins. Relatively higher spot LNG & term LNG prices will have a negative impact on CGD companies as margins on industrial and commercial sales are likely to be impacted. High gas prices would also deter conversions.

The Government of India is pushing for use of LNG as a fuel for commercial vehicles following the example of countries like China, where lakhs of LNG driven vehicles are in use. LNG is preferred over HSD for commercial vehicles owing to better economics and lower total cost of ownership. The use of LNG is preferred for large and medium commercial vehicles vis-à-vis CNG primarily because of two factors: Much larger re-fuelling distance and higher injection pressure allowed by LNG, which is better for engine life.

Currently, CNG enjoys a huge advantage over alternate fuels like petrol and diesel owing to the use of low-priced domestic gas for the same and lower taxation by the centre and the state governments. However, as CNG gains popularity, the centre and the state governments may see the fuel as a lucrative source of revenue and increase taxes, denting its competitiveness.

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, lack of appropriate pipeline tariff regime, absence of uniform taxation with various states having different VAT rates, separation of pipeline ownership and marketing, slow pace of approvals etc. Despite recommendations by the PNGRB, the states are yet to provide a regulatory push such as lower road tax on CNG/LNG vehicles, single window clearance for approvals, etc.

The project execution activities in the sector have also been adversely impacted by the delays and disruptions caused by the COVID-19 pandemic, shortage of skilled manpower, overbooked contractors and suppliers and activism by farmers against laying of gas pipelines. Additionally, competition from electric vehicles, especially for the state transport bus segment and hydrogen, would also increase going forward. ■



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The "Green Hydrogen" is expected to revolutionise energy and feedstock sources for several applications including oil refining processes, production of fertilizers, Ammonia and Methanol as fuel, steel plants, transportation sector, injections in natural gas pipelines grid, synthetic fuels, buildings, etc.



P. D. SAMUDRA
FORMER CEO & MANAGING DIRECTOR
THYSSENKRUPP INDUSTRIAL
SOLUTIONS (INDIA) PVT. LIMITED

The growth of renewables and renewable powered Hydrogen production has created global momentum for "Green Hydrogen" as a clean fuel, as well as energy storage option. More than 95 percent of world Hydrogen (which is approximately 90 MMTPA) is produced from fossil fuels via Steam Methane Reforming Process (SMR) or via Coal Gasification Route (CGR). Such production of the Grey Hydrogen leads to emission of CO₂ in the range of 10 Kgs/Kg of Hydrogen in the SMR process or 5 Kgs/Kg in the Coal Gasification Route, which has been the cause of great concern from an environmental point of view.

Hydrogen has been around for a long time but most of the Hydrogen produced is so called Grey Hydrogen, i.e. Hydrogen produced from fossil fuels like natural gas or coal. Green Hydrogen production uses a carbon free source of energy in the form of electricity such as solar or wind, for the electrolysis of water for production of Hydrogen, resulting in minimal net emissions.

There is increased consensus around the world that concerted steps need to be taken to reduce global warming specially caused due to use of fossil fuels, to the levels less than 2 degree celsius and if possible, to cap it at 1.5 degree celsius, higher than pre-industrial levels.

During the United Nation Climate Change Conference (COP 26) at Glasgow, more than 30 countries and the European Union pledged their nationally determined contribution in order to ensure energy transition in

phases and thereby reduce emissions. Many large economies including India have committed to the "Net Zero" targets, within the next 3 to 5 decades.

The "Green Hydrogen" is expected to revolutionise the energy and feedstock sources for several applications including oil refining processes, production of fertilizers, Ammonia and Methanol as fuel, steel plants, transportation sector, injections in natural gas pipelines grid, synthetic fuels, buildings, etc.

The existing worldwide production of over 90 MMTPA is expected to increase by more than double to around 200 MMTPA by 2030, mainly using renewable energy sources such as solar and wind power for the electrolysis process for production of Green Hydrogen.

Presently, India is one of the large consumers of Hydrogen with approximately 7 percent of world's capacity i.e. approximately 7 MMTPA is produced mainly from fossil fuels like natural gas. On 17th February, 2022, the Government of India published Green Hydrogen Policy to boost up domestic production of Green Hydrogen to 5 MMTPA by 2030; thus paving a way to make India march towards net zero and creating potential for exports.

Economical production of "Green Hydrogen" in comparison to conventional "Grey Hydrogen" is presently the challenge mainly due to high capital costs of the electrolyzers which contain components made from exotic materials.

Leading Indian companies are putting in large efforts to improve upon the local supply



The Government of India published Green Hydrogen Policy to boost up domestic production of Green Hydrogen to 5 MMTPA by 2030; thus paving a way to make India march towards net zero and creating potential for exports.

chain to reduce Capex. The costs of energy inputs like solar power are expected to reduce further as huge capacities are being set up. In the near future, the target is to reach the price of Green Hydrogen to the levels of US \$2 - US \$2.5 per Kg.

A large number of Indian public and private sector companies have started preparing for such a change over to Green Hydrogen and are in process of making tie ups with BOO (Build, Own, and Operate) operators and technology suppliers.

STATUS OF RENEWABLE ENERGY IN INDIA

Renewable energy being the main source for production of Green Hydrogen via electrolysis of water, it is very important to understand the steps already taken by India in terms of availability of renewable energy.

As per Government's National Electricity Plans, the installed capacity for electric power generation of 393 GW as of 31st December, 2021 is expected to undergo quantum jump to the level of 832 GW by end of the year 2030. Remarkably, the share of renewable sources based electric power (mainly solar and wind) will increase from present 18 percent to 44 percent, thus providing a huge capacity of renewables based energy to the tune of 400 GW, mainly coming from solar and wind power. Therefore, with such continued increase in renewable energy, India will be certainly poised within a decade not only to cater to internal demands of Green Hydrogen but also venture to export in a big way.

EXPORT POSSIBILITIES AND OPTIONS FOR TRANSPORT

Several small and medium size countries would be interested in importing Green Hydrogen from India to meet their energy tran-

minus 33 degree Celsius) or Methanol (at ambient temperatures).

By the way, presently worldwide approximately 20 MMTPA of liquified Ammonia is transported by using specially designed cryogenic sea vessels with refrigeration facilities. India itself imports approximately 3 MMTPA of liquified Ammonia for downstream production of Phosphatic fertilisers. India has installed over 40 large size liquid Ammonia Cryogenic storage tanks at many coastal locations to receive, store, and transfer liquid Ammonia.

It is a very common practice world over. The Green Ammonia thus despatched to the other country can be further chemically cracked to get Green Hydrogen back and use the same as fuel; or the Green ammonia can



sition plans. For exports, the ideal way would be to transport green Hydrogen using the sea route. The modes of transporting the energy as Green Hydrogen would be ideally in the form of liquid Hydrogen; or by converting it to Ammonia and transporting as liquid Ammonia or conversion to Methanol and transport it in liquid form.

The first ship in the world designed to carry 8,000 MT of liquid Hydrogen has been manufactured in Japan. It made its maiden trip between Japan and Australia carrying back cargo of liquid Hydrogen, just a few months ago.

The transportation costs of liquified Hydrogen (at minus 253 degree Celsius) is rather expensive compared to Ammonia (at

be directly used as fuel.

Methanol has been regularly transported via ships in huge quantities and as such can be used directly as fuel. There is certainly a very good potential for India to explore and plan export of green Hydrogen in various forms as described above. The technical feasibility has been established. Government may consider facilitating coastal based Export Zones as "Green Hydrogen Parks".

There are new exciting environment friendly opportunities emerging for India to become a Green Hydrogen hub which could lead to changes in old concepts of producing energy for our own usage with a good potential for its export in the near future. ■

Your essentials,
our expertise.



CONTRIBUTING TO SUPPORT THE GREEN ENERGY TRANSITION

India needs to adopt a circular economy path on a more proactive basis as it is the third highest emitter of greenhouse gases and accounts for 9.2% of total world emissions



**SATHIAMOORTHY
GOPALSAMY**
MANAGING DIRECTOR
TECNIMONT PRIVATE LIMITED
(MAIRE TECNIMONT GROUP)

Over the past decade there has been a greater emphasis on building a more sustainable economy from both developed as well developing nations by steadily moving away from the usage of fossil fuels. Transitioning from a linear to a circular economy is perhaps the only viable solution that can ensure achieving the UN sustainability goals. It underscores the need to shift towards the use of renewable resources and aims at eliminating waste through the superior design of materials, products, systems, and business models. It's even more important for a country like India to adopt a circular economy path on a more proactive basis, as it is the third highest emitter of greenhouse gases and accounts for

9.2% of total world emissions.

There has been a greater amount of emphasis by both the Government of India and domestic companies to help the country in its mission towards a clean energy transition. To reduce the carbon footprint, an increasing number of companies across the globe are now exploring the green hydrogen option, which has been labelled as one of the cleanest forms of energy in the world.

We at Maire Tecnimont S.p.A., an Italian based industrial group which leads the global natural resource processing industry (downstream oil & gas plant engineering, with technological and executive expertise), through our Group subsidiary NextChem operating in the field of green chemistry and technologies in support of the energy transition, have found technologies' solutions able to make the energy transition possible. NextChem is well-placed to play both the roles of partner and coordinator in several international research projects.

NextChem's green acceleration roadmap is focused on three areas of activity: Greening the Brown – technologies for the reduction of pollutant and GHG emissions released from existing plants; Circular Economy – mechanical recycling and waste-to-chemical technologies for the chemical conversion of plastic waste and other discarded materials.

Waste that can be recovered via chemical recycling includes, for example, mixed plastic packaging from urban waste collection, refuse derived fuels and the so called "dry-fraction" of waste derived from the mechanical-biological treatment of mixed waste. Through a chemical conversion process where hydrogen and carbon contained

in the waste are recovered, a synthesis gas is obtained that can be used to produce compounds like ammonia, methanol, ethanol, and hydrogen.

Chemical recycling which is a thermal process but differs from incineration because the chemical conversion happens via oxygen, and not by reaching the combustion point. The process is known as "partial oxidation" and uses pure oxygen as an oxidiser. The conversion phase is followed by a subsequent purification phase which stops pollutants from being emitted into the atmosphere. The gas obtained can be considered "circular" as it derives from post-consumer materials. The residues from the process are inert and can be reused in industrial applications such as brick making. Finally, Green-Green is the third area of activity consisting of technologies which use biomass or biological raw materials to produce intermediates, biofuels and bio-plastics.

In this context, NextChem has developed the Green Circular District Model. The Green Circular District brings benefits to the environment, the economy, and society through decarbonization, recycling and recovery, production, employment, and local economic development.

This model integrates proprietary and licensed technology already proven, available and ready to be industrially implemented, and it allows to realize industrial projects which are environmentally, socially, and economically sustainable.

The Green Circular District model is mainly aimed at green recovery of industrial brownfield sites, above all in petrochemical and steel sectors. The aim of the model is to produce high quality recycled polymers,



To reduce the carbon footprint, an increasing number of companies across the globe are now exploring the green hydrogen option, which has been labelled as one of the cleanest forms of energy in the world.

circular chemicals, and low carbon fuels, replacing fossil sources in industrial processes (as natural gas or hydrogen from methane) with feedstocks (renewable or circular) with a significantly lower carbon footprint, which allow to reduce CO₂ emissions of industrial sites and to enhance recycling while improving circular economy. Finally, the production of chemicals which are the building blocks for the industry using already existing sites, as well as waste as feedstock, allows to reduce virgin raw materials supply.

The Green Circular District can become the driving force for the shift from a linear economy (manufacture-consume-dispose) to a circular one (manufacture-consume-recycle-remanufacture), using materials and substances derived from recycling which can be used again in the production of goods and the energy and chemical industries improving overall environmental impacts. The model is based on the integration of green chemistry technologies such as MyReplast Upcycling, Chemical recycling and the production of green hydrogen via electrolysis technology.

MyReplast Upcycling is a technology that allows to mechanically recycle several polymers which compose post-consumer plastics, and to obtain high-added-value recycled materials with the same properties as fossil-based plastics. The term Upcycling was coined by a Germa

n mechanical engineer named Reiner Pilz in 1993, who explained the concept as follows, "Recycling, I call it down cycling. They smash bricks, they smash everything. What

we need is upcycling, where old products are given more value, not less".

The Waste-to-Chemical technology developed by NextChem, through its subsidiary MyRechemical, allows plants to produce added-value circular chemical products from waste. The starting point is the high percentages of carbon, and to a lesser extent hydrogen, contained in waste. Technically speaking, the technology combines non-recyclable plastic waste (sorting scraps from plastic packaging waste) with RDF (Refuse Derived Fuel) or dry fraction chemical conversion to obtain a circular gas known as syngas. From syngas it is possible to obtain circular methanol, ethanol, and hydrogen. The latter can subsequently be used to power industrial plants or public transport networks at competitive prices and with a lower carbon footprint.

Hydrogen is a fundamental energy carrier: it can be used as a fuel and as a feedstock in many industrial processes, it is storable and transportable over long distances. Hydrogen will play a key role in the decarbonization process. It can be used in transport, as a raw material in several industrial sectors such as steel or chemical, or as a building block to produce different products, such as fertilizers.

NextChem's portfolio includes different technologies for the production of hydrogen: Electric Blue Hydrogen based on traditional know-how but which involves the use of electricity to feed the endothermic reactions of methane steam reforming. Electric Blue Hydrogen can reduce the amount of CO₂

emitted by 45% compared to the traditional process. The innovation is, beyond the CO₂ capture, the electrification of the process, to which is added the possibility to use energy from renewable sources to provide the heat for the reaction.

Green hydrogen, produced via water electrolysis technology using renewable energy sources is the only zero carbon option. Green hydrogen competes with both fossil fuels and other "shades" of hydrogen, because it is the most sustainable version but its production still poses problems in terms of costs and continuity of the energy supply. For a widespread application of hydrogen, it is important to produce a sufficient volume to meet the demands of industry, using sectoral synergies and providing flexibility to the energy system.

Circular Hydrogen can help to solve the problem of non-recyclable waste, which is currently incinerated or disposed of in landfill. Beyond the environmental benefits, the production costs are competitive compared to traditional hydrogen. Plants producing circular hydrogen could be located in traditional energy-intensive industrial sites, such as refineries, where they can contribute to their decarbonization, or close to waste sorting plants where they would optimize logistical processes while reducing carbon footprint also in the transportation phase.

With NextChem being created under the fold of Maire Tecnimont, our vision is to contribute towards the global drive to support the green energy transition with most of the public and private companies working on Green Hydrogen, Green Chemistry, or Circular Economy initiatives and more.

We acknowledge that India has enormous potential in this field. We have robust daily waste generation due to high population, however, most of the municipal bodies are struggling to dispose of the same. NextChem's integrated solution is equipped to handle and create value added products out of this municipal solid waste, turning the problem of its disposal into an opportunity for growth. ■

HYBRID LNG & AMMONIA INFRASTRUCTURE: KEY TO INDIA'S GREEN ECONOMY

Interest in ammonia will only grow as the world races towards decarbonisation. Backed by advances in emerging technologies, ammonia offers new opportunity to help accelerate the world's transition to a carbon-free society



RAJIV MENON
COUNTRY MANAGER & MANAGING DIRECTOR, INDIA
BLACK & VEATCH

As the power industry advances its efforts to decarbonise amid rising global demand for carbon-free energy sources, ammonia's role in the green energy economy continues to evolve.

India is one country that has identified hydrogen and ammonia as alternative fuels to replace fossil fuels. Producing green hydrogen and green ammonia by using renewable energy will help the country achieve environmentally sustainable energy security.

