November 2022

# Sustainability and the chemical industry

## Knowledge paper for India Chem 2022

pwc

INDIA CHEM 2022
2nd - 3rd November 2022
Pragati Maidan, New Delhi

Azadi Ka Amrit Mahotsav

FICCI

# Message from Ministers

डॉ. मनसुख मांडविया
DR. MANSUKH MANDAVIYA

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

स्वास्थ्य एवं परिवार कल्याण
व रसायन एवं उर्वरक मंत्री
भारत सरकार
Minister for Health & Family Welfare
and Chemicals & Fertilizers
Government of India

**MESSAGE**

The chemicals and petrochemicals sector is a very important constituent for the growth of the Indian economy or in general any economy in the world. The government under the dynamic leadership of Hon'ble Prime Minister Narendra Modi is continuously working towards strengthening the sector and working towards making India into a global chemicals and petrochemicals manufacturing hub.

Various initiatives taken by the government like Ease of Doing Business, reforms in the Corporate Tax regime, and support to the MSME sector have made India an attractive destination for investment in the Chemicals & petrochemicals industry. We are also strongly encouraging indigenous production, better R&D and innovation, and collaboration between Industry & Academia. With a strong focus on boosting manufacturing in the country schemes like Production Linked Incentive (PLI) scheme is in the works for the chemical sector to further foster domestic production and exports. Also, recently in order to ensure the safe use of Chemicals in industrial set-up, the Department of Chemicals and Petrochemicals and the International Labour Organisation signed an MoU for adopting the International Chemical Safety Cards. India has adopted global best practices wholeheartedly to ensure the development and welfare of the citizens and to adopt the path of sustainable development with safe & responsible use of chemicals for the nation's growth, development and progress.

The ministry is taking various steps to unlock the tremendous potential of the sector and to make use of India's technological capabilities and skilled workforce. This industry has been an integral part of the global industrial landscape. The government's thrust to promote key end-use sectors, through PLI schemes under Aatmanirbhar Bharat program, such as pharmaceuticals, telecommunication & networking equipment, automobiles, electronics, textiles etc. will drive the demand for chemicals and petrochemicals in the country further and help in fulfilling the vision of achieving USD $ 5 trillion economy at the earliest.

To stand together as one nation, we should focus on our strengths and leverage opportunities that will help us sail and make India an investment destination for global players in the sector. I am sure India Chem 2022 will put a spotlight on India's Vision for 2047 in Chemicals and Petrochemicals and set goals to be achieved within Amrit Kaal.

Best wishes for the successful organization of the event

**(Dr. Mansukh Mandaviya)**

**30 October, 2022**

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# Message from Ministers


भगवंत खुबा
ಭಗವಂತ ಖೂಬಾ
BHAGWANTH KHUBA

रसायन एवं उर्वरक एवं
नवीन एवं नवीकरणीय ऊर्जा राज्य मंत्री
भारत सरकार
Minister of State for
Chemicals & Fertilizers and
New & Renewable Energy
Government of India


31.10.2022

## MESSAGE

The Chemical & Petrochemical (CPC) industry plays a crucial role in country's industrial and agricultural growth. Indian chemical industry has achieved significant milestones in terms of capacity enhancements, employment generation and attracting investment. Currently, chemical industry is on the higher growth trajectory and it is growing even faster than the GDP.

Indian Chemicals and Petrochemicals sector has been making consistent efforts to attain environmental sustainability. This knowledge paper highlights the important aspects related to sustainability such as usage of green hydrogen, plastic recycling, circular economy etc. Government recognizes this sector as one of the growth driver sector which contributes nearly 9.0% to the manufacturing Gross value added and it is anticipated that this share will further increase in future.

The prospects of India's chemical sector are bright and the growth of the sector will be further driven by strong domestic consumption, enhanced purchasing power of the consumers. India has all necessary potential to emerge as global manufacturing hub, which can play a crucial role in global supply chains. The availability of cost-effective skilled manpower and India's rapidly improving policy frameworks are acting as growth enablers.

I am delighted to be a part of India Chem 2022 and I wish this event great success.

**(Bhagwanth Khuba)**


**Chemicals & Fertilizers** : Room No. 315, 'A'-Wing Shastri Bhawan, New Delhi-110001 Tel : 011- 23382364, 23383686, 23381768
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# Message from DCPC

अरूण बरोका, भा.प्र.से.
ARUN BAROKA, IAS

सत्यमेव जयते

सचिव
भारत सरकार
रसायन और उर्वरक मंत्रालय
रसायन और पेट्रोरसायन विभाग
Secretary
Government of India
Ministry of Chemicals & Fertilizers
Department of Chemicals & Petrochemicals

**MESSAGE**

It is my privilege to be a part of India Chem 2022 and to be associated with National and International industry representatives under one umbrella. India is an enticing hub for chemical companies and is one of the most significant contributors to the growth and development of any economy. Basic chemicals and their related products, not only constitute a significant part of Indian economy, but also indicate the pace of growth in the economy. To provide a secured and reliable supply chain to the world, the chemical sector in India has a scope for significant growth. India ranks at sixth globally, and fourth in Asia in terms of global sales of chemicals. More than 80,000 varieties of chemical and petrochemical products are manufactured in our country and the industry employs over two million people. India is the fourth largest producer of agro-chemicals globally and exports about 50% of its production.

Indian Chemical & Petrochemical industry have huge potential which needs to be harnessed. Government of India is extending all-out support to give impetus to this industry. Government of India has taken several initiatives which will support the growth of chemical industry in India. 'Make in India' is one of such initiative, meant to foster growth in Indian chemical industry with the objective of improving the competitiveness of domestic manufacturing, attracting investments, and enabling exports. Also, to address the major issue on the availability of petrochemical feedstock, Government has overhauled the previous PCPIR policy and is taking active steps to make necessary amendments.