Positioning ammonia as a key player in India's zero-carbon energy landscape will require ammonia-ready storage and transportation infrastructure.

A gas at room temperature, ammonia is

incredibly stable and can be easily liquified for storage and shipment around the globe in the same fashion as liquefied natural gas (LNG). It can be used across energy-intensive industries in several ways to help lower global carbon footprint:

- Made up of one nitrogen and three hydrogen atoms, ammonia can also be decomposed or "cracked" to produce hydrogen along with nitrogen, a non-greenhouse gas.
- Ammonia produced from renewable energy (or green ammonia) can serve as an energy storage medium, able to store electricity during high periods of production and transport that energy to parts of the globe with limited access to renewable energy sources.
- Ammonia can be burnt directly as a carbon emissions-free energy source, thanks to the development of new technologies that produce ammonia from renewable energy or reforming of methane with captured CO₂.

Ammonia also offers new possibilities to facilitate the use of hydrogen, which is emerging as a zero-carbon breakthrough that promises to transform the power generation market.

AMMONIA A KEY PLAYER IN THE HYDROGEN REVOLUTION

Backed by new advances in technology, hydrogen is expected to rise in prominence over the next decade.

According to Black & Veatch's 2022 Asia

Electric Report, when looking out more than 10 years from now, 73 percent of respondents believe that hydrogen will help meet carbon emission goals more than any other technology (Figure 1) while 46 percent think it will take off as a clean and affordable alternative to gas generation.

However, fully integrating hydrogen into the energy mix will be a complicated endeavor, as the low volumetric energy density of hydrogen – and its extremely low boiling point – have made it challenging, both technically and economically, to develop infrastructure for the large-scale storage and transportation of hydrogen.

Ammonia, on the other hand, offers several desirable characteristics as a hydrogen carrier:

First, ammonia can be liquefied under mild conditions. The boiling point of ammonia at atmospheric pressure is -33°C (-28°F), similar to propane. Ammonia has been produced for industrial and agricultural purposes, and proven methods of storing and transporting liquefied ammonia at scale are available.

Second, ammonia is more energy dense than hydrogen. The volumetric hydrogen density of liquid ammonia is about 45-percent higher than that of liquid hydrogen, which means that more hydrogen can be stored in liquid ammonia compared to liquid hydrogen with the same volume.

One pathway to accelerating India's decarbonisation efforts will be to convert India's extensive LNG infrastructure – its existing LNG receiving terminals and stor-

Which of the following methods do you expect will be included specifically to help meet your carbon/emissions reduction and/or clean energy goals? (Select all that apply)

Source: Black & Veatch

	Beyond 10 years
Hydrogen	73.0%
Retiring traditional fossil-fueled generation sites	51.4%
Battery energy storage	43.2%
Combined cycle	27.0%
Wind	27.0%
Natural gas	24.3%
Making traditional fossil-fueled generation more efficient	18.9%
Power purchase agreements (PPAs)	18.9%
Solar	18.9%

age facilities – to facilitate the safe, efficient transport of ammonia.

LNG INFRASTRUCTURE OFFERS OPPORTUNITY

LNG has been used as an energy source for over 50 years, due to its reputation as the cleanest fossil fuel as well as its ability to balance out the power generation mix. This has led to growing investment in LNG storage and transportation infrastructure.

India, for instance, has set a target to raise the share of natural gas in its energy mix to 15 percent by 2030 from 6.7 percent in 2021. To achieve the target, initiatives it plans to take include the expansion of its national gas grid to about 35,000 kilometres (km) from the current 20,000 km as well as its LNG terminal capacity.

With this extensive global infrastructure in place, LNG receiving terminals and storage facilities can be modified to facilitate the safe and efficient transport of ammonia in the global energy trade.

On that note, India’s LNG and gas power plant owners and developers would be well-served to begin preparing their LNG receiving terminals to become ammonia-ready, and to receive liquefied ammonia when needed as

renewable energy production continues to increase.

CONCLUSION

Interest in ammonia will only grow as the world races towards decarbonisation. Backed by advances in emerging technologies, ammonia offers new opportunity to help accelerate the world’s transition to a carbon-free society.

Proven methods of storing and transporting ammonia already exist, and the supply chain of ammonia for CO2-free energy is developing.

For LNG terminals to play a critical role in the safe and efficient transport of liquid ammonia, strong industry partnerships will be critical. Black & Veatch, with its 80-year history working with hydrogen and ammonia production in the fertilizer industry, has been supporting the industry with commercial ammonia and LNG infrastructure projects. Expertise in syngas and acid gas processing, sulfur recovery, material handling, power generation, power delivery and water treatment allows the company to provide its clients with complete feasibility assessments to engineering, procurement and construction (EPC) project services regardless of the project scope.

Sidebar: Leveraging business intelligence to enhance operations, maintenance and decarbonisation pathways

Fast evolving technologies, fluctuating fuel costs and a shrinking pool of experienced operators and subject matter experts to manage systems and processes effectively are key challenges faced by India’s process industry, including the chemicals sector.

Industry research suggest that billions of dollars have been incurred by process plants due to unplanned downtime of critical equipment and other forced upsets. Fatalities have also been reported due to operational malfunctions, equipment failure and/ or unsafe conditions leading to loss of human lives, in addition to costly litigations.

Integrating Operational Technology (OT) and Information Technology (IT) is one approach to improve the reliability and efficiency, and resilience of India’s process industry. Merging data analytics with engineering expertise can help to deliver timely and actionable insights that optimise the full potential of the industry’s assets and facilities, and help the industry transition effectively to lower carbon operations.

Integrated communications and analytics tools, like Black & Veatch’s Asset360, enable these opportunities for prioritised improvement and to identify potential critical system failures in a timely manner.

ASSET360® synergises data analytics, people and processes to facilitate round the clock cloud-based, secure remote monitoring of industrial assets capable of delivering timely and actionable operational insights.

ASSET360®’s Asset Performance Management program can help India’s process industry, including the fertilizer manufacturing sector, draw on sensor data to detect emerging risks, minimise unplanned downtime, enhance efficiency, improve performance and safety, and improve planning effectiveness. ■



Digitalization



Achieving Growth
and Innovation



DIGITAL DISRUPTION: THE ULTIMATE TRANSFORMATION MANTRA

Digitalization is having a significant impact on the chemicals and petrochemicals industry with the potential to completely overhaul value chains, lead to higher productivity and spur innovation, resulting in the creation of new channels to market

From novel process technologies to sustainable plastics, digitalization opens up unending possibilities for the chemical industry

Given the fact that there is a growing buzz about digitalization across various industries, the excitement about its potential in chemicals too is considerably remarkable. With COVID-19 pandemic accelerating the adoption of digital technologies, going digital is not merely a survival tactic to navigate through immense challenges but also as an important ingredient for the industry's future growth. In fact, the digital transformation in chemicals presents a largely unexplored new potential to increase efficiencies and help companies design novel products and processes.

Experts are confident that digitalization will have a significant impact on many areas of the chemical industry, with the potential to change value chains, lead to higher productivity and more innovation, and create new channels to market. Chemical companies can use advanced analytics to extract management-relevant information from the large amounts of unstructured data that they generate. This information can then be used to improve how plants are run and to make better-informed and speedier decisions across the full range of a chemical company's business processes.

The key issue for chemical company leaders is to understand more clearly where the impact of digital will hit the industry and what it will imply for their companies. The

first is using digital-enabled approaches to improve companies' business processes, which we call functional excellence. Second is the potential for digital to affect demand patterns in end markets, with implications for the chemical industry's value chains. The third is where digital developments lead to changes in the business models through which chemical companies capture and create value for customers.

Disruptions in automotive, construction, agriculture, and other end-use industries are creating opportunities and challenges for the chemicals industry. For example, while relatively novel technologies like additive manufacturing, currently being demonstrated but not fully commercialized in many applications from engineering parts to house building, might create a need for new materials, at the same time, they may reduce the consumption of traditional chemicals and materials. Most chemical enterprises are already reevaluating future growth strategies, including looking at digital value-added services to supplement existing product offerings.

CHALLENGES GALORE

The chemical industry has become increasingly complex as the variety of products and processes expand and competitive intensity has grown. 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.

There is a lot of data hanging around and how an organization makes sense out of it, is very important. The necessity of aligning different departments and business functions by using Internet of Things (IoT) based platforms must not be only about capturing process data but improving the quality of analytics.

Another challenge that needs to be addressed is bringing in more data scientists on board to 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. Apart from this stated role of digitalization, automation is very much required. A few times there are negative connotations around the term such as loss of jobs but in reality we move the resources to skilled jobs while basic jobs get automated. It has supported our growth journey in better ways.

Digitalization in the chemical industry will require a clear picture of readiness, particularly the steps required to establish an accommodating culture that promotes flexibility and learning. As with any major initiative, digital transformation in chemicals is likely to be challenging.

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 that include user experience, talent enablement, asset reliability and performance, material system innovation, and ecosystems.

OPPORTUNITIES

Digitalization is having a significant im-

Manufacturing Excellence and Digital Transformation Partners





pact on the chemicals and petrochemicals industry with the potential to completely overhaul value chains, lead to higher productivity and spur innovation, resulting in the creation of new channels to market.

With the advent of COVID-19, its importance has increased multifold. Since many of their product offerings came under essential supplies during the pandemic, companies had to operate round the clock to ensure the safety of people. Using IoT deployments, they were able to run their operations and maintain much needed business continuity. They were also able to assess equipment reliability based on data points, predicting whether there will be failure of equipment or not. Compared to earlier when it used to take days to collect the data individually from different units, they are now able to look after the various facilities and also maintain a tab on energy consumption.

Going forward, the next stage of using digital to optimize performance should go well beyond the plant and readily integrate with physical assets. For example, new digital technologies like blockchain and predictive analytics can be integrated with existing IoT infrastructure to enable track-and-trace capabilities. New process technologies like crude-oil-to-chemicals have already been deployed in some refinery-scale plants. As an example, Indian Oil Corporation has launched a large-scale digital transformation programme and a Digital Centre of Excellence to bring value, deploy solutions, and enable change. About 100+ initiatives

are being implemented to rope in 10,000+ employees, also covering customers, supply chain. With advanced analytics, it unlocked the power of Artificial Intelligence (AI) and Machine Learning (ML) to develop intricate simulations. For historical and real time data, it identified and prioritized the problems and solved them with cutting edge analytics.

Predictive analytics is increasingly seen as the panacea to address chemical industries' pain points. This AI-powered technique uses historical and real-time data to predict critical future outcomes, reduce risks, improve operations, cut costs and increase revenue. Chemical manufacturers can increase the operating time of critical assets by using predictive analytics to find ways to anticipate their failure. Many private players in India are devising the strategies to customize their digitalization implementation so as to suit their long term requirements.

Digitalization helps companies in

- Better decision making
- Manhours reduction
- Prediction of critical future outcomes
- Reduction in risks & improve operations
- Cutting costs and increase in revenue
- Come up with better processes
- Improving production, yield, safety & sustainability

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. ■

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DIGITAL JOURNEY: START SMALL, FAIL EARLY, AND REVISIT

The barrier to digital journey is not technology but it is the culture. Change Management is a must with strategy & vision along with a new operating model. People, Process & Technology (PPT) is taken as a three legged table to march on this digital journey



VIVEK GUPTA
JOINT VICE PRESIDENT & HEAD
INSTRUMENTATION & DIGITALIZATION
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Digitalization or digital transformation is top of the agenda for the majority of chemical companies globally and in India. Digital initiatives must be led with a commitment from the top, with a clear communication at all levels to ensure its success.

Digitalization is making a lot of noise but when it comes to implementation a lot of challenges come up and then a clear RoI (Return on Investment) is needed for investment. Digital chasm is required for its success.

One needs to correctly identify the problem which needs to be addressed using technologies. When it is done, involvement of all stakeholders also starts, otherwise who owns it, becomes questionable. Benefits expected then pave the path for selection of right technology.

In process industries where legacy of many years exist, rewards and recognition frameworks tend to reward the existing behaviours and individuals and groups will resist change if they do not believe the digital vision. It is therefore said that the barrier to digital journey is not technology but it is the culture. Change Management is a must with strategy & vision along with a new operating model. People, Process & Technology (PPT) is taken as a three legged table to march on this digital journey.

PEOPLE

Assets get depreciated over a time period but employees get appreciated with their knowledge and experience gained. That is where the digital journey helps. Experienced staff get retired and newer staff have to be trained on to the system. Artificial Intelli-

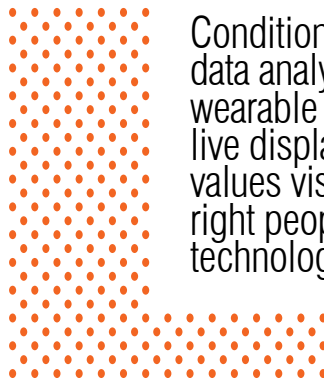
gence (AI), Machine Learning (ML) etc. play a vital role to make the system intelligent enough and vacate the time for operators to think strategically and get relieved of daily manual monotonous paperwork. Manufacturers have to do a lot for the engagement of their existing workforce and expand the careers of the people they already have. Capability building programs like knowledge upgrade with re-skilling & up-skilling, job satisfaction to build excitement in the current force and also the next generation who are computer and mobile savvy will need to be addressed. People should feel that technology has enabled them and it not an extra burden on them, this is very important. The change team consisting of cross functional team (CFT) members will then bring about the desired changes. Visible benefits increase the confidence level of the people to take more interest and participation.

PROCESS

It plays the role of change agent. One truth clearly visible is that just developing a new technology and putting them in the existing environment will not yield desired results. To reach its full potential, processes need to be redefined, re-written and re-implemented in a simplified manner. Then a revised criterion of performance tracking and management also needs to be looked into. It will help in driving this initiative as a continuous improvement system which later becomes part of the company's culture. This journey needs seed funding. Change Teams are expected to deliver the results too early and their failure is often seen as unsuccessful while in digital

journey start small, fail early, and revisit for right technology is the mantra. Moving too fast makes it difficult for many companies and they fail at the pilot stage itself. Ability to shift financial and human capital to digitalization is crucial.

Silos need to be broken and all functions need to take part. IT-OT convergence is also very important. Processes need to be revisited from time to time for making it relevant to the times. The whole process has to be led by the Chief Digital Officer (CDO) who has to be supported by plant heads for success



Condition monitoring, predictive maintenance, data analytics, big data, digital twins, drones, wearable gadgets, Energy Management System, live display of KPIs both in terms of process values vis-a-vis cost with right Information to the right people at right time is what digitalization technologies should deliver.



in this journey and bring about the desired results. Top driven process with clear vision is therefore required for its success.

TECHNOLOGY

This T is an important leg of the three legged table of PPT as it drives the whole transformation journey. Reduction in energy and increase in throughput with secured system architecture is required from any digital technology under consideration. Selection of the right technology is important as the whole journey relies on this. Mostly, the legacy DCS have no process historian. In order to achieve gains with the use of technology, it is necessary as DCS data need to be taken out either to the cloud/on premises server for

further analysis. Hardware cost of such installation becomes a bottleneck to start with. It has to be accompanied with some kind of AI/ML solution which justifies its investment. One vendor capable of delivering all is also required as process knowledge along with technology is essential. Embracing technology and digitization efforts at all levels of the company will bring new life to the existing equipment. Old equipment does not have all the measurements required for its monitoring. As equipment becomes older, close monitoring of vital parameters is very much required and so are the assets.

Technology should suit the equipment and existing plant processes and not the other way. Condition monitoring, predic-

tive maintenance, data analytics, big data, digital twins, drones, wearable gadgets, Energy Management System (EMS), live display of KPIs both in terms of process values vis-a-vis cost with right Information to the right people at right time is what digitalization technologies should deliver. Overall Equipment Effectiveness (OEE) monitoring thus shall help in optimizing plant operations wherein live monitoring shall enable to take corrective actions well in time. Environment, Health & Safety (EHS) is another area where technology can help a lot for a healthy and safe environment to bring about more productivity.

Advanced Process Control (APC) & Analytics models can work together to give real time results and thus better throughput and lesser energy. Human dependency should become less and technology systems should become autonomous so that decisions can be taken intelligently. There is no single digital solution applicable even for the same kind of industries as it varies from assets and process parameters, digital twin helps in this direction.

No one escapes from this digital journey and each one has to adopt, sooner will be beneficial. It is a continuous journey and more & more technologies will help in making automation smooth and seamless for CDOs. ■

SUSTAINABLE DEVELOPMENT AND DIGITAL TRANSFORMATION

The company develops and tests breakthrough carbon capture solutions, uses digital simulation systems to validate results and economics based on data collected in the demonstration plants



RON BECK
SENIOR DIRECTOR OF
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ASPEN TECHNOLOGY, INC.



ABHINAV CHOWDHARY
COUNTRY MANAGER, INDIA
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in South Asia, and indeed across Asia, is making major commitments to areas such as hydrogen, carbon capture and storage, renewables and microgrids and plastics recycling and reuse.

As the economic recovery gains momentum, many companies are well ramping up their digital transformation efforts. In a survey of 220 companies, conducted by Crystol Energy and AspenTech, digitalization emerged from the pandemic as a top-four priority. 14 per cent of companies moved accelerating digitalization, up their priority list, compared to pre-pandemic. A key reason is because moving towards sustainable development, leads to increased investment in digitalization projects, which further

Major energy and chemical companies have set ambitious sustainability goals. In Europe, BP, Shell, Equinor, Repsol, and Eni have announced ambitious renewable energy and zero carbon targets. In the US, chemical giants Dow and LyondellBasell and other major companies have made strong commitments to develop a circular economy. Leading players such as Sinopec, Saudi Aramco, SABIC, ADNOC, and Reliance have announced the start of major net zero carbon initiatives.

One of the routes to long term sustainable growth, lies in the balancing of energy evolution towards zero carbon sources while meeting the projected growth in resource needs over the next three decades and the imperative to supply more of the global population reliable and affordable electricity. However, the global energy sector is very volatile, with still a significant dependency on fossil fuels and currently spiking oil and gas prices, espe-



Major energy and chemical companies have set ambitious sustainability goals.

cially in Europe but also globally. Despite the remaining uncertainty surrounding duration of the pandemic and speed of economic recovery, industry and government

accelerates change and innovation. The pace of investment is growing and the global transition to modern methods of generating energy has gained momentum.

INCREASED VOLATILITY AS THE NEW NORMAL

With increased market volatility as the new normal, capital-intensive and process companies need to be aware of eight key industry trends that will determine the trajectory forward.

First, companies need to stay focused and on course with digitalization, as the journey is an evolutionary continuum. In response to economic and energy shocks, energy companies have notably accelerated their digitalization programs. The outcome has exceeded expectations in the field, and digitalization is on an accelerated trajectory. It will likely scale significantly in the coming years. This will place them well in a volatile business environment and also to attract young high-quality workers.

Second, technological innovation has skyrocketed. The pandemic has accelerated the pace of innovation focused on value creation for companies. Funds will likely be allocated to support anticipated growth, in conjunction with the post-pandemic economic recovery. In fact, this process is already well-observed in parts of Asia. Funds will also be allocated to achieving sustainable development goals, reorganizing supply chains, as well as improving resiliency. Companies innovating in circular economy and energy evolution are positioned to succeed.

Third, it is necessary to maintain and increase attention to energy efficiency issues. Businesses will focus on increasing the efficiency of bulk chemicals, fertilizers, oil refining, LNG liquefaction, as well as the production, storage, and transportation of petroleum products. All of which helps in reducing operating costs and carbon footprint.

Fourth, companies will need to further reduce carbon emissions. For example, the largest regional energy companies will closely study the experience of early adopters in Europe and the Middle East. This will be done to identify the most promising technologies in capturing and reducing carbon dioxide emissions across all stages of energy production. This includes better digital measurement approaches and predictive modelling to select mitigation strategies.

Fifth, there will be increased innovation in the field of new energy sources and new materials. Despite the economic and technical problems that impede the imme-



The pace of investment is growing, and the global transition to modern methods of generating energy has gained momentum.

diate commercialisation and scaling up of hydrogen value chain, hydrogen energy and transport are gaining momentum in attracting industry interest.

Sixth, the oil refining will shift towards production of chemical intermediates as mobility evolves towards electric vehicles (EVs) and hydrogen fuel cells. It is evident that as the economy grows and the middle class gains momentum, initiatives such as India's Ratnagiri Refinery & Petrochemicals Ltd (RRPCL), potential future megaproject, which combines oil refining and chemical production, following on the heels of several Middle East oils-to-chemicals projects, becomes more urgent to meet growing and changing demands.

Seventh, with the continued evolution from oil to natural gas – especially pertaining to chemical feedstocks and power generation. The demand for electricity continues to grow, and as such, the role of natural gas in meeting the needs in this area increases.

Finally, the industry will largely be moving towards more sustainable chemical production. The desire of society to reduce general and plastic waste is becoming a driving force, for integrated and chemical enterprises to invest in increased innovation in the process.

REDUCING POLLUTION AND INCREASING SAFETY

Digitalization is already playing a key role in many areas of industrial development – such as simulating technological innovation, process intensification, technical and eco-

nomical optimisation, as well as accelerated scaling. For example, the Technology Center Mongstad demonstration plant, which develops and tests breakthrough carbon capture solutions, uses digital simulation systems to validate results and economics based on data collected in the demonstration plants.

The world's leading algae fuel researchers are using digital modelling tools, energy and economic solutions to develop new means of achieving energy balance and increasing the cost-effectiveness of this approach. Researchers developing a new generation of technological processes for the hydrogen economy, fuel cells, in chemicals, use digital modelling solutions, as the basis for innovation.

There are also promising new hybrid model technologies, that are ideally suited to accelerate work in these areas.

For example, Air Products offline digital twin models, continuously tuned to current plant data, to optimize production and safety for a fleet of Hydrogen plants across the US Gulf Coast. The company needed to maximize plant efficiency, better support operations, as well as utilize increasing data with a limited number of expert simulation users.

With Aspen Plus models of their grey and blue hydrogen plants, the ability to monitor, troubleshoot and optimise these plants from one technical centre is achieved. Air Products has improved operational decision-making, leading to more than US \$1 million worth in benefits and cost savings. Engineers can also troubleshoot operational issues more easily. ■

BUSINESS VALUE FROM APPLIED AI SOLUTIONS IN PROCESS MANUFACTURING



DR. PRATAP NAIR
PRESIDENT & CEO,
INGENERO TECHNOLOGIES

The philosophy of development and deployment of AI solution applications for process manufacturing is very different from the early AI applications in retail and social media

Artificial Intelligence (AI) solutions can deliver a plethora of benefits to the process manufacturing industry. Enhanced operational safety, quicker decision-making processes, improved forecasting and planning, greater reliability, higher quality, improved yields and energy efficiency, and better sustainability compliance are just some of the benefits routinely achieved.

However, according to two recent Gartner reports, 85% of AI and Machine learning (ML) projects fail to deliver, and only 53% of projects make it from prototypes to production.

Our experience in successfully deploying applied AI solutions and reviewing failed projects at plant sites, before our involvement, has taught us that the fault is not with the capability of the technology tools being used, but the inadequate synthesis of the Applied AI components. Bringing together the applicable data, a clear definition of the business problem upfront and the appropriate teams to support both the configuration and the deployment of the solutions is needed. Without all of these components present and actively working together, even the best ML algorithms cannot save the project. ML algorithms are often considered to be the end all, of an AI solution. ML is only a part of the AI solution, albeit an important component. Also, ascertaining whether the AI solution being considered, will be able to solve a manufacturing need, that has not been already addressed by traditional methods and if so, can it improve upon the solution and what would this improvement be worthwhile to the manufacturer, are important aspects to review up front. Synthesis of all these components

by a capable, dedicated team experienced with successful implementation is key.

The philosophy of development and deployment of AI solution applications for process manufacturing is very different from the early AI applications in retail and social media. The model that addresses a manufacturing problem is highly dependent on the use case. The modern AI pioneer, AI entrepreneur and former Director of the Stanford AI lab, Andrew Ng, stated in his recent interview with the editor of IEEE Spectrum on Feb 9, 2022:

"In the consumer software Internet, we could train a handful of machine-learning models to serve a billion users. In manufacturing, you might have 10,000 manufacturers building 10,000 custom AI models."

CUSTOMIZING THE AI SOLUTION TO THE MANUFACTURING PROBLEM IS CRITICAL TO CAPTURE VALUE

An important aspect for manufacturing solutions, which is often overlooked, is the relevance of the data being used and its quality. This requires involvement of a domain specialist investing significant time to get it right and not end up with a "garbage in, garbage out" situation. However great the model and algorithms used are, they cannot overcome inappropriate or otherwise inadequate data. Andrew Ng acknowledged this in his comment:

"What I'm finding is that for a lot of problems, it'd be useful to shift our mindset toward not just improving the code but in a more systematic way of improving the data,"

Cassie Kozyrkov, the Chief Decision Scientist at Google and creator of the popular

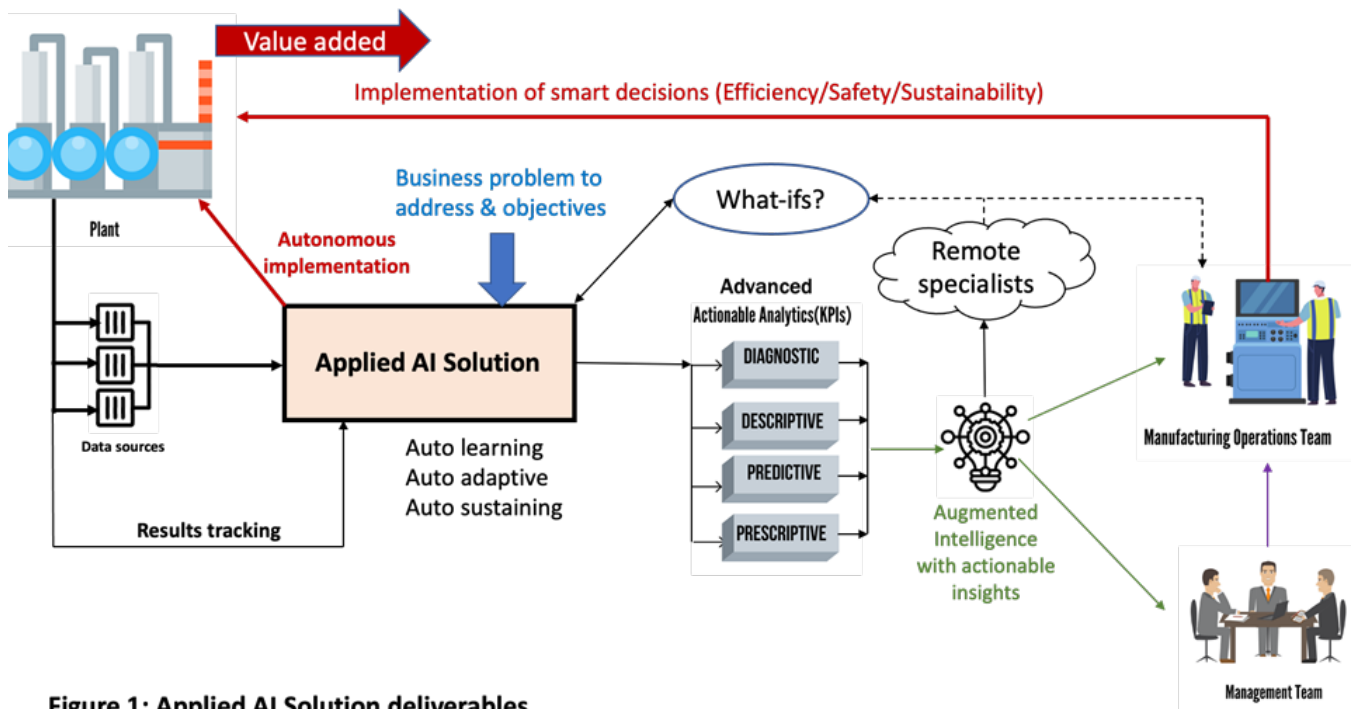


Figure 1: Applied AI Solution deliverables

Making Friends with Machine Learning series, succinctly and entertainingly put it as:

“The world represented by your training data is the only world you can expect to succeed in.”

In other words, your ML model is only as good as the data that goes into it. So, an important part of developing your ML based model solution is, selecting appropriate features (input variables), curating the data upfront before training, for coherence and relevance with respect to the end objective and the problem being solved. Success in this process requires domain knowledge.

Another very important aspect is defining the business problem and the objective of the AI solution. As obvious as this sounds, ignoring or inadequately performing this step before setting out to build and deploy an AI solution is repeatedly seen as a major cause for AI/ML project failures. This again requires close involvement of domain specialists, with an understanding of what ML algorithms can and cannot do and which problems are worth solving using the AI solution. Cassie Kozyrkov nicely articulates this with some inimitable analogies:

“Many teams try to start an applied AI project by diving into algorithms and data before figuring out desired outputs and ob-

jectives. Unfortunately, that’s like raising a puppy in a New York City apartment for a few years, then being surprised that it can’t herd sheep for you.”

“Doing all the right heavy math to carefully solve the wrong problem, is futile investment”. “Select valuable quests to send ML engineers on, saving them from mathematically impressive excavations of useless rabbit holes.”

An effective AI solution (as shown in Figure 1) should be auto adaptive to process variations and provide the users with:

- A description of the status of the operation, at a glance, in real time (Descriptive analysis)
- A diagnosis of an issue or situation that would help quick troubleshooting (Diagnostic analysis)
- Prediction of where the operation is headed (Predictive analysis)
- Prescription on what changes to make to fix a problem or improve performance/optimize (Prescriptive analysis)
- A facility to perform What-ifs, using the AI solution (What-if analysis and subsequent optimization)

To achieve this, the Applied AI solution requires a judicious synthesis of following key components:

- Data connectors (Historical/Streaming)
- Data Analysis platforms and ML algorithms
- Fundamental models and domain knowledge
- Visualization platforms with interactive reporting
- Workflow/decision support implementation for the Internet of People
- Cloud/On-premise/Hybrid architecture

Figure 2 illustrates the key components that must be synthesized for success. There are many proprietary from several software licensors in the market, as well as open-source software products for each category of tools, shown in the figure. Selection needs to happen based on the application objectives, applicability to applications for process manufacturing, effective cost of implementation and prior standards, if any, selected by the manufacturer.