India Chem 2022, organised by Department of Chemicals and Petrochemicals (DCPC), Government of India in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) is an ideal platform to deliberate upon the strategic interventions required to make the sector Aatmanirbhar and convert challenges into opportunities.

I wish the event all the success and look forward to useful insights by the stakeholders.

(Arun Baroka)

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# Message from FICCI

**Arun Chawla**
Director General, FICCI

The Indian chemical industry is an important and growing constituent of the country's economy. Encompassing 80,000 commercial products, the Indian chemical sector is highly diversified and provides a variety of raw materials for a number of key industries. The industry employs more than two million people and has a significant role to play in making India a USD 5 trillion economy.

The Department of Chemicals and Petrochemicals, GoI, has introduced several significant regulatory and policy initiatives to facilitate and boost the development of this sector. As a result, India's chemical sector is on a robust growth trajectory. The market size of the chemical and petrochemical sector in India is expected to grow from the present valuation of around USD 178 billion to USD 300 billion by 2025 as per the last India Chem 2021 knowledge paper. Compared to other countries, India has emerged as an attractive business destination for the global chemical industry on the basis of multiple critical parameters.

I am delighted that the Department of Chemicals and Petrochemicals, GoI, in association with FICCI, is organising the 12th edition of India Chem 2022. I am confident that this event will accelerate the momentum of developments in the country's chemical and petrochemical sector and help in attracting further investments.

On this occasion, FICCI is pleased to present a report on 'sustainability and the chemical industry'. Although the concept of sustainability has gained prominence in most industries today, it has been an area of focus for the chemical industry for a while now. Due to the inherent nature of chemicals, their use has always been subject to regulations. As sustainability plays a crucial role in their development and usage, this report highlights sustainable solutioning for the chemical industry. We thank PwC, our knowledge partner, for contributing to this report. I hope you will find this to be a useful read.

I wish the event a great success and hope all the participants will benefit immensely from it.

# Message from FICCI

**Prabh Das**
Chairman, FICCI National Petrochemicals Committee, and
Managing Director and CEO, HPCL-Mittal Energy Limited

The chemical and petrochemical industry is a key contributor to the social and economic development of our country. The Indian economy has been resilient over the last couple of years. As the country continues on its growth trajectory – aided by Government policies aimed at improving ease of doing business, increasing self-sufficiency and boosting incremental manufacturing output – the chemical and petrochemical industry stands ready to contribute to this growth.

The petrochemical industry is in a unique situation as it faces four challenges. These challenges are elevated energy prices, broader trends to cut emissions, substantial reform of the production process to aid the initiative to cut emissions, and operations in the post-pandemic environment. As with any challenges, these bring us opportunities which can be leveraged to redefine our industry in the years to come.

Post-pandemic, the recovery of the Indian economy, particularly the manufacturing sector, is helping the industry weather the storm. Central banks around the world continue to hike interest rates to control inflation, which seems likely to persist for the short-term. This has also raised fears of a sharp downturn in global demand due to reduced economic activity. In this scenario, margins are likely to be under pressure. Therefore, in future, only companies that build a competitive advantage in carbon management and are able to come up with new business models, will be successful.

Focusing on carbon management is imperative not only from the perspective of adhering to regulations or changes in the global business environment, but also its ability to act as a key enabler for business longevity in our industry.

Security of supply is increasingly becoming a topic of concern across the world. Owing to the pandemic and geopolitical disturbances, the fragility of global supply chains has, once again, come to the forefront. In a world in which the trade of chemicals, intermediates, plastics, fertilisers, specialty chemicals and pharmaceuticals has assumed geopolitical importance, it is perhaps time to challenge ourselves and make our industry not only self-sufficient but also a global petrochemical hub.

At HMEL, we are committed to India's growth story. We have made domestic investments in setting up refining capacities of 11.3 million MT per annum and 467 KT per annum in polypropylene. We are bullish on the opportunities for the petrochemical industry and in the process of commissioning a 1.2 million MT per annum cracker complex in Punjab, with an additional capacity of manufacturing 1,200 KT per annum of polyethylene and 500 KT per annum of polypropylene. We are committed to our net zero goal and pursuing many decarbonisation projects. We are setting up a bio-refinery to produce bioethanol for fuel blending. We are also in the advanced stages of discussion for projects on renewable energy and plastic waste recycling. We believe that these investments will be key enablers for our growth, and we are glad to be able to energise a better tomorrow for all of us.

I am happy to note that the Department of Chemicals and Petrochemicals under the Ministry of Chemicals and Fertilizers, Government of India (GoI) along with FICCI is organising the 12th edition of 'India Chem 2022'.I hope that the summit attendees will find the insights shared in this knowledge paper helpful.

# Message from FICCI

**Deepak C Mehta**
Chairman, FICCI National Chemical Committee, and Chairman and Managing Director, Deepak Nitrite Ltd

The year 2022 is turning out to be a seminal one for India. The nation has completed 75 years of its political independence and has become the fifth-largest economy in the world, surpassing that of the United Kingdom.[1]

The future outlook remains positive. The International Monetary Fund (IMF) has forecasted GDP growth of 7.4% in 2022,[2] and has projected that the economy shall climb to the fourth spot by 2027, overtaking that of Germany.[3]

However, the macroeconomic view doesn't look as promising. No sooner did the world emerge from the COVID-19 pandemic than unforeseen economic headwinds began blowing over the global markets.

The effects of supply chain disruptions and high inflation have become even more pronounced, as geopolitical tremors from the Russia–Ukraine conflict continue to agitate commodities and threaten energy and food security.