Bridging the gap activities as part of the synthesis, entails:

- Creation of a Business Requirement Document (BRD) to define the business problem and objectives
- Data selection from both big and small data
- Up front data curation based on the business problem being addressed (in addi-

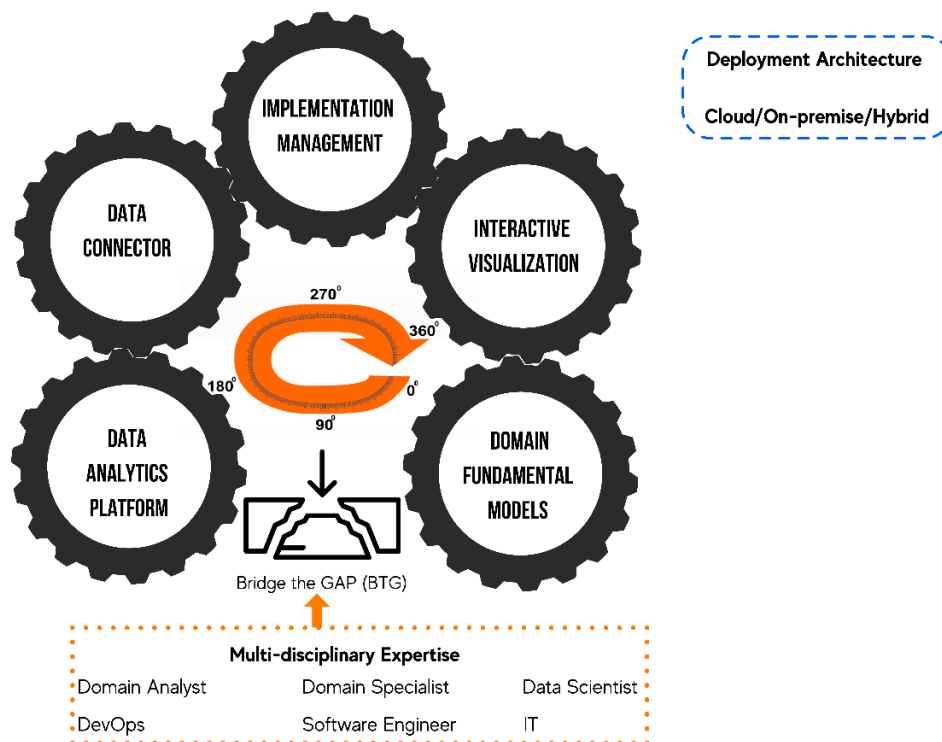


Figure 2: Synthesis of AI/ML tools for an effective Applied AI solution

- tion to the data cleaning typically utilizing data mining tools)
- Striking a balance between too much data cleaning and too little to ensure retaining optimum signal-to-noise ratio
- Smart feature engineering based on a combination of automated feature selection tools and inferred engineering variables arising from fundamental science.
- Selection of the technology tools/platforms
- Synthesis of the technology tools/platforms
- Model training, testing and validation on unseen data
- Deploying to production based on architecture selected

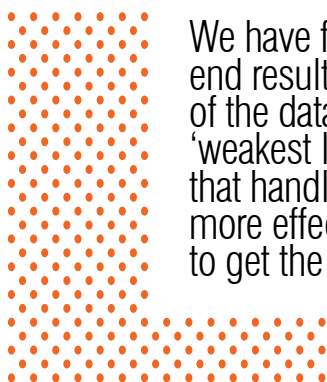
- Domain driven narrative of results for value capture
- Automating the data to results process
- AIOps

This activity/process supported by a multi-disciplinary team, with a significant domain knowledge component, is central and key to being able to deliver a successful AI solution that results in added business value for process manufacturing applications. While this process may seem to be an art, Ingenero makes it a science and has consistently provided successful deployments over the last decade.

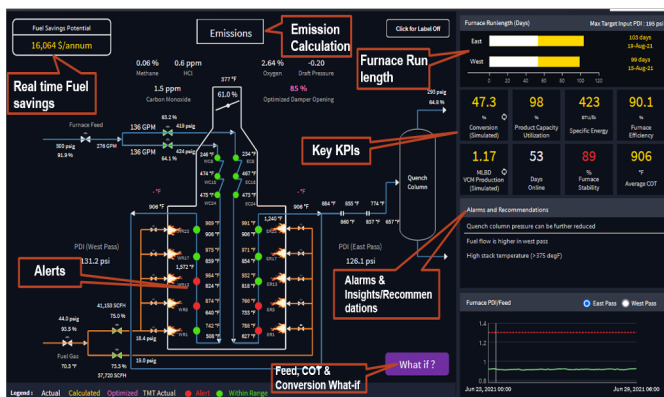
When deploying an applied AI solution for

process manufacturing applications, it is to be noted that the objective is not to research the best algorithm or develop algorithms (often the instinct of a Data science team), but to deploy a solution that delivers results reliably and sustainably. So, a team with this aptitude, attitude and focus is necessary to deploy an effective applied AI solution, in a time bound manner. Use ML algorithms that will do the job instead of going on a quest for the most complex or advanced one. We have found in almost all cases that the end results are no different, since the quality of the data available is almost always the “weakest link” and the “rate limiter” and having that handled to bring it up to snuff, would be more effective, with respect to time and cost, to get the same result.

With two decades of practical experience of doing remote daily operations analytics work for process manufacturers, Ingenero has the domain experience along with a deep knowledge of the analytical tools and algorithms and work processes necessary for successful implementation. Ingenero infuses domain knowledge captured in fundamental models, based on established chemical engineering principles, into the ML models,



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Benefits realized

- a. Burner optimization leading to Improvement in run length from 70 days to 170 days, at high utilization.
- b. 5.06% increase in production from baseline
- c. Improved furnace stability from 81% to 93% leading to high uptime.
- d. Reduced furnace coking rates by optimizing heat flux and operating parameters

Figure 3: Applied AI solution for performance improvement of a VCM furnace – sample screenshot

as a training assist or as augmentation models and also leverages it for upfront data curation, which is an essential step. This background and capability have enabled Ingenero to successfully deploy Applied AI solutions at plant and management levels regardless of type of refinery unit or petrochemical plant. Some common applications for process manufacturing deployed include:

- Dynamic best benchmark operation for improved performance
- Equipment health tracking and fault detection for reliability and safety
- Fouling identification and forecasting, with

mitigation to extend Turn Around cycles.

- Furnace performance optimization (across various processes for both Production, Energy and Emissions)
- Emissions and waste management
- Controller performance tracking and optimization
- Instrument health tracking and alerting
- Predictive maintenance

Figure 3 shows a case example of a VCM furnace application, showing how real time display of the various types of analyzed information, from the applied AI solution (i.e. Ingenero's I-SSPDE) implemented in a US facility. ■

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SHIFT TOWARDS DIGITAL TWIN

The capability supports three of the most powerful knowledge tools in human toolkit and these tools are basically for conceptualization, comparisons, and collaboration



PARTHA SUR
GENERAL MANAGER - TECHNOLOGY
HALDIA PETROCHEMICALS LIMITED


Exponential innovation fuelling hope, disrupting the VUCA world with the onset of the arrival of industry 4.0 waves, building seamless bridges with entities: Digital world, the Virtual world with the Physical World. The digital technology has opened up plethora of opportunities created for full set of new age technologies stack of future e.g. Artificial Intelligence (AI), Advanced Analytics, Augmented Reality (AR), 3D Printing, Quantum Computing, Smart Automation, Robotics, Bioinformatics, Nanotechnology, Neurotechnology, 6G communication, Blockchain, Internet of Things (IoT), Autonomous System, and Cybersecurity are aimed at addressing human need, improving quality of life by way of speedy development in all spheres of life.

Chemical industry is very vast and all encompassing, comprising of commodity and specialty, basic chemicals, performance chemicals, synthetics, elastomers, API drugs, and pharmaceuticals will become the obvious beneficiary from these high-end technology development for serving human, the ecology, and the environment and in turn help in minimizing waste of scarce resource in every activity performed by human. 'Process Digital Twin's is uniquely positioned to utilize at its breadth and reap benefits through deployment of above technology stack depending on complexity of objectives for economic and social well beings with rapidity in future.

Digital twin entails three distinct parts - the physical products in real space, the virtual product in virtual space, and lastly the connection of data and information that ties the virtual & real products together. It was in the aftermath of NASA's successful project launch in 2010, digital twin gained tremendous popularity in academia, government institutions and in industry settings across organizations as a ploy to advancing in technology for harnessing business performance enhancement, conceptualization in R&D prototypes in multiple business domain for knowing the unknowns.

On a simplistic view away from complexity humans face difficulty in visualizing in life situation what is happening inside from 2D drawing made from plain paper and pencil and the complexity increases with the multi-fold increase in process complexity that petrochemicals product inherits, required to follow a set of fundamental theoretical unit operations (Heat, mass transfer, fluid flow property changes, chemical reactions occurring leading to compositional changes, prediction of product properties occurring inside) for the entire conversion processes tied together, goes from one intermediate to another until the finished product is produced acceptable to customer for specific application. Hence new technology features like 'Digital Twin' makes people think better, relate their work better with better real-life understanding.

Design of 'Process Digital Twin' and its utility depends on the use case being deployed. Digital twin capability supports three of the most powerful knowledge-tools in human toolkit and these tools are basically conceptualization, comparisons, and collaboration. Taken together these attributes form the foundation of the next generation of problem solving and innovation. In Petrochemicals business, setting Physics and Chemistry led first principle centric models coupled with



Digital twin entails three distinct parts - the physical products in real space, the virtual product in virtual space, and lastly the connection of data and information that ties the virtual & real products together.

Artificial Intelligence (AI), Machine Learning (ML) capability i.e. sort of hybrid models will find better suited application in designing a set technology products e.g. Product Twins, Production Twins, Performance Twins, and Asset twins and all put together gives the digital backbone and helps in separating the crowd from the technology oriented, knowledge driven organization of future and continue to thrive.

Use case deployment should be thought out well and then plan better in advance. Next step is to identify a specific area of business to start with, define the objectives and seek support and funding from stakeholder and top management. Look at technologies that will be necessary, it does not mean that all technologies that are available in the market apply nor are relevant to a particular segment of business that the organization is serving to its customers. Second, identify a team and specify a timeline of completion. 3rd start small and communicate successes, benefits and the value that project has delivered; share difficulties, group learning from the project and lastly be flexible to adopt continual improvement with time and refine it as it goes.

If we deep dive into the digital twin conceptual framework at the core of it is digital representation of a physical product in all its aspects including the functional, behavioural part of it. It represents the whole life cycle of a product starting from designing it mechanically, describing it through embedded software satisfying principles of flow mechanics, thermal, chemical and electrical aspects in it. Digital twin also describes how to manufacture a product, replicating every behaviour of the physical product in operation while in service and during its maintenance activity.

Digital twin represents a physical product in a digital world, allowing us to do experimentation; does the thing faster, for example it helps in timely simulation as opposed to building costly physical prototype; designed to do things more often until the optimal solution is reached. The virtual product so designed will use less and less of resources i.e. both money and human capital. In



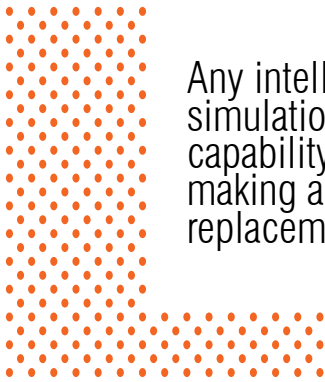
essence its core capability is to do multiple simulations, build many different models instead of just one and then pick the one which meets the optimum, suits best for the application. Lifecycle of a physical product starts with designing a product or designing a plant in CAD models, then simulating those CAD models without implementing it real time and then engineered for coding it in detail with an aim to optimize from flow dynamics point of view, determining product attributes like property prediction etc. in essence turns out to be a game changer that provides broad set of models in design space for attaining higher order goals.

Next phase of lifecycle of Digital twin is manufacturing the product and naturally it becomes the longest phase of run where it utilizes the model capability to enhance operational efficiency, reduce emissions, minimize downtime of large machines (compressors, turbines, motors etc) that are integral to plant operations offers enormous visualization to people and processes at large. It is to be kept in mind for operations phase model's order of complexity ought to reduce from the data processing perspectives, hardware needs, optimizing computer CPU capacity for longer term sustenance for in-line optimization in real-time. It is said that all models are bad

but definitely some are good.

It is also to be mentioned here that digital twins are in operation, another very important aspect in product lifecycle is the maintenance activity. When predictability in maintenance comes into picture, it naturally gets linked to artificial intelligence (AI), essentially driven by data that goes into model development; it forms the very important foundation of the product life cycle. With faster adoption of artificial intelligence technology, widening of design space has become a reality; it offers multiple degrees of freedom in carrying out design simulations and helps in selecting the best simulated case for freezing the design, reducing cost and time for complex design practices.

Similarly, the mechanical aspect of design, fluid flow dynamics, mass & energy balances based on first principle also becomes integral to it, built on embedded software comes into the model in play. As-built plant design should get accurately represented in the digital twin supported over a longer time horizon as part of product life cycle offering. On a comparative tone industry 4.0 is to gather cues from the environment and remediating it as information is received but on the contrary job of digital twin would be to predict it before an event occurs. In sim-



Any intelligent digital twin aided with simulation of physical objects will build capability to augment human decision making and in no way guarantees replacement of humans.

ilar technical parlance artificial intelligence is also a technology putting together with digital twin generates data from the physical plant or product and fits into the real-life plant virtual models utilizes for decision making, helps in building predictive and preventive maintenance capabilities for plant equipment and machineries.

With digital twins in play, higher order and more granular attributes in product design can be attained. In the context of using artificial intelligence in the physical product allowed to roam around and if utilized in plant operation-maintenance activities, then it is necessary to deploy a digital twin to build standby capabilities to know what and how it is doing, what sort of emergent behaviour it does, meaning when it was designed we did not know it could do versus when connected to digital twin it will provide understanding what data it took to change such behaviour. For autonomous entities deployment in industrial and commercial establishments, it is essential that we put digital twins together to gather all core aspects. Putting them together will help in navigating it scientifically. Digital twin brings value in larger aspects of visualization, a big part of it today for example in 3D visualization gives enormous capabilities. Any intelligent digital twin aided with simulation of physical objects will build capability to augment human decision making and in no way guarantees replacement of humans.

Digital twin has 3 phases of deployment namely: prototype before the physical product is made, 2nd digital instance where an expensive objective is running or put into operation to gather all sorts of behaviour it does and then the 3rd 'digital twin aggregator' which takes all the steps that include

sensorization of data, pull every information which human think he knows but did not. Hence the whole idea of digital twin is going to evolve and create capabilities to develop prognostic and predict failures to fix it before they are occurring. It is also true with the phenomenal increase in computational capabilities at a lesser cost, digital twin is going to throw enormous perspectives to bring in futuristic view in hours, days and month ahead to human and help in alerting if same ways of doing the things continues as it is being done; digital twin predictive capability on failure will enhance multi-fold visibility and in a way it will be a real assistance for human going forward.

Digital twin for remote operation-absence of physical proximity can be leveraged simultaneously as an watch dog from any part of the world instantly with strict authorization, securitization etc as a result physical proximity can be avoided for example operations like a nuclear reactor, smelter in a steel melting shop where molten iron is poured in a reactor; close proximity to such operation is not at all desirable but humans are to be there and has to be involved, digital twins provides augmented intelligence. Make sure everybody understands remote operation what it can lead to, ought to be extremely cautious of it and its every outcome. Therefore, it should be tied to the larger cultural issue of the organization rather than a technology issue for handling such complex operation scenarios. There are plenty of opportunities and it becomes a double-edged sword if it is not designed thoughtfully, it may create havoc; a lot of process understanding to go in while building, articulating design aspects of virtual product digital twin. Data fidelity in terms of true representation of digital twin with the

actual product or plant with time granularity of data is a key for instances where it ought to act in real instances need to act without physically being there e.g. exothermic reaction causing runaway in a reactor calling for the reactor to go to a fail-safe mode instantly to eliminate the cause of temperature runaway. Hence humans have to be in place in critical physical settings remotely to handle such scenarios in the aftermath of such an incident taking place. Intelligent digital twins will augment human decision making and not intended for replacement of humans in the entire loop.

Sustainability - Use of information in digital twins and predicting outcome will cost less and less as against wastage of a lot of money, reputation through prevention and elimination of occurrences; minimize wastages of resources, environment, etc.

Digital twin harnesses larger insights of a physical thing, brings in fore what is going on inside, creates situational awareness for helping humans to take control of a situation, and plans for remediation better with proper planning. In essence it builds the foundation on which the data being collected now will help us do a much better job in terms of efficiency and effectiveness in product development and in the entire production process, enriching industrial artificial intelligence and machine learning capabilities.

It should not be allowed to let such complex systems to run on its own, human requires to take control of it. There appears to be no fixed blueprint readily available for which product or which part of the life cycle a company should start building a digital backbone in the process industry, a careful analysis is required in terms of dynamics of the market, differentiation a company wishes to create against its competitors.

Combination of feed forward loop where it is possible to automate some part of product lifecycle and then there is feedback loop from service to manufacturing in factory setting to redesign the product and so forth and its seamless integration with latest digital infrastructure starting with Edge computing, Big data, and Cloud computing starting from planning phase to design to operation to maintenance will spur growth in technology, know-how's aid in new age material development as a part of future business strategy. ■

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CONSUMER SAFETY



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DIGITAL TWIN: THE KEY TO AN EFFICIENT, NET-ZERO FUTURE FOR CHEMICALS & PETROCHEMICALS

The use of digital transformation technologies can generate greater control, performance, flexibility, integration, and optimization while complying with energy efficiency and sustainability goals



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MARKETING ANALYST
VIDYA TECHNOLOGY

The Chemical and Petrochemical industries are always investing in innovation. Responsible for a wide range of products used in everyday life, they manufacture products for urban, rural, and industrial use. From insecticides to medicines and even personal care, chemical industrial processes are crucial for our everyday lives. In its turn, the petrochemical sector is responsible for the production of industrial raw materials, such as natural gases and oil refinement.

As both sectors work with oil as raw material for their operation, they have on their path, difficult challenges regarding the future need for a net-zero operation. Among the main difficulties faced, there is the high dependence on oil as an input for the manufacture of its products and the combustion as an important process in the operation, culmi-

nating in the liberation of Greenhouse gases (GHG) in the atmosphere.

According to the EPA (the United States Environmental Protection Agency), the industrial sector is responsible for at least 23% of the emissions in the whole world. This data, combined with the need to mitigate climate change, culminated in international agreements, such as the Paris Agreement and the UN (United Nations) Sustainable Development Goals (SDGs). The last one is composed of 17 targets related to poverty eradication, global sustainability, improving the quality of life, and the need to zero carbon emissions up to 2050.

In spite of those challenges, the COVID-19 pandemic of 2020, culminated in significant advances in the field of biotechnology. Through research developments in this area, the chemical sector can have the opportunity to take advantage of new techniques that undermine the dependence on oil for manufacturing.

Besides this opportunity, the sector can implement technologies from digital transformation, such as Digital Twins, Artificial Intelligence, and IoT (Internet of Things) in its operation to optimize the industrial processes and comply with the goals to decarbonize its operations.

According to McKinsey & Company, operation optimization is one of the best methods to achieve net-zero emissions.

“We observe, on average, that a 10 percent increase in production efficiency

delivers a 4 percent reduction in emissions intensity, all else being constant [...] Predictive Maintenance and automated condition monitoring can reduce planned interventions and extended runs”

Therefore, the use of Digital Transformation technologies can generate greater control, performance, flexibility, integration, and optimization while complying with energy efficiency and sustainability goals.

CHEMICAL AND PETROCHEMICAL PROCESS AND ITS CHALLENGES

For natural resources such as water, minerals, and organic products as raw materials used to be transformed into marketable products, they need to pass through a long process of chemical transformation within the industrial plants of this sector.

The main chemical process within this industry is combustion. It is from the burning that the chemical transformations occur and give form to the non-renewable products mentioned above. However, this process is very aggressive to the environment and actively compromises decarbonization targets.

The result of this is that the sector is responsible for 7% of the world's energy consumption and 4% of carbon emissions.

In the current economic scenario, climate change is a central issue for leading experts and investors. The subject is a matter of great debate, and its relevance has led many industries to think about strategies that change their operation towards a sustainable model, with conscientious use of natural resources, renewable energies, and good practices



aligned with ESG (Environmental - Social - Government) concepts.

The sector must find ways to transform its operation to keep it running for the long term. Finding renewable energy sources is critical to reducing greenhouse gas emissions and complying with energy transition targets.

Advances in biotechnology, along with the application and development of Digital Twin technology for the O&M phase with the aim of better process control, greater energy efficiency, and accident prevention, have the potential to be the path for the reinvention of the segment.

According to data collected by Deloitte, a reference company in research: “Many chemical companies are expected to increase investment in research and develop-

ment (R&D) resources and take advantage of advances in decarbonization and recycling technologies to reduce their impact on the environment and that of their customers, as well as reduce plastic waste. As a result, 2022 should see more industry players create goals and plans around reducing emissions and monetizing waste.”

This data reinforces the importance and potential that the Digital Twin has for changes in the industrial sector with the objective of decarbonization. Through development, research and innovation, industries will have the opportunity to change extremely unfavorable scenarios to carbon-free operations and processes.

But how can Digital Twin deliver greater energy efficiency with less environmental impact?

This is the question that many industries in the industrial sector have been asking lately. The answer to it is not simple, but Digital Twin technology has proven to be a great ally in the search for an increasingly sustainable operation and zero carbon.

The Digital Twin is a kind of cyber-physical system that consists of a continuous flow of data between physical elements and their digital replica.

Initially conceived by Michael Grieves in 2002, the concept is the result of a search

According to a report by markets and markets, the Digital Twin market was estimated to be worth \$3.1 billion by 2020 and is expected to grow to \$48.2 billion by 2026.



CHLOR-ALKALI



PEROXIDES



SULPHITES



ADVANCED MATERIALS



PHOSPHATES



POWER INSULATORS





for continuous improvements in the development of projects, products, and engineering activities. It is worth mentioning that the model proposed by Grieves aimed at the possibility of satisfactory management through all phases of Product Lifecycle Management (PLM).

Although Michael was the pioneer, the first practical example of a digital twin emerged by NASA after attempts in 2010 to perform simulation testing on its spacecraft vehicles. Due to the high applicability of the technology in all phases of PLM, many industries, from manufacturing to Chemical and Petrochemicals, can take advantage of the Digital Twin for process improvement, project and product development, and even programs related to the operation and maintenance phase of a plant.

The technology uses multiple data sources as input into the system. This means that

plant data is being collected and contextualized within a platform that allows managers to have easy access to critical and valuable information for decision-making and performance analysis.

Through the Digital Twin, industrial plant managers have greater control over the many variables involved in the process. Access to relevant and contextualized data can generate:

- performance loss analysis
- early flaw identification
- asset life-cycle durability prediction
- energy efficiency and consumption
- the measure of the amount of gas released into the atmosphere
- scheduling teams according to demand

Digital Twin: the key to a sustainable and efficient future in the Chemical and Petrochemical industries.

The Digital Twin created great opportu-

nities for the industrial sector. Elected as a top technology by Gartner in 2019, Digital Twin has been gaining more relevance in the industrial sector thanks to the great benefits generated by its implementation.

The implementation trend is growing, and according to a report by markets and markets, the Digital Twin market was estimated to be worth \$3.1 billion by 2020 and is expected to grow to \$48.2 billion by 2026.

Certainly, the tendency is that more industries will implement the technology in the medium term, making it an essential tool for industries in the digital transformation movement.

NEW OPPORTUNITIES GENERATED

Digital twins can be implemented at any stage of the asset lifecycle (PLM). There are models for the design and construction phases, most common in the construction and project development industry. Another kind of application is for the operation and maintenance phase, with more attractive purposes for process industries.

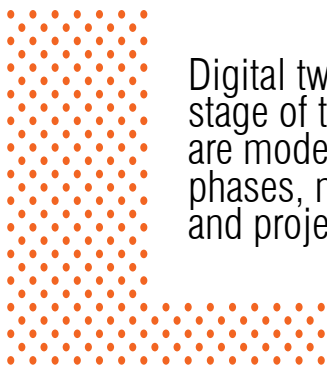
This technology has a great advantage in the opportunity of total control in an industrial plant. From the implementation of this technology, industries can integrate and centralize their processes, generating greater assertiveness in the execution of activities and less time spent.

Another attractive benefit of the technology is the possibility of implementing Artificial Intelligence algorithms that along with the Digital Twin will provide insights into possible scenarios, budgets, and can also generate important information about possible failures within the operation.

Besides the benefits mentioned above, one of the great advantages of the Digital Twin is the data contextualization provided by the technology. Perhaps this is the most important benefit generated by the technology since digital processes and operations have huge amounts of data that need to be processed to be used as a generator of knowledge by decision-makers.

It is now up to the Chemical and Petrochemical sector to use the technology to improve its energy efficiency, prevent accidents and have total control over its operation and emissions. ■

Digital twins can be implemented at any stage of the asset lifecycle (PLM). There are models for the design and construction phases, most common in the construction and project development industry.



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IMMERSIVE LEARNING PROVIDES TRAINING CATALYST THE CHEMICALS WORKFORCE NEEDS



STEPHEN REYNOLDS
INDUSTRY PRINCIPAL – CHEMICALS
AVEVA

Upskilling a new generation of workers within the constraints of the new normal depends on cutting-edge solutions such as immersive training. Its benefits include plant-specific learning, reduced risks and costs, and faster training times

Over the course of the pandemic, we've seen how connected meetings bring us together in one room. It's now possible to take a virtual class photo, where all participants gather in a room virtually. But the benefits of remote, collaborative software go further than cool backdrops or virtual auditoria. In the new normal, industrial businesses can replicate hands-on training from thousands of miles away.

Immersive training takes the virtual meeting one step further. The technology brings learning to life in an environment this generation understands and embraces.

For businesses with remote or dangerous installations, such as in chemicals or oil and gas, immersive training offers engineers, technicians and other professionals an interactive learning classroom where they

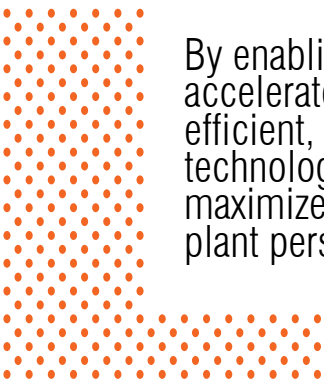
can simulate possible scenarios, and gain (virtual) hands-on experience in high-risk situations.

UNDERSTANDING IMMERSIVE TRAINING

At its core, immersive training uses technologies such as augmented reality (AR) and virtual reality (VR) to create engaging, experiential learning in a safe, controlled and virtual environment. Trainees may put on off-the-shelf gaming peripherals such as console controllers and VR headsets like the Oculus Rift to access bespoke training programs that support learning for both new and experienced staff.

To draw a parallel with another industry, trainee pilots use flight simulators to understand how aircraft operate in a variety of environments and conditions. The chemicals industry carries many similar risks. Just as an airline wouldn't put an untrained pilot in command of a plane, chemicals companies aren't going to take the risk of letting inexperienced personnel operate their plants.

AR and VR training can be used in many different ways. The technologies can offer an introduction to facilities and installations. They can also support safety and performance by reducing the risk of accidents and the need to shut down plants for real-world training. Novice operators can practice high-



By enabling businesses to deliver accelerated training that is sustainable, efficient, and effective, learning based on technologies such as AR and VR helps maximize return on investment (ROI) in plant personnel training.

risk industrial procedures in safe training simulators, and teams can work together to strategize and test new products. Immersive training minimizes project risks, facilitates accelerated training with a lower budgetary outlay and maximizes ROI – all while maintaining safe plant operation. And because simulating chemicals processes saves on energy and raw materials, virtual training offers significant sustainability benefits.

SPEAK THEIR LANGUAGE

The need for new ways of training has gained currency as experienced operators and engineers retire. Like other industrial sectors, the chemical business faces a generational shift in the workforce and a growing need to pass expertise onto younger workers. Until recently, however, the sector has been largely reliant on traditional training methods that do not truly engage the digital natives that will soon form the majority of the workforce.

Millennials and Gen Z workers have grown up with and intuitively understand immersive 3D settings where they can interact, explore, make mistakes, and then try again. This understanding may come from video games, but such virtual worlds can also be leveraged for industrial training.

Immersive training brings learning to life in a way this generation understands and embraces. The use of simulations, role play, and virtual walkthroughs are all elements of immersive learning.

UNIFY THE LEARNING EXPERIENCE

While off-the-shelf VR and AR training environments have their place, unifying an organization's many systems into a single, secure data hub can help chemical companies unlock the benefits of immersive learning. Such a unified environment reduces the time and effort involved in sharing detailed engineering data and accelerates learning by enabling business-specific outcomes.

Linking up with a company's digital twin, for example, enables organizations to parachute trainees into immersive, 3D versions of real-world plants. There, they can operate



within an environment that mimics the dynamic process behavior of the plant.

Such bespoke solutions build businesses' confidence in their staff on several levels. Staff quickly learn their way around plants. They can easily understand the impact of wrong decisions. And they experience how correct safety and reliability improve plant performance without affecting health and productivity.

At chemical producer BASF, a virtual training center enables 600 new operators and engineers each year to learn about their new workplace remotely before moving into the real pilot plant. Trainees, often fresh graduates unfamiliar with process technology, can take their first steps in virtual environments similar to the gaming consoles they know. Early users appreciated the digital approach and reported a sense of confidence around complex equipment and in subsequent real-world training set-ups.

CONSIDER CLOUD SOLUTIONS

The possibilities of immersive training truly come into their own when anchored within cloud-based solutions.

On-premises simulators carry a high up-front capital expense and can only train one batch of employees at a time. By contrast, a subscription-based cloud solution shifts the cost to operating expenses that match training activity and budgets. Furthermore, cloud solutions open up training to a significantly larger group of employees that may be located anywhere – with trainees able to access modules on demand.

OLEUM, the European training center for Total Group's oil and petrochemical business, was an early adopter of a cloud-based operator training simulator (OTS). By integrating the OTS with its corporate learning management system it found a modern scalable, flexible and economic solution that expanded its ability to train operators across the business without spending millions on travel, and lowering the time taken to train an operator from months to weeks.

MAXIMIZE TRAINING ROI

By enabling businesses to deliver accelerated training that is sustainable, efficient, and effective, learning based on technologies such as AR and VR helps maximize return on investment (ROI) in plant personnel training. Not only are fewer training installations required, but travel costs are saved with virtual learning.

Similarly, scalable cloud-based systems offer better value for money. AVEVA data shows that immersive learning environments can generate as much as 40% in training time and cost savings.