Access to liquidity is becoming increasingly challenging, as central banks remain on course for an extended period of tightening monetary policy. A global recession might become a reality in the coming year.

Amid these numerous uncertainties, India stands tall as a safe haven for investors, and promises economic outperformance for many decades to come. The chemical and petrochemical (CPC) sector holds tremendous potential to spearhead India's next phase of resurgence as an economic superpower.

India's per capita consumption of chemical products is at a mere USD 91. It is a far cry from the corresponding figure in China and the US, where it stands at over USD 1,200.[4] The Indian CPC industry continues to grow robustly at a compound annual growth rate (CAGR) of over 9%,[5] compared to the overall global chemical production growth of 3.5% for 2022.[6]

The CPC industry accounted for around 9% of India's manufacturing gross value added (GVA) and 1.3% of its national GVA in FY 2020–21. Chemical manufacturing accounted for 1.4% of the total foreign direct investment (FDI) equity inflows in FY 2021–22.[7]

Reports suggest that the Indian specialty chemical industry shall outpace its Chinese counterpart and double its share of the global market to nearly 6% by 2026 from 3–4% in FY 2021–22.[8] These projections instil a sense of confidence that the sector is ready to 'Make in India' for the world. I strongly believe that the rise of the CPC sector has all the necessary ingredients to inspire a manufacturing renaissance in India.

As the world shifts its gaze towards India, we are witnessing an unprecedented chemical revolution that has all hands on deck – be it the Government, markets or scientific communities. The Petroleum, Chemicals and Petrochemicals Investment Region (PCPIR) policy, followed by 100% FDI allowance under the automatic route, are distinct measures that shall boost an ecosystem of entrepreneurship and innovation.

The Production Linked Incentive (PLI) scheme for a myriad of sectors, most of which are directly dependent on chemicals, is poised to unlock the huge latent domestic demand of an aspirational India.

1 https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?most_recent_value_desc=true&year_high_desc=true

2 https://www.imf.org/en/Countries/IND#

3 https://www.weforum.org/agenda/2022/09/india-uk-fifth-largest-economy-world/

4 https://www.hdfcsec.com/hsl.docs//Indian%20Chemical%20-%20Steering%20well%20through%20the%20pandemic%20-%20HSIE-20210124163951746947 2.pdf

5 https://www.ibef.org/industry/chemical-industry-india

6 https://report.basf.com/2021/en/managements-report/forecast/economic-environment/chemical-industry.html

7 https://www.pwc.in/assets/pdfs/industries/oil-and-gas/publications/evolving-horizons-indian-chemical-and-petrochemical-industry.pdf

8 https://www.crisil.com/en/home/newsroom/press-releases/2022/03/india-to-double-specialty-chemicals-market-share-in-5-years.html

On the one hand, the CPC sector is scaling up in sync with the prime minister's clarion call for an 'Atmanirbhar Bharat', and on the other, the PLI scheme is paving the way for robust demand from downstream and end-user sunrise and emerging sectors. These sectors deal with battery and storage applications, electric vehicles (EVs), solar PV cells, semiconductors and space technologies.

In my opinion, the most pertinent theme for the CPC sector's 'Vision 2030' shall be the industry's transition towards decarbonisation and a circular economy. In this regard, hydrogen presents an opportunity for significant progress, as does deep integration of intelligent automation.

The incumbent vantage point demands that the industry innovate considerably to gain a competitive advantage. As the lines blur between the physical and virtual worlds, leveraging digital ecosystems for predictive analysis and process automations can provide rich returns. These could be in terms of real-time data access, data transparency, scalability and, most importantly, reducing direct human interface in factory environments.

For India to accelerate further, it is imperative that all sectors directly or indirectly impacting the economy are in sync and continue to perform well. The nation has been a food bowl of the world owing to its diverse agro-climatic system. It is also a leading global technology services hub. With its unmatched socioeconomic fundamentals, political stability and a free market economy, India is well poised to become a global manufacturing and commercial hub for chemicals by 2030.

# Foreword

**Deepak Mahurkar**
Partner and Leader
India Oil and Gas Industry practice
PwC India

This year marks the 150th anniversary for PwC in India. Against the backdrop of this milestone, PwC is proud to associate with FICCI as the knowledge partner for India Chem 2022.

Given recent developments in the world, the global chemical and petrochemical industry has undergone a significant transition. For India, however, several opportunities have emerged, and these can be leveraged to overcome global challenges that are leading to supply chain and feedstock constraints.

India Chem 2022 will serve as a great platform for stakeholders from the industry to meet and collaborate. PwC is delighted to have supported the Department of Chemicals and Petrochemicals under the Ministry of Chemicals and Fertilizers and FICCI in organising the FICCI Chemicals and Petrochemicals Awards 2022 and preparing a knowledge paper.

This paper highlights the strides made by the industry towards fulfilling environmental sustainability requirements. Moreover, the industry is poised to take on the global challenge of reducing GHG emissions and leverage new opportunities in the market to combat the issue of global warming. Apart from these aspects, this paper discusses India's role in the future evolution of the chemical and petrochemical industry.

Wishing India Chem 2022 a grand success!

# Foreword

**Manoj Mehta**
Director and Head – Chemicals, Petrochemicals, Agrochemicals and Civil Aviation, FICCI

The Indian CPC industry has grown significantly in the last 75 years, demonstrating its importance for the growth of the agricultural and industrial sectors. This knowledge paper discusses the growth potential of the chemical and petrochemical industry with the theme 'Vision 2030: Chemicals and Petrochemicals Build India'. It also analyses the investment opportunities in the chemical segments and the Government's progressive efforts to promote investments and improve the country's Ease of Doing Business (EoDB) ranking. The self-reliance and sustainability factors are also presented in the paper.