The latest generation of immersive digital tools are enabling businesses to enhance the efficiency and development of their training programs in an efficient and flexible manner. As a new generation of digital-native employees enters the workforce, future-forward companies would be wise to invest in immersive training now if they want to build attractive workplaces that provide high job satisfaction and enable staff to excel. Better training means better results. ■

SOP DIGITIZATION AS A 1ST STEP TOWARDS DIGITAL TRANSFORMATION

Engaging and supporting the operator of today into the future with guided process control



SAMEER PIKLE
NATIONAL HEAD - DIGITALIZATION
MICROVERSE AUTOMATION

As businesses try hard to gain a competitive edge against their business competitors in today's complex market scenarios the way operators perform their work in their manufacturing operations, has evolved drastically. Shifting from being purely functional to highly analytical, and becoming smart operators has become a necessity and an integral part of today's business processes – significantly changing the way businesses operate and add value to archive their business outcomes.

Operators earlier were required to be proficient in following set procedures and achieve maximum production. Current operators are expected to be cross functional and go beyond duty to achieve stated business outcomes. In short be agile.

To think Digital Transformation is all about data and data driven technology would be belittling the contribution of the shop floor workers in this journey towards achieving Operational Excellence. For any improvement in overall efficiency of a plant or OEE any solution so proposed should take into consideration in the ease of doing work on the manufacturing lines / shop floor with minimal instructions and maximum compliance to Standard Operating Procedures (SoP)

To advance operator effectiveness, the latest Process Automation Controllers (PAC) enables operators to better leverage information in both routine and critical conditions for optimal decision making. Such intelligent PAC's satisfies the growing need for tools that enable them to collect, connect, analyze, and act upon vast amounts of real-time operations data, supporting a more engaged and intelligent workforce.

HISTORY OF MODULAR PROCEDURAL AUTOMATION

A procedural operation consists of a set of operator tasks that are conducted in a set way time-after-time to achieve a certain goal such as starting or shutting down a unit or making a product. As demonstrated by Paul McKenzie (Bristol Myers Squibb) at the World Batch Forum (WBF) North America conference 2007 in Baltimore, it could even apply to the operation of an analyzer. So how was the journey to modular procedural automation?

If you look back at the functions available to control systems for both programmable logic controllers (PLC) and distributed control systems (DCS), they focused on discrete and continuous control. Sequential and batch control functions were added later and the logic was more complex. Batch processes are more procedural in nature, but typically involve sets of procedures running in parallel on varying process units and in multiple process stages which almost always need to have built in flexibility. The ISA-88 standard ultimately addressed batch automation very well; however, attempts were made in the 1970s and 1980s to implement advanced procedure management using control system functions with strings of function blocks or by straight-line coded applications. These functions certainly could handle the sequential nature of procedure management but they had limited flexibility.

CURRENT INDUSTRY CHALLENGES:

One key area is in alerts and communicating to the operator. Work Process management and control require a complex interface but control systems by their very nature limit this ability. Therefore, providing

limited information to the operator hampered his ability to make procedure decisions, take action on alternatives, and realize the reasons for current process states and reasons for process deviations. Managing a procedure or process transition in automatic mode was non-effective and operators chose to accomplish procedure management manually.

Another difficult area to overcome was that most Standard Operating procedure (SOP) management involves unsteady state operation which includes many manual operations for the field and plant floor operator. This meant that the skill and knowledge of running the SOP stayed with the operators and operations staff and not with the control system.

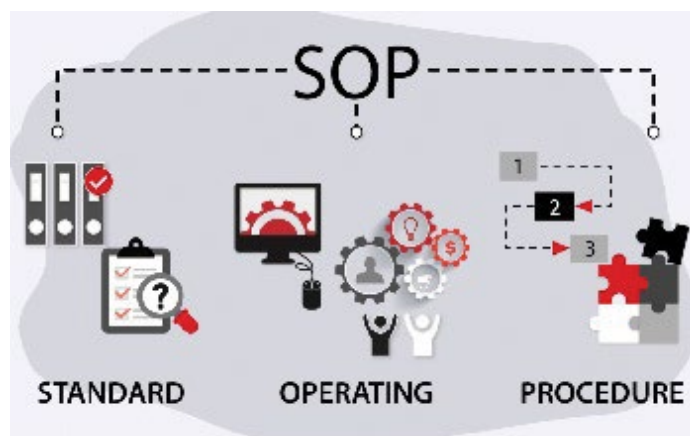
The Chemical industry with both continuous and batch processes began implementing SOP digitization. Procedure and process transition flow charts with steps guided the operator from operator consoles.

TRANSITION MANAGEMENT

In its basic definition, transition management is a method of implementing advanced procedure management. The goal is to improve overall performance through faster and smoother transitions. This contributes to extended equipment life and optimized production and increased product yields. There are three broad operational procedures involving transitions: startup, shutdown and unit state change. The unit state change includes transitions like grade changes, production rate changes, process equipment switches, etc. Transition management applies equally to a complete process unit and to a selected piece of equipment in a processing unit, like a shutdown valve, or a heat exchanger. Transitions also inherently increase the risk of disruptions that can lead to incidents or lost production. Incidents that occurred during startup and shutdown continued to be a major factor. An addition-

al study showed that examination of major incidents by the average loss per incident indicated that operational error caused the largest average dollar loss.

A fourth area that is added to transition management is "abnormal" process state changes, like a process trip resulting in a asset shutdown or a larger event causing a production shutdown. In some abnormal transitions, like a process trip, most of the time there is a window of opportunity for a process operator to reset the equipment and bring the operating conditions to normal. But this window is narrow needs to be effectively used



else it results in longer shutdown and higher production losses. These four categories of transition management which have been well known for the last 20 years in chemical industries.

CAPTURING & CREATING PROCEDURAL KNOWLEDGE BASE

The existing paper-based operator procedures are "static" in nature. The actual procedural knowledge and skill is with the operators. However, knowledge and the accompanying skill sets to run these procedures manually is diminishing. How to preserve the knowledge of the best operators and their practices is a challenge. SoP Digitization can help in capturing their activities and create a knowledge base. Level of tech-

nological complexity is increasing, the timely flow of information, data, and knowledge is more important than ever in the process industries.

PROCEDURAL OPERATIONS

The chemical facilities are run and maintained according to operational procedures and every process a SOP. A SoP has a set of tasks that are conducted in a sequence and in set time. These procedures require consistent execution. There are three main types of procedures: manual prompted and automated.

1. Manual: Manual procedures are performed by operators taking actions either in the control room or in the field. Often operators perform these procedures based upon their training and experience. There is always a variability associated with manual operations. Documentation is necessary for process improvement, compliance and additional data analysis.

2. Guided : Guided procedures are implemented in a control or manufacturing execution system which steps through the procedures, stopping at the end of each step or action and waiting for the operator to manually grant permission to continue. Prompted procedures can decrease variability, transition times and enable automatic record keeping.

3. Automated : Automated procedures are implemented in control systems and generally only stop at the end of normal operational sequences. If an abnormal situation takes place or an operator intervenes, the sequence can be held or perform exception handling. Automated procedures reduce variation and time.

Conclusions: The work already achieved in chemical industries has proven the value of SoP digitization. It creates operational knowledge base, process consistency which reduces operator dependence and improves production. ■

DEVELOPING PRODUCTS FOR THE INDUSTRIAL COATINGS SEGMENT

Our vision is to shortlist the Tridiagonal technologies and evaluate and adapt it to Indian requirements and scale it



PRAVEEN KAPSE
VICE PRESIDENT –
DIGITAL TRANSFORMATION
TRIDIAGONAL SOLUTIONS PVT. LIMITED

? **How can chemical and petrochemical companies leverage Industry 4.0/digital solutions to increase their profitability?**

The digital economy is expanding. The availability of digital technology and its application will enable the data-driven decisions across the board. The organization's digital capability shall help in stabilising operations and control the desired throughputs by using Advanced Process Control (APC). The role-based visibility of plant and enterprise-wide intelligence using data science/analytics will increase competitiveness, decrease costs, and improve productivity. With the right cultural transformation agents (internal/external), implementing Industry/Chemical 4.0 such as data infrastructure, APC, APM, supply chain analytics, etc. can be leveraged for sustainable and profitable operations.

? **Would you brief us about Consulting Solutions and how will it be beneficial for chemical and petrochemical companies?**


Today, chemical and petrochemical companies are on the cusp of digital trans-

formation. There are multiple challenges in making this transition happen, such as digital maturity or readiness, right road map, selection of right technologies stack, cultural transformation, upskilling, etc. Tridiagonal Solutions play the owner's consultant role to identify, create and deploy value in a digital transformation journey of the customers. Our core competence is to leverage our deep process understanding and focus on successful implementation of the Industry/Chemical 4.0 technologies.

We undertake digital transformation roadmap preparation focusing on manufacturing operations. It starts with gap identification (processes/IT-OT), defining key pain areas, mitigation actions, digital capabilities to be developed and solutions/tech stack to be deployed. With the right combination of skill sets, partner ecosystem, and business models, we support companies in providing Industry/Chemical 4.0 solutions. It involves data historians, Advanced Process Control (APC), Asset Performance Management (APM), Operator Training Simulation (OTS), asset integrity, data science and analytics for manufacturing intelligence, remote monitoring, etc.

? **What are Tridiagonal's offering to petrochemical, hydrogen and gas companies? What's your USP?**

Since its inception, Tridiagonal Solutions has been playing key role of that of a catalyst to test new technology, optimize existing processes/assets in the chemical, petchem and energy sectors. As the first incubation company of National Chemical Laboratory (NCL), a constituent member of the Council



We have been continuously evaluating new technologies such as CO₂ capture, green hydrogen, etc. and have developed the collaboration ecosystem of R&D establishments, research institutes, technology providers, etc.

of Scientific & Industrial Research India, we have been leveraging a combination of technologies to support various R&D, operations, digital transformation initiatives of chemical, petchem and oil & energy industry. For e.g. model-based engineering to study various phenomenon's (combustion, separation, mixing, drying, etc.) physical/digital validation, hybrid modelling, advanced process control, data analytics, etc. We have delivered more than 1,000+ projects in various domains, viz, process/energy optimization studies, debottlenecking, scale-up & tech transfer, batch to continuous, Advanced Process Control (APC), Asset performance management (APM), digital twin, data science/ analytics, etc.

We have been continuously evaluating new technologies such as CO2 capture, green hydrogen, etc. and have developed the collaboration ecosystem of R&D establishments, research institutes, technology providers, etc. Our vision is to shortlist the Tridiagonal technologies and evaluate and adapt it to Indian requirements and scale it.

? **Tridiagonal has tied up with companies like Siemens, Honeywell, Seeq, Factsage and Vidya. How will this help Tridiagonal in providing 360-degree solutions to its clients?**

The technology companies have put in huge efforts in the last two decades to develop solutions using the latest tech stack such as Industry 4.0, Web 4.0, data computing & integration, cyber security, etc. The customers on the other hand get lost in buy versus build decisions, or spend time in evaluating multiple solutions/vendors without validating the business requirements.

For a successful digital transformation, one needs the tech stack that meets business requirements. It should be embraceable by different stakeholders (not just skilled resources) and easily scalable. We have built a strong partner eco-system of leading technology providers, for e.g. companies such as Seeq, Honeywell, Vidya, Factsage, etc., which meets these success criteria and pro-



vides 360-degree solutions to the customers. The solution covers Chemical 4.0 - vertical and horizontal integration, L0 to L4 & above, digital twin, etc.

We at Tridiagonal Solutions specialize in application and implementation of these technologies/solutions and create business value for our customers.

? **How do you see Tridiagonal Solutions playing a role in digital transformation projects in the Indian chemical industry?**

Tridiagonal Solutions have evolved as a technology company in the last two decades and have been consistently creating value for our global (Fortune 100, 500) customers. We have been investing in building the core expertise – breadth, depth and latest technologies. The chemical/petchem companies in India are at an early stage of digital transformation journey and need enablers to initiate, prove and scale the implementation of digital technologies. We play this enabler role with a focus on application of Industry 4.0 technologies (APC, APM, digital twin, data science & analytics, etc.) along with the combination of skill sets and partner ecosystem.

? **The company has one of the world's largest multiphase flow laboratories for serving the oil & gas industry. How does this lab help oil & gas companies?**

In order to maintain the sustainable operations of E&P companies, the companies invest huge capital in enhancing the recovery of oil & gas post commissioning and operate in the set limitations. They ignore the need for production enhancement studies, flow assurance qualification tests or proof of concept tests of new technologies. It is essential to do such pre-commissioning studies and generate production enhancement/ optimization data to ensure the E&P fields operate with the right operational matrix and take informed decisions. The reason E&P companies in India fail to do such pre-commissioning qualification is due to lack of field scale infrastructure and R&D testing set-up, which can mimic the actual field conditions. We operate one of the largest field-scale flow testing facilities in India, and have been supporting global oil & gas majors like Chevron, BP, Shell, Deepstar consortium, etc. We have some unique assets here for wax deposition, erosion, corrosion and complex multiphase flow testing. ■



In a world of quality demands
SMART ADHESIVES INSPIRE PRODUCT ROBUSTNESS



Supply Chain



Becoming Competitive
and Differentiator



DEVELOPING A BETTER CHEMICAL SUPPLY CHAIN

Resilience in the chemical supply chains points toward the logistics partner's robust ability to speed up or slow down the flow of goods depends on external requirements



BHAVESH BARETHA
MANAGER - CHEMICALS
MAERSK SOUTH ASIA

The Indian chemical industry has been gradually expanding, with statistics indicating growth at a CAGR (compound annual growth rate) of 9.3% up to US \$304 billion by 2025. This growth is supported by research & development and initiatives adopted by the Government of India that include reduction of customs duty on several imports, promotion of the 'Make In India' campaign and the launch of production linked incentive (PLI) schemes with 10-20% output for the agrochemical sector to foster an ecosystem for manufacturing growth in domestic markets and exports.

More recently, the government allocated Rs. 233.14 crore (US \$32.2 million) to the Department of Chemicals and Petrochemicals under the Union Budget 2021-22. India is also seeing an increased investment from foreign strategic investors, with Japan, Korea, and Thailand leading the charge as they seek to diversify supply chains from China.

With the increasing growth trajectory of the industry, the role of supply chain partners has become far more crucial. It's not enough to meet typical logistical requirements merely; logistics providers need to go beyond and understand the core needs of the industry as it evolves.

Chemical companies seek supply chain partners who can support continuous production lines with effective storage solutions, increase margins with supply chain cost-efficiencies, improve safety and compliance, gain customer loyalty with greater visibility, and on-time deliveries. To top all these generic requirements, supply chain partners must acknowledge that one size does not fit all. This means that they must understand and fulfil customers' core needs with solutions customised to their

different needs and specifications.

Above all this, especially after being in a pandemic situation for over two years now, one of the most important aspects of chemical supply chains has come around resilience, given the importance and sensitivity of being on time during transits. But what does this resilience mean?

It means that the supply chain partners should be able to quickly adjust the flow of cargo as per the market's changing needs or conditions in the logistics ecosystem. The underlying message here is that the supply chain partners should be able to switch between different modes of transport through cargo journey – between ocean, landside, or air. It is also essential to have the flexibility of storing the chemical cargo at any stage of logistics safely and securely suitable to the type of cargo. In summary, resilience in the chemical supply chains points toward the logistics partner's robust ability to speed up or slow down the flow of goods depending on external requirements.

The flow of information is becoming an increasing necessity to aid the resilience expected by a shipper from a supply chain partner. The information in consideration here includes the type of cargo that is being moved, as it defines how it is handled, and forecasting the supply and demand in the market. This information from the shipper helps the supply chain partner plan the logistics in the most effective manner leading to effective inventory handling, directly impacting the cost and bringing it down. There is a lot of data at both ends of the supply chain and through the journey. This data needs to be shared across all the involved stakeholders for driving maximum efficiency.