As you are aware, India has come a long way to become the sixth-largest economy in the world in chemical sales. India's key advantage over other economies is its demographic dividend and rapidly growing middle class with higher spending power. This makes it a consumption-driven economy. Although doing business in India has its own challenges, the Government has introduced several structural reforms to make it conducive for foreign companies to invest in the country. The GoI is supporting this industry by introducing several initiatives (e.g. 'Make in India') to improve the competitiveness of domestic manufacturing, attract investments and enable exports.

India is positively placed for multi-year growth over the next few years across the entire CPC value chain. The GoI's initiatives have improved India's performance in the EoDB ranking. Also, to address a major issue on the availability of petrochemical feedstock, the Government has overhauled the previous PCPIR policy and is taking active steps to make necessary amendments, which will soon be implemented to support and advance the downstream industries.

I wish India Chem 2022 a grand success.

# Contents

# Sustainability and the chemical industry

## How sustainability creates value

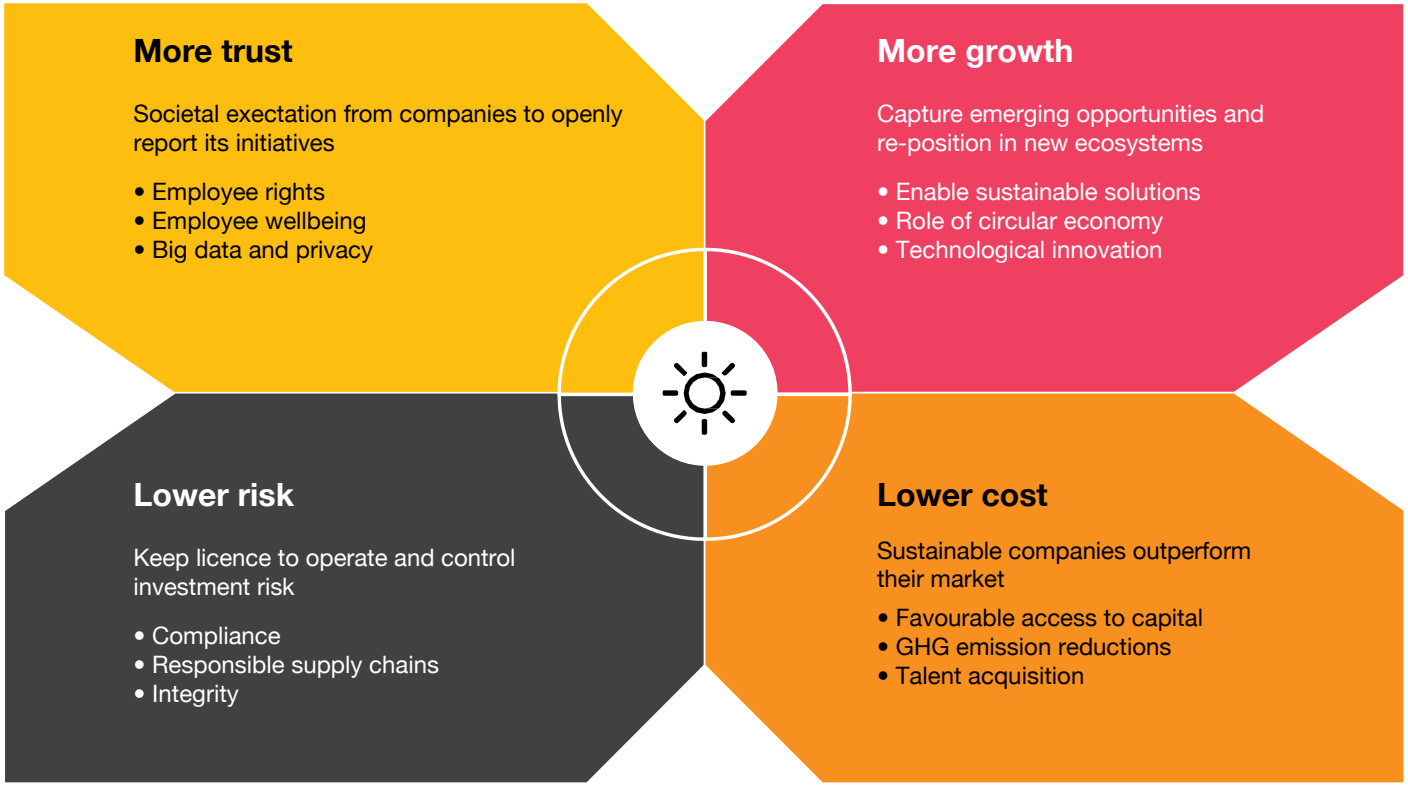
PwC's 23rd Annual Global CEO Survey revealed that 58% of the CEOs in the chemical industry were already planning investments focused on sustainability in 2019–20.[9] This development underscores the significance of sustainability in the chemicals sector and its importance for value creation.

Sustainability creates:

### More trust

Today, consumers are consciously supporting and choosing companies that are organised in an environment-friendly and socially responsible manner (which includes their supply chain). Sustainable companies, with the right reporting and mindset, enable more trust among consumers. Specifically, Gen Z prefers working with organisations built on environmental, social and governance (ESG) principles and actively supports communities that work towards social causes.

Figure 1: The ways of value creation




**Source:** PwC analysis

9 https://www.pwc.com/gx/en/ceo-survey/2020/reports/pwc-23rd-global-ceo-survey.pdf

## Lower cost

Sustainability helps to increase valuation. In a competitive capital market with a constant demand for high returns, sustainability is being perceived as a differentiator. Therefore, companies focusing on sustainability have a lower cost of capital and better chance of being prioritised by investors (including private equity investors), often earning the right to price themselves at a premium.

## More growth

The shift towards sustainability requires the adoption of circular business models, use of renewable feedstocks, and reuse and recycling of end-of-life products. Companies leveraging such opportunities will have considerable growth prospects and the option to re-position themselves in new business ecosystems. Moreover, companies that explore digital technology solutions to increase resource productivity will have the upper hand in the competitive market.

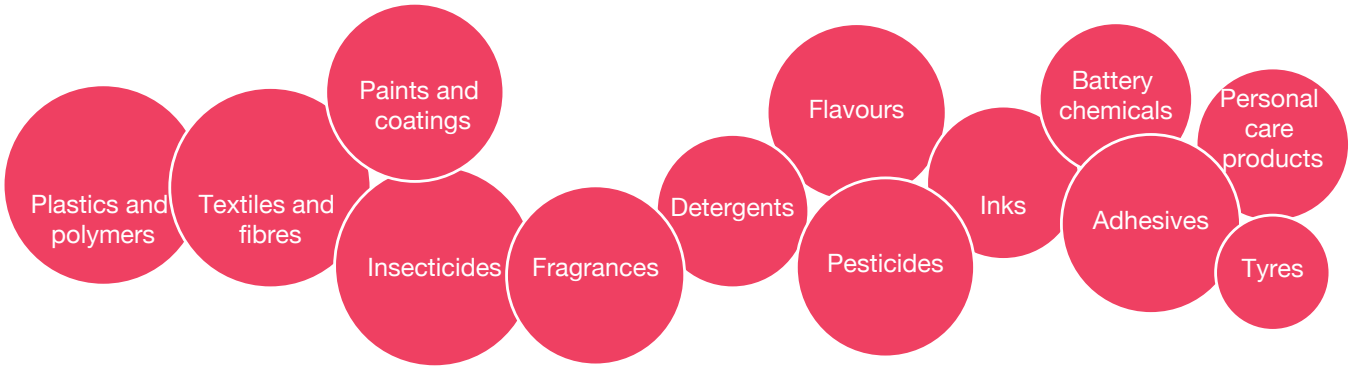
## Lower risk

Companies with ingrained sustainability principles have a well-defined environment and health and safety management policies that are aligned with profit goals. Moreover, regulatory compliance ensures a lower risk of operational failure, occupational hazards and accidents.

## Value of the chemical industry

The chemical industry and its ability to understand and modify the interaction of different elements in order to produce desired commercial products, has significantly contributed to the development of human life. The industry contributes significantly to almost every key area of human development – be it food, healthcare or energy. The industry has been constantly responding to needs of growing population ranging from access to food to medical care to increased connectivity by providing us with (developments across) fertilisers, pesticides, pharmaceuticals, plastics, insulation, wiring, battery chemicals, adhesives, etc.

Figure 2: Chemicals used in day-to-day life



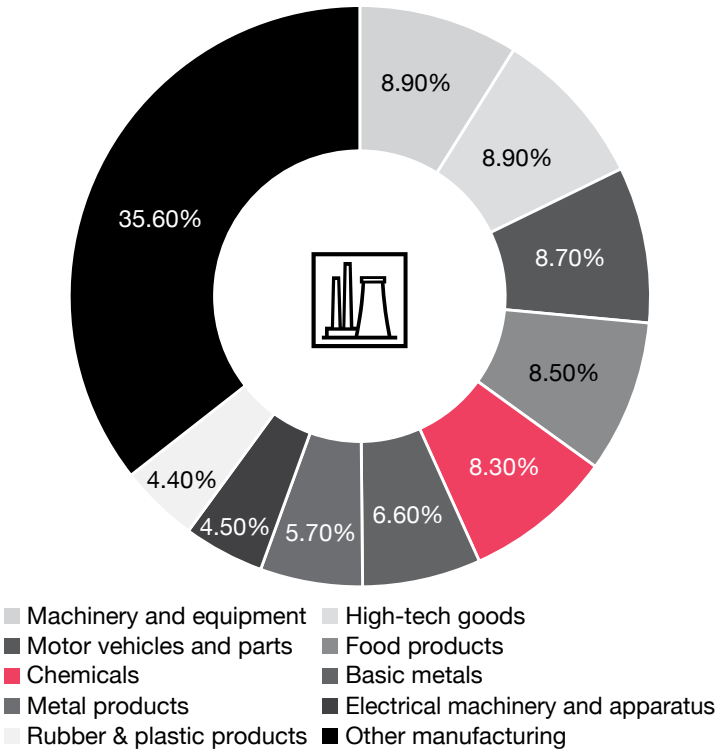

**Source:** PwC research

The chemical industry has strong backward and forward linkages and is the mainstay of agricultural and industrial development. It is the fifth-largest manufacturing sector and covers more than 95% of the good manufacturing sectors, contributing to the development of the economy. In 2017, its contribution to the global gross domestic product (GDP) was estimated to be USD 5.7 trillion (including direct, indirect and induced impacts) which is equivalent to 7.1% of the world's total GDP.

Economic growth has always been the major objective of all countries across the board. However, a singular focus on growth has resulted in the exploitation of natural resources and environmental degradation. As this growth is unsustainable, global industries are now finding ways to focus both on the economic development agenda and environmental protection.

The chemical industry has always been at the forefront in providing solutions to rising global concerns, like climate change and the energy crisis. It can help create a pathway to a sustainable future by developing eco-friendly products using green resources and resource-efficient technologies. Additionally, the industry has the potential to introduce innovative climate and energy strategies across the industrial manufacturing value chain, and thus reduce the carbon footprint. There is a growing focus on decarbonisation and recycling technologies in order to achieve climate-neutrality goals and transition towards a circular economy.