Digital transformation and sustainability are the next developing key trends in logistics. They are most sought after by companies looking to enhance their overall value chain with reduced costs & time, higher reliability



Chemical companies seek supply chain partners who can support continuous production lines with effective storage solutions, increase margins with supply chain cost-efficiencies, improve safety and compliance, gain customer loyalty with greater visibility, and on-time deliveries.

provide end-to-end sustainable supply chain solutions. Engaging in strategic partnerships with various entities across the world, we've already made great strides towards this goal, including investing in the design of the next generation of vessels that would run on green fuels, the introduction of electric trucks for landside movement, sourcing sustainable aviation and ocean fuel amongst many others. Maersk is offering ECO Delivery to customers willing to decarbonise their supply chains. An Emissions Dashboard is also available for customers keen to track their supply chain's



& safety compliance, and complete visibility from end to end. Technology is gradually playing an increasingly important role in transforming businesses and driving their growth. Shippers look to their supply chain partners to provide them with intelligence and visibility that reduces manual work and processes and, at the same time, empowers them to act quickly and intelligently when faced with situations such as delays or changes to destination or demand.

Blockchain is also becoming an increasingly familiar face as it helps create platforms that can connect entire

ecosystems and reduce paper trails. The TradeLens platform, jointly developed by IBM and Maersk, underpinned with blockchain technology, is a key example of how a network of stakeholders can be on the same platform to provide real-time visibility and trackability of cargo movement together contribute towards the digitisation of the supply chains. This is especially important for the chemical sector, where timely deliveries mean a lot more than many other types of cargo.

As an industry leader, climate action has become a strategic imperative for A.P. Moller – Maersk, and we are stepping up efforts to

carbon footprint and make adjustments according to their own goals.

At Maersk, we are proud to offer specialised integrated logistics solutions for the chemical industry with a strong focus on resilience, digitisation, analytics, and sustainability at its core. Through these solutions, we are committed to designing and implementing supply chains for our customers that are tailor-made to their requirements and reduce manual paperwork and processes while also providing real-time visibility and trackability of the movement of their cargo. ■



IMPACT OF AI AND ML ON LOGISTICS & SUPPLY CHAIN



SANKET SHETH
MD & FOUNDER
ELIXIA TECH SOLUTIONS

Technology should be targeted and implemented across people, places, and processes over the entire chemical supply chain in order to bring in logistics efficiency

Technology has become the most crucial catalyst in bringing about supply chain transformation and optimizing its future performance better than ever before. Artificial Intelligence (AI) simulates human intelligence in the most accurate way possible. It collects data, analyzes information, and provides cognitive decisions to enhance the overall supply chain performance. Machine Learning (ML) is a subset of AI and is very specific to how a machine performs on the basis of past experiences. AI and ML together come as a great help when it comes to optimizing logistics and supply chain processes.

NEED FOR TECHNOLOGY IN CHEMICAL SECTOR

When it comes to the chemical sector, the logistics and supply chain is particularly different from other industries' processes. This is mainly because of three reasons:

(i) Production and consumption of the chemical products are mostly at distant and separate locations. Hence, manufacturing, storage, transit, and distribution need to be

aligned well to ensure the chemicals hold their composition throughout.

(ii) 96% of manufacturing goods depend on chemicals for direct or indirect usage. A slight delay in the unavailability of products can affect the operations of other major industries. Hence, the industry needs to work round the clock to meet the market requirements.

(iii) The product if not handled properly can itself be hazardous in nature and can impact humans, machinery, and other assets involved in the management of the products. So for obvious reasons, one needs to be extra cautious while working with chemical products.

In order to bring in logistics efficiency, technology should be targeted and implemented across people, places, and processes over the entire chemical supply chain.

SUPPLY CHAIN REVOLUTION IN CHEMICAL INDUSTRY

The nature of the chemical industry products and by-products demands highly efficient solutions to manage the entire supply chain. Safety, quality, and reliability of people and processes need to be kept in mind throughout the logistics and supply chain journey. Starting from the manufacturing operation, the target of technology is to predict the demand and produce the right quantity of products at the right time. AI-enabled supply chain along with machine learning algorithms then capture real-time data along with information from the production lines to ensure that a balance of demand and supply is achieved.



AI-led supply chain optimisation software is the best solution when it comes to route and load management of vehicles. Managing the distribution of chemicals involves strong planning of packaging, loading, and even optimising the routes for faster and timely deliveries.

Machine learning drives process automation for manufacturing the required chemical composition with 100% accuracy. Petrochemicals and refineries in particular have specific composition requirements and they thus need ML support to operate and manage the production of the required products. For e.g. BASF, a German producer of paints, recently adapted machine learning technology to interpret customer requirements and give inputs to manufacturing units to prepare the paints in the composition required by the clients.

When it comes to chemical transportation, the entire movement of products needs to be planned carefully. Some of the companies in the sector may even need a cold chain network to manage the storage and freight of the products. Temperature monitoring solutions along with highly advanced GPS telematics software provide real-time information on products and vehicles in transit. Nowadays a variety of devices are available in the market with both wired and portable setups that can be used for own as well as market vehicles to ensure complete transportation visibility.

Safety of the drivers and vehicles is another important factor when considering tracking solutions. AI and ML-based solutions continuously gather data and anticipate potential risks even before the incidents happen. Few other features that cater to safety are SOS button installation, instant alerts and communication, night and continuous driving alerts for drivers, maps enabled with nearby safety services, and many more.

AI-led supply chain optimisation software is the best solution when it comes to route and load management of vehicles. Managing the distribution of chemicals involves strong planning of packaging, loading, and even optimising the routes for faster and timely deliveries. All these technologies when implemented well can definitely contribute to reduced logistics costs and better operating efficiencies of the supply chains.

Another important area that needs technological assistance in the chemical industry



is inventory management. Unmanaged inventory is costly and in this case, even hazardous to nature if not disposed of properly. So, both higher and lower production gets difficult to manage physically and financially. Almost all companies have individual ERPs and WMS software that work to maintain optimum inventory levels, what is crucial here is the successful software integration of all the management solutions on one single platform to handle product schedules from predicting production to achieving deliveries.

AI AND ML FOR CHEMICAL SUPPLY CHAINS

The role of technology doesn't end here with process automation in chemical supply chains. AI and ML driven software continuously stores data of all products and processes, conducts in-depth analysis on process performance and provides intelligent ac-

tionable insights to improve overall supply chain performance. Along with operational efficiencies, these solutions can also help maintain compliance regulations throughout chemical logistics. Such solutions provide access to real-time data, dashboards and instant reports to monitor and manage logistics and supply chain operations. By adopting cloud technologies, companies can work on the existing data while capturing new information, thus saving time to create complex compositions of chemicals. Control tower solutions for chemical industries can thus be great enablers in saving logistics costs and increasing the overall supply chain productivity. Hence, all the key focus areas of the chemical supply chain - efficient production models, lower transportation costs, and greater safety and reliability, can be undeniably achieved with the help of AI-enabled solutions. ■



ADDING MORE SPECIALTY CHEMICAL PRODUCTS



DR. RAFI SHAIK
FOUNDER
CABANIO.COM

The Quantico Group investment will drive business development and marketing, chemical manufacturers' onboarding, deploying innovative technologies, and streamlining operational processes thereby taking the company to the next level

2022 global trends in online chemical business and its implications on India?

As the chemical industry moves into 2022, there is a strong demand for both commodity and specialty chemicals. Chemical manufacturers are gradually adopting digital technologies across various areas such as manufacturing operations, product development, pricing, supply chain, and market expansion.

The industry will experience increased capital expenditure (Capex) as leading industry players are focusing on building capacities and expanding into growing the industry through both organic and inorganic routes. However, the industry could face margin pressures amid raw material cost inflation which will remain high throughout the first half of 2022.

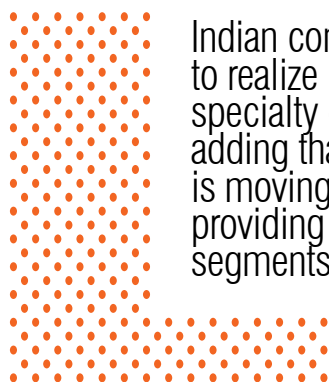
What's the size of the online chemical business in India with respect

to FY 2022-23 and areas where it is growing?

The pandemic shook the chemical industry just as it did other sectors and in H1 FY22, the majority of companies witnessed a slump in their operating margins and looking for a new opportunity in the wake of COVID-19. According to market research companies, the digital chemical industry market size in India was valued at US \$27.1 billion in 2021, and it is expected to reach US \$162.7 billion in 2030, recording a promising CAGR of 21.4% from 2022 to 2030.

Asia promises to be an attractive market for specialty chemicals globally and India presents a growing opportunity for local players. Indian companies need to ramp up readiness to realize maximum advantage from the specialty chemical sector's growth potential, adding that the market in specialty chemicals is moving to Asia with strong tailwinds providing growth momentum across the forty segments that make up the market.

The specialty chemical segments in India - Agrochemicals, surfactants, specialty polymers, textile chemicals, and dyes are among the top segments expected to maintain relative leadership and further grow in line with market demand. Cosmetic chemicals, adhesives and sealants, flavours and fragrances, printing inks, food additives, and water management chemicals are a few emerging segments expected to grow fast through online sales and thereby increasing the market size in FY 2022-23.



Indian companies need to ramp up readiness to realize maximum advantage from the specialty chemical sector's growth potential, adding that the market in specialty chemicals is moving to Asia with strong tailwinds providing growth momentum across the forty segments that make up the market.

Q What is the current product base of Carbanio? What's your future plan to increase product base to give it a pan-India presence?

Carbanio is India's leading B2B chemical marketplace and we have all the categories of chemical products with respect to the chemical industry. We are focusing on adding more specialty chemical products from chemical manufacturers across India. To achieve this, we are now digitizing all chemical clusters in India. India has excellent chemical clusters which lend themselves to digitization to create a bigger product base for Carbanio.

Q Recently, the company has raised US \$1.3 million led by Quantico Group. How are you planning to utilize this fund?

Our recent funding adds more strength to our digital-led disruption in the chemical industry. The Quantico Group investment will drive business development and marketing, chemical manufacturers' onboarding, deploying innovative technologies, and streamlining operational processes thereby taking the company to the next level. With current funding, we are adding more team members and expanding our reach in Telangana, Maharashtra, and Gujarat.

Q When are you planning to raise the next round of funding? What would be the likely amount?

Carbanio, a leading B2B chemical marketplace has been growing strongly over the last four years, in particular with increased demand due to the pandemic, and has a strong value proposition. Our current focus remains on growth and maximizing its network effects. We expect to soon begin raising Series A funding for the next phase of growth.

Q How are you planning to leverage partnerships with educational institutes? Are you planning to sign any new partnerships?

As a B2B chemical marketplace, we have



business users and academic organisations. Till now academic organisations are using age-old processes for ordering chemical products through enquiry, quotation, and negotiation process.

Carbanio now offers digital solutions to avoid lengthy process of enquiry, quotation, negotiation, and providing convenience to order chemicals 65% lesser than market price in a few clicks. With this big digital disruption now more than 1,300 research organisations including IITs, NITs, IISER, and universities are directly ordering chemicals through Carbanio.

Q You have launched CarbanioPlus. How will this product be helpful for research institutions and facilities provided to institutes?

CarbanioPlus is Artificial Intelligence (AI) enabled custom manufacturing solution for niche and complex chemicals. CarbanioPlus, an extended arm of Carbanio.com is an integrated network of global manufacturers aligned with stringent processes using robust and advanced technology helping clients globally achieve the new chemical manufacturing in a shorter timeline.

Carbanio has millions of chemical products and thousands of trusted chemical manufacturers across India. Now we are leveraging their manufacturing capacity by using our advanced

Artificial Intelligence (AI). Chemical businesses often require customized chemicals, however, finding the right manufacturer is always a challenge. CarbanioPlus, a technology driven integrated manufacturing network, offers one-stop solution for quick solution and custom manufacturing chemical needs.

Q Are you also planning to go international? if yes, countries and sectors where you are initially focusing on?

Yes, we are planning to go international soon. Before we start our international operation, we would like to reach all the chemical companies in India. Digital technology has established itself as a lever to enhance efficiency and productivity. Many companies worldwide are embracing digital potential; India's companies could also tap into this opportunity to expand their profit margins.

In addition, India is the largest manufacturing hub for chemicals to global organisations. So, before we focus on the international market, we would like to strengthen our digital supply chain across India to provide uninterrupted support to global business.

Currently, we are having a strong network of global chemical manufacturers and clientele from 17 countries including, USA, Australia, Europe, and Middle East. ■



KEEPING INVENTORY FOR THREE MONTHS TO AVOID SHORTAGES AND LOSS OF SALES VOLUME

Brenntag has plans to invest in warehouse facilities closer to customers in North India to help service the market better



ALOK SHARMAN
REGIONAL DIRECTOR – SOUTH ASIA
& MANAGING DIRECTOR – INDIA
BRENNTAG INGREDIENTS INDIA PVT. LTD.

? What are the global trends in chemicals and ingredient distribution business in 2022 and how do you see its implication on India?

Chemicals: Key trends in chemicals are leaning towards natural, organic, sustainable, biodegradable, low/zero carbon footprint chemicals. Customers have started moving up the value chain.

The supply situation of key chemicals and ingredients is expected to remain tight in 2022 due to global logistic challenges and the current geopolitical situation, as a result of the Russia-Ukraine crisis amongst others. For example, crude derivatives form 30–45% of raw material costs for paint companies. A rise in crude oil and currency depreciation adds to the pressure of the price of raw materials and therefore profitability of paint companies.

To counter continuing supply challenges, organisations will have to be working strategically to put up the right business continuity plans in place. Distribution companies with a global footprint like Brenntag can potentially provide partial relief to supply challenges by alternate sourcing, demand forecasting and end-to-end supply chain services. Service excellence is also a key tool for differentiation for us, along with value-added offerings like blending solutions, repackaging, etc.

Food ingredients: Globally, we are seeing Generation Z and Baby Boomers become increasingly focused on improving mental wellbeing and managing stress through their

nutrition. Stay-at-home lifestyle during the pandemic has impacted food behaviour. 32% of consumers globally have cooked or baked at home and increased their snacking at home as well. Fresh, local, and traditional foods are getting priority in this environment and are expected to remain strong as their multiple benefits hit home with consumers. Better ingredients, authenticity and better nutrition are a key focus of consumers' buying decisions. Many also look at natural ingredients in the labels. Other trends are: reductions (sugar, salt, etc.), control (immunity boosters), and enriched positive effects (gut health through fibre, protein, vitamins, and minerals).

India is catching up with global trends due to increased customer's preference for healthy alternatives and people becoming more nutrition conscious. Key trends in India are in line with global mega trends – plant-based products, tech to table, gut health, back to roots, and amplified experience (food as entertainment). Additionally, food processors are focusing on greener and cleaner India. Some companies claim they are water positive, carbon positive, solid waste recycling positive for over 10 years. Others are giving 100% commitment to use reused and compostable packaging.

Also, sustainability and health are driving veganism as a key trend, as it is seen as healthier and better for the planet. Consumers are increasingly looking for plant-based alternatives to meat and dairy. Increased options in quick service restaurant food chains also include menus with vegan options. For consumers, food safety, health aspects and nutritional content are becoming top purchasing preferences.

? How are you trying to minimize supply chain constraints in 2022?