**Figure 3:** Contribution of the chemicals to global manufacturing GDP – 2017




**Source:** https://icca-chem.org/wp-content/uploads/2020/10/Catalyzing-Growth-and-Addressing-Our-Worlds-Sustainability-Challenges-Report.pdf

**Figure 4:** Impact of the chemical industry on global industrial and economic growth – 2017

**Direct impact**

**Activity of the global chemical industry itself**

1. Added USD 1.1 trillion to the global GDP and employed 15 million people.
2. Accounted for 8.3% gross value added (GVA) of the total global manufacturing.

**Indirect impact**

**Activities of other industries that are supported by the procurement of goods and services from the chemical industry**

1. Every dollar generated by the chemical industry generated a further USD 4.20 elsewhere in the global economy.
2. Invested USD 51 billion in R&D, supporting 1.7 million jobs and USD 92 billion in economic activity.

**Induced impact**

**Activities of other industries which are supported by the spending of chemical industry's workforce and workers in its supply chain**

3. Spent USD 3 trillion on goods and services, which contributed USD 2.6 trillion to global GDP and 60 million jobs.
4. Supported labour income of USD 939 billion and USD 779 billion through indirect and payroll-induced channels respectively.

**Source:** https://icca-chem.org/wp-content/uploads/2020/10/Catalyzing-Growth-and-Addressing-Our-Worlds-Sustainability-Challenges-Report.pdf

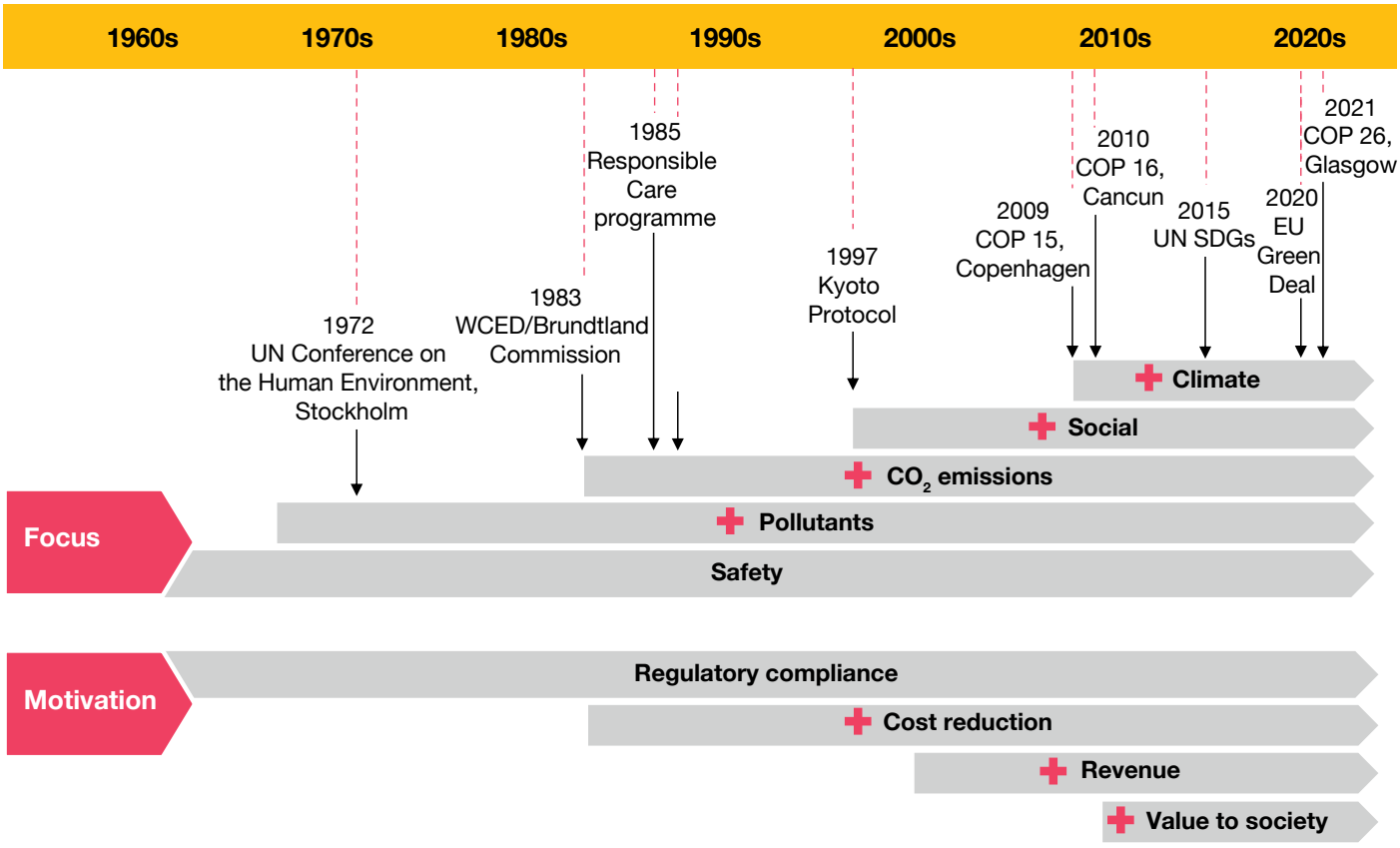
# Sustainability focus of the chemical industry

The increasing sustainability focus of the industry can be attributed to the implementation of stricter regulations over the past six to seven decades. Although the concept of sustainability has gained importance in most industries today, it became an area of focus for the chemical industry much earlier. Due to the inherent nature of chemicals, their use has always been subject to regulations. Moreover, sustainability plays a crucial role in their development and usage.

## The evolution of the chemical industry's sustainability focus

The introduction and focus on safety measures in chemical manufacturing operations dates back to the 1960s. The United Nations Conference on the Human Environment, held in Stockholm in 1972, was the first world conference to place environmental issues at the forefront of international concerns. This led to the creation of the United Nations Environment Programme (UNEP). Later, in 1983, the World Commission on Environment and Development (WCED), also known as the Brundtland Commission, was formed with the objective to direct nations towards the goal of sustainable development. The commission published a report titled 'Our Common Future' in 1987, which introduced a new approach, now termed as 'sustainable development'.[10] The greenhouse effect was one of the important topics highlighted in the report, which shifted the sustainability focus towards emission control, along with safety and environment. In 1985, while the Brundtland Commission was preparing the report, the Chemistry Industry Association of Canada (formerly the Canadian Chemical Producers' Association) started a voluntary initiative in association with various chemical companies across the world called the 'Responsible Care programme'. This initiative, which is practised even today, is a voluntary commitment made by chemical companies to implement environment and safety measures in corporate management policies and business principles. With the rise in the development of the industrial sector, cost reduction and revenue generation in compliance with applicable regulations became the primary focus of the chemical and allied industries.

Figure 5: Evolution of the chemical industry's sustainability focus




**Source:** PwC research

10 https://www.are.admin.ch/dam/are/en/dokumente/nachhaltige_entwicklung/dokumente/bericht/our_ common_futurebrundtlandreport1987.pdf.download.pdf/our_common_futurebrundtlandreport1987.pdf

The twenty-first century witnessed various events formalising global warming as an international issue. The adoption of the Kyoto Protocol in 1997, 15th session of the Conference of Parties at Copenhagen in 2009 (COP 15, Copenhagen) and COP 16, Cancun, in 2010 were some of the noteworthy events. In 2015, all UN member states unanimously adopted the Sustainable Development Agenda accepting 17 Sustainable Development Goals (SDGs), along with 169 targets and policy indicators. Chemical companies have been among the early respondents to such climate change initiatives and sustainability goals. Since then, the Responsible Care programme and UN's Sustainable Development Goals have become the guiding principles for chemical companies and various industry associations around the world in their drive towards sustainability.

Later, in 2020, with the approval of the European Green Deal, the European Commission committed to the goal of achieving net zero emissions in the European Union (EU) by 2050, based on a set of policy initiatives considering the ESG factors. Since then, chemical and allied sector corporations, economies and various bilateral and international agencies across the globe are driving initiatives committed to climate change such as Paris Agreement (COP 21). The objective of the agreement is to limit global warming, preferably to 1.5°C by 2050, compared to the pre-industrial era.[11] This has shifted the focus of the chemical industry towards customer centricity and value creation for society.

## Obligations towards compliances

Owing to the vast size of the chemical industry, wide array of chemistries and product categories, dependence of various customer industries on chemicals, number of direct and indirect employees and their safety and livelihood, it is essential for the industry to have a robust regulatory mechanism in place. Therefore, several regulatory mechanisms of varying stringencies are implemented by the chemical sectors of different countries globally, at national and regional levels.

National and regional compliances are implemented in the form of standards, rules and legislations to enable chemical management.

11 https://unfccc.int/

These include targeting the complete lifecycle of chemicals – beginning with their manufacturing process, until they are disposed or recycled. Chemicals are used by various stakeholders across different sectors during their lifecycle. As a result, chemical companies are compliant with all the cross-sectoral legislations and regulatory frameworks, which are implemented by authorities using various legal instruments and methods. Product registration, its labelling and classification, technical and safety data sheet of product, product-quality inspections, permissions for sale, applicability of licences to operate the chemical plants and discharge waste, waste discharge limits, etc., are some of the legal instruments and ways by which chemical companies are bound.

**Thus, chemical companies must comply with the laws and legislations for:**

- chemical management and handling
- chemical usage
- environmental management
- chemical disaster and emergency management
- special categories of chemicals.

Some large chemical companies and chemical industry associations have gone past the mandatory regulations set forth by the government and are setting more standards for the management of chemicals and adoption of clean technologies (e.g. Responsible Care programme).

While the voluntary measures introduced by industry associations are proactively taken up by larger players, smaller organisations often struggle to go further than the mandatory compliances and are unable to take up voluntary measures. This is primarily because of the limited manpower and availability of resources. While the focus of chemical companies has always been to comply with the regulations, they struggle with unanticipated events such as accidents resulting in release or spillage of chemicals, insufficient control mechanisms leading to pollution, gaps in coordination between government and regulatory agencies, outdated technologies to comply with and support increasingly stringent regulations and unavailability of a trained workforce.

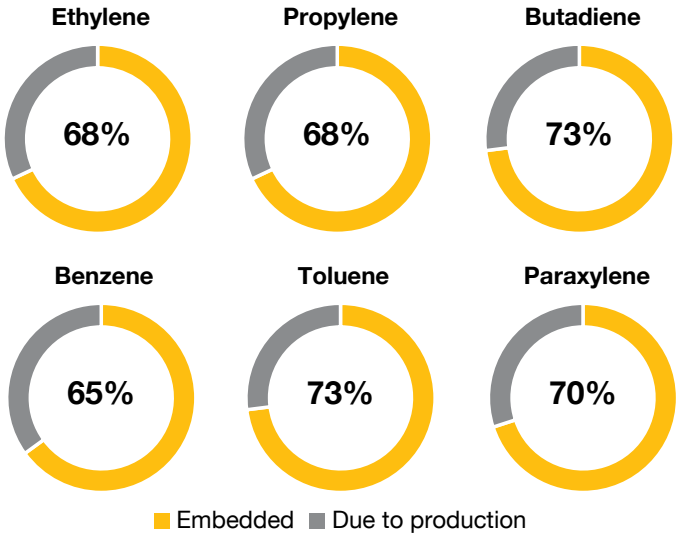
## Challenges due to a carbon-constrained world

As the chemical sector pivots towards a sustainable way of working, feedstock is one area that requires more attention as market undulations often play spoilsport to the industry's aspirations.