Brenntag India mainly imports chemicals from Asian countries. The challenge we faced during the pandemic was the shortage of containers for handling cargo. We have started keeping inventory for three months to avoid shortages and loss of sales volume and market share.

Another major problem many companies face is the non-availability of transportation infrastructure across multiple emerging economies. Brenntag India has warehouses at multiple locations stretching from North-South, to West-East to cater to our local customers.

Digital platforms bring chemical distributors, manufacturers, and consumers together and provide suitable solutions. Brenntag India has already embraced a digital/e-commerce platform – Brenntag Connect – to receive customer enquiries, orders, searching products and pricing inquiries, viewing and downloading documents, tracking shipments, etc. thus reducing turnaround time in these internal processes. Brenntag India customers can now register and start adding chemicals and ingredients to their shopping carts on Brenntag Connect available on our website.

? Key learnings during the pandemic and how do you plan to move ahead in future with respect to supply chain challenges?

Freight prices increased by three times during the pandemic and there was a shortage of containers. The world was not at all prepared for handling such a scenario. Brenntag employees worked tirelessly to ensure the continuity of business for us and our customers and have had outstanding business results with the support of our key business and supply partners. We plan to move ahead in the future by having better forecasts and building enough inventory to meet our business requirements.

? How has Brenntag India performed both in the Essentials and Specialties Business Units?



Since 2020, the Brenntag operating model has included two global divisions, Brenntag Specialties and Brenntag Essentials, with a distinct market approach addressing the changing needs of our business partners. With our transformation program “Project Brenntag” we are laying solid foundations for sustainable organic earnings growth and even stronger partnerships with our customers and suppliers.

Brenntag Specialties division is focused on performance chemicals and ingredients, which tend to enhance performance of the manufacturing process and end products. Hence, they are directly used in the production of customer’s end products. The key factor behind the growth of specialty chemicals is that they are more consumer-centric and are designed for specific applications to manufacture end-use products as compared to commodity chemicals. Thus, they offer higher growth rates, although the volumes of the specialty chemicals are generally lower than commodity chemicals.

Brenntag Essentials division is the agile, lean, and most efficient partner of choice for our customers in local geographies for high volume delivery, which requires local market knowhow, creates a strong Brenntag brand recognition and works in markets with high barriers to entry. The operating model is complemented by a distinct go-to-market approach with globally harmonized and ad-

vanced customer segmentation, in addition to a focused sales organization geared to customer requirements.

Both Brenntag Essentials and Brenntag Specialties have performed above budget for the year 2021 with Brenntag Specialties being the larger part in the Indian market.

? What is the role of Brenntag's Regional Hub of Asia Pacific in ensuring centralized coordination between regional suppliers and India specific sites?

The Regional Hub as a single point of contact for Asia Pacific supply chains helps reduce traditional complexities. With it, suppliers have one regional point of contact for supply chain issues and receive forecasts and full-container load orders. Customers feel assured with stock availability in Asia and have reduced lead time for regular product orders.

Brenntag also has a global sourcing arm called Global Sourcing Organization (GSO), which provides access to industrial and specialty chemicals from emerging markets like China, India, Korea, Taiwan, and Southeast Asia whilst ensuring quality, reliability, sustainability and in compliance with Brenntag standards. Brenntag India has the second largest team of GSO in Asia Pacific, second to China.

From the Regional Hub, GSO and procurement arms of Brenntag Essentials and Brenntag Specialties business units coordinate to facilitate supplier products to Brenntag India sites.



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The Indian food processing industry is having a robust double-digit growth. We plan to grow in line with a continued solution-based approach, leveraging Brenntag's global knowledge and local application expertise with application development centres.

Q The company has signed a distribution agreement with Elementis in Asia Pacific. What are your India plans?

The relationship with Elementis in India aims to explore new opportunities by having a deeper understanding of the market and changing customer needs, and by partnering in localization and innovation. Brenntag will set up a Coatings Applications Development Centre near Mumbai to support customers and offer them our technical application capabilities. The team is super excited and is looking forward to creating more value for customers in India.

Q What are the new initiatives being planned by Brenntag India and Capex allocation for the same?

Being a chemical and ingredients distribution company, Brenntag has plans to invest in warehouse facilities closer to customers in North India to help service the market better. Further blending facilities for Food, Material Science, Lubricants along with Material Science application laboratory are also being planned.

Q What is your business outlook for the Indian market in 2022? How are you planning to achieve it during the year?

A strong increase in demand is noticeable after two years of subdued demand during the pandemic. We are aligning our portfolio to market demand, and plan to stay invested in key industry trends.

The Indian food processing industry is having a robust double-digit growth. We plan to grow in line with a continued solution-based approach, leveraging Brenntag's global knowledge and local application expertise with application development centres.

At Brenntag, we apply a customer segment approach - offering the right technological and commercial expertise and specific value proposition. Furthermore, Brenntag India continues to invest in human capital and build a great workplace culture. In fact, we have been again certified as a Great Place to Work.

Q How do you address sustainability issues? Any key initiatives in the Indian context in 2022?

Sustainability is a fundamental part of Brenntag's corporate strategy, a constant business driver and an integral part of Brenntag's corporate culture.

Brenntag's key role in the value chain offers huge potential, but also entails an obligation to contribute towards greater sustainability in the industry.

Safety is the highest priority at Brenntag, both for our employees as well as our customers and partners. Brenntag India strives to ensure bringing down the TRIR (Total Recordable Injury Rate). There exist strict management and safety standards across all Brenntag India sites. We are engaged in various environmental activities like tree planting, opting for paperless offices, solar powered offices, as well as using split ACs instead of central air conditioning. Further plans are to ensure that the new warehouse we are soliciting in North India will meet our sustainability parameters.

Q Brenntag has committed to switching its electricity consumption completely to green electricity by 2025 under the global RE100 initiative. What are your India plans?

We are committed to the principles of Responsible Care and Responsible Distribution. The Brenntag India office in Gurgaon has already implemented a solar powered office set-up. We also follow natural lighting at our warehouses. We believe in staying in proximity with our local customers, so by optimizing both the distance to the customer and transport requirements, we will also lower CO2 emissions and improve our environmental footprint.

Q Is Brenntag India planning any acquisition for increasing its market share in India?

Both organic and inorganic growth have been integral parts of Brenntag's strategy. In 2018, Brenntag acquired Raj Petro, which has turned out to be a very successful acquisition. Similarly, we will always be interested in distribution and value-addition service companies which will provide synergy to the growth of Brenntag India. ■

Special Initiatives 2022

E-CONFERENCES

JAN	1.	Chemical Industry Outlook 2022
	2.	Chemical Logistics: Developing the Right Chemistry
	3.	Sustainability, Climate Change, and Carbon Neutrality
FEB	4.	Demystifying Budget 2022
	5.	Ports: Enabling Growth of Chemical industry
	6.	Petrochemicals: Positioning India as Hub
MARCH	7.	Digitalization: Driving Growth in Chemical Industry
	8.	Chemical Industry Reimagined: Vision 2034
	9.	Redesigning PCPIR for India's Growth
APRIL	10.	Indian Chemical Industry: Mergers & Acquisitions
	11.	Petrochemicals: Managing Growth, Resilience, and Building Sustainable Future
	12.	Agrochemicals: Developing a Competitive Landscape
MAY	13.	Increasing role of Carbon Capture, Utilisation and Storage (CCUS)
	14.	Plastic Recycling and Circular Economy
	15.	Specialty Chemicals: Growing Share of India in Global Market
JUNE	16.	Industrial and Protective Coatings: Challenges and Opportunities
	17.	Importance of HSE in chemical industry
	18.	Hydrogen: Energising the Energy Ecosystem
JULY	19.	Construction Chemicals: Fuelling Growth of Chemical Industry
	20.	EV/Battery: Changing Landscape of Urban Mobility
	21.	Role of CSR in Chemical Industry
AUG	22.	Paints & Coatings: Challenges and Opportunities
	23.	R&D: Critical Components for India's Success
	24.	Importance of Occupational Safety & Health for Chemical Industry
SEP	25.	Battery: The Buzzword
	26.	Shifting Landscape of Chemicals in Global Market
	27.	Chemical Industry: Achieving Net Zero Carbon
OCT	27.	Innovation, Ingenuity, and Collaboration in Petrochemical Industry
	28.	Adhesives and Sealants: Challenges and Opportunities
NOV	29.	New Trends in Chemical Technology Processing
	30.	Increased role of EPC Players in Chemical Industry
DEC	31.	Green Chemistry: Putting India a Step Ahead
	32.	Dye & Dye Stuffs: Challenges and Opportunities

EDITORIAL SPECIALS

JAN	Specialty Chemicals/Alkali Chemicals
FEB	Supply Chain & Logistics
MAR	Petrochemicals
APR	Chemical Technology Processing & Technology/EPC
MAY	Agrochemicals
JUN	Digitization/Digitalization
JUL	Hydrogen
AUG	Paints & Coatings
SEP	Dye & Dye Stuffs/Textile Chemicals
OCT	Feedstock/Gas/LNG
NOV	Sustainability/Occupational Safety & Health/Responsible Care
DEC	Adhesives and Sealants

EVENTS

JULY	NextGen Chemicals & Petrochemicals Summit 2022	Virtual
AUG	Supply Chain & Logistics Summit 2022	Physical
SEP	Agrochemicals Summit 2022	Physical
NOV	Petrochemicals Summit 2022	Physical
DEC	Paints & Coatings Summit 2022	Physical

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ONE NATION, ONE LOGISTICS

Logistics will continue to play an important role and the Mantra is Analyse, Identify, Plan, Viability through Ecosystem (AIPV). There should be an information platform, where each member in the Logistics and Supply Chain needs to be part of the platform



NIVEDAN SAHANI
ADVISOR - IT & TELECOM

Logistics & Supply Chain are the key differentiators in a substantial geographical presence in India across all verticals as it has the second largest population in the world. Starting from the neighbourhood kirana shop to large manufacturers are dependent on the timely supply to end consumers/customers. If we don't address these challenges effectively, in an integrated approach using Logistics & Supply Chain effectively and timely, the cost of production and supply chain increases, which affects the bottom line of manufacturing companies. As per estimates, approximately 14-17% amount is spent on Logistics & Supply Chain starting from raw materials to finished product.

The Logistics & Supply Chain challenges can be addressed through integrated approach and through skilled manpower on ground. It is being observed that in the absence of skill and trained manpower there is a substantial unseen cost added to manufacturing organisation. There are many industries, like petroleum, chemical, and healthcare that have different challenges on logistics and government regulations and without skilled/trained manpower there will always be revenue add on Logistics & Supply Chain.

The government initiatives under "Made In India" and "Make In India" is and will be a big boost to manufacturing industries. We need to create a collaborative approach to position India in the top three position and upcoming manufacturing hub so we have to improve Logistics & Supply Chain considerably in the country.

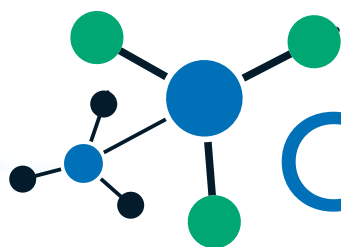
The government is spending and will be spending on infrastructure to support manufacturing industries. We have approximately 136,440 Km national highway road

infrastructure and 224 ports are operational. Industries need to adopt a collaborative ecosystems approach, investing on skill/trained manpower to compete globally.

Recent studies have shown adoption of an ineffective logistics model attributing high cost particularly on road transportation. We can address this problem by adopting information and communication technologies. If we take the example of Walmart stores, each product itself gives alerts for automatically generating purchase orders when it reaches a certain level of sold out items. There are multiple suppliers getting alerts about exact quantity, product details, and expected delivery time. We hardly see any customers coming out of the store for "Out of Stock" reasons. It looks very easy but it is possible because of logistic technologies. This is the reason they are still the number one outlet store globally with highest customer satisfaction. We need to take into account that Walmart sells everything, not only household items.

Have you ever walked into a McDonald's, Pizza Hut, KFC, Starbucks, and Burger King and saw a signboard "We don't have Bugger, Pizza Base, Chicken, Coffee or Ice cream" as we have not received our materials? They manage thousands of outlets worldwide without a single day of non-availability of materials, how is it possible? The answer is robust supply chain platform deployment and technology adoption by the company.

We can see our own domestic oil & gas public sector organisation and we have not seen any petrol pump stating we have no oil to fill your tank. All this is due to their supply chain adoption. It starts from importing crude oil to refineries to depot and then to oil out-



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- Shift Towards Green And Non-fossil Fuel
- Increase In Mergers, Partnerships, and Acquisitions
- Innovations to Drive Growth
- Digitalization & Industry 4.0 Gaining Momentum
- ESG Becoming Mainstream

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lets. Please visualise starting of placing the orders for procurement of crude oil till you fill your tank.

If we all want to see government Make In India initiatives to be successful, private organisations need to play an extremely important role and responsibility. We need to take a top-bottom approach, it starts from large manufactures (high end) to mid-market to MSME to unorganised sectors. The approach should be How from Where (HfW).

The How from Where (HfM) foundation starts with the supply chain and its integration with logistics. Any manufacturing organisation knows their business but the big question is how they need to optimise the cost and from where? These can be addressed, if they are part of larger ecosystems.

How we need to be part of larger ecosystems and to address HfM, seeds need to be planted by the high end market segment by inviting mid-market, MSME, unorganised sectors to be part of ecosystems automatically through MSME or sectors enablers.

This can be only possible by adoption of technologies and market understanding. Bottlenecks are that we do not adopt or accept

change and that kills our traditional business model versus new business model (adoption gaps). If we sit back and analyse what we have done or what we are doing will clear the smoke glass and show you a mirror but unfortunately we don't accept it (reasons known to industries).

Recommending the following for an efficient Logistics & Supply Chain Model.

1. Revisiting your traditional working methods
2. Looking at where your organisation stand continuing with the traditional models
3. Creating 3-5 years vision plan
4. Identifying the gaps
5. Planning how to bridge those gaps

The first set is to be part of an ecosystem or create ecosystems, if you look at Amazon or Alibaba they created the ecosystems and therefore they are big. If the industry manages to reduce Logistics and Supply Chain costs by 2% from 14% of revenue figures, the number will speak for itself.

Logistics will play an important role and will continue to play till industries exist and the Mantra is Analyse, Identify, Plan, Viability through Ecosystem (AIPV). There should be an information platform, where each member

in the Logistics and Supply Chain needs to be part of the platform. This will help entire manufacturing, exporters, carriers, airports, sea ports, road, and inland rivers transporters industries to optimize their assets and resources effectively to address their customers' needs and requirements.

If logistic organisations work towards the RoI (Return on Investment) base model of their business, they will be able to calculate the last penny of their investment, easily identify the gaps, and unutilised assets. Organizations need to update their data on a real time basis for their customers to book their services to meet their requirements. This will be a win-win situation for everybody in supply chain ecosystems. This will help unorganised logistic industries to be part of larger ecosystems.

Starting from the lower end of the market to the top end of the market which will be interconnected and utilising each other's services, in other word cross selling of services till last mile delivery. This will also improve quality of services with healthy competition which improves the bottom line at each stage of the logistic chain. One Nation One Logistic approach is the need of the hour. ■



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Now, with a bigger family



Creating bonds that touch millions of lives



A pioneer in chemicals globally, Aditya Birla Chemicals has leadership positions across product lines with a diversified portfolio of over 1000 products. We partner with our customers to provide path breaking solutions to more than 15 industries. Serving customers across 80 countries, our products are trusted in every segment and touch millions of lives around the world.

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