### Embedded carbon footprint

Crude oil and natural gas are the dominant starting materials for petrochemical production. Petrochemical production accounts for nearly 14% and 8% of the global demand for oil and gas respectively.[12] Basic petrochemical feedstocks (e.g. olefins- ethylene, propylene, butadiene; aromatics- benzene, toluene and xylene) are the origin points for a majority of the chemical value chains. Although petroleum products and hydrocarbons (other than petrochemicals) account for a major share of the global oil demand today, petrochemicals are expected to change the global oil demand mix significantly. The demand for petrochemicals is estimated to have a compound annual growth rate (CAGR) of 2.5–5% as compared to the demand of other hydrocarbons/ petroleum products, which have a CAGR of 0–2%.[13]

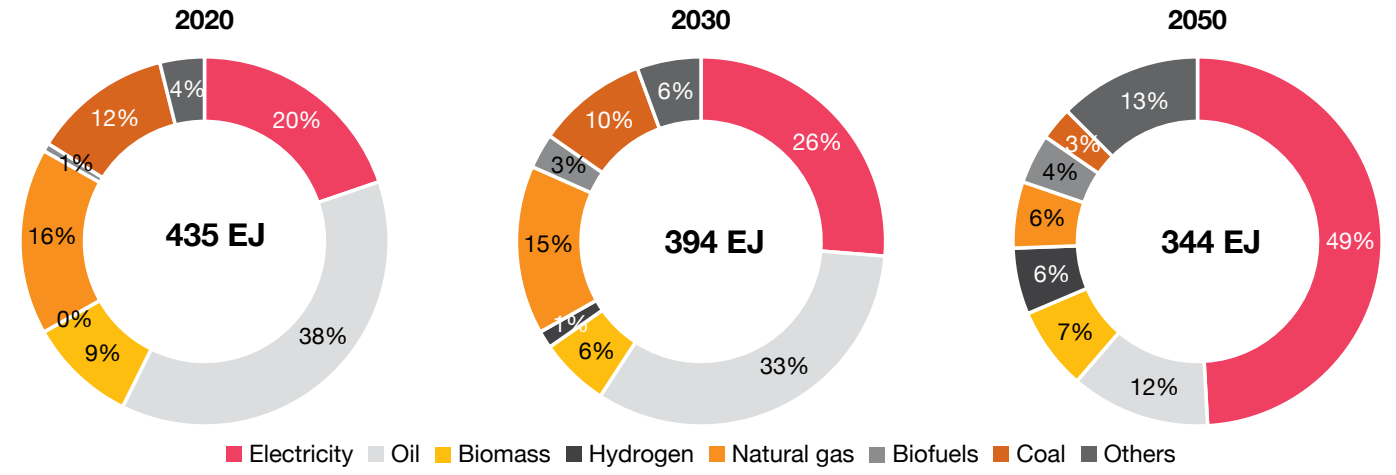
Figure 6: Embedded carbon footprint of key petrochemical feedstocks




**Source:** www.renewablecarbon.eu

While oil and gas are and will remain important for the chemical industry, they also bring in about two-third of the embedded carbon footprint.[14] This embedded fossil-based carbon footprint eventually results into $CO_2$ emissions along the lifecycle of various petrochemicals and chemicals produced. From a sustainability standpoint, if the inflow of embedded carbon and related $CO_2$ emissions is prevented, the overall $CO_2$ content in the atmosphere will no longer increase. Since carbon is an important constituent for majority of the chemicals, decarbonisation from a chemistry perspective is considerably difficult. As a result, preventing the inflow of fossil-based carbon with viable non-fossil alternatives such as biomass, $CO/CO_2$ utilisation and recycling, is the solution. Renewable carbon obtained from biomass and recycling can together contribute to approximately 15% supply of the non-fossil carbon. However, this has a limited supply potential due to land scarcity, biodiversity loss and recycling inefficiencies. On the other hand, renewable carbon from captured $CO_2$ holds unlimited supply potential, but its contribution is currently very low.

Figure 7: World energy demand (net zero scenario)




**Source:** https://www.iea.org/data-and-statistics/data-tools/net-zero-by-2050-data-explorer

Although some applications of non-fossil carbon alternatives may not be completely sustainable, the applications of fossil-based carbon will remain unsustainable. It is thus imperative for the chemical industry to de-fossilise the carbon and transition into renewable carbon with its circular utilisation.

12 https://ec.europa.eu/energy/sites/ener/files/documents/iea-the_future_of_petrochemicals.pdf

13 PwC analysis for select petrochemical feedstocks and hydrocarbons

14 vom Berg, C. and Carus, M. et al. 2022: Renewable Carbon as a Guiding Principle for Sustainable Carbon Cycles

## Tightened oil and gas supply

Despite the residual impacts of the COVID-19 pandemic, especially due to China's stringent lockdown measures, the demand for oil and gas rebounded. However, the slowdown in investments for asset development during the pandemic, accelerated energy transition theme during the pandemic, the reluctance of the major oil-producing countries to raise production levels despite demand, and most recently, the ongoing geopolitical situation, have resulted in a tight supply market – both for crude oil and natural gas.

Owing to this, ongoing production as well as further field developments will be under pressure because of the increasing energy transition focus and pressure from the sustainability-focused investor groups for oil and gas companies. The major oil-producing group of countries have also been thinking on the phased increase in production levels for crude oil as many of its members have reduced their production targets. Moreover, the group has been conservative about the pace of demand recovery. The supply situation has been further exacerbated by the ongoing geopolitical conflicts.

As geopolitics increasingly plays a significant role in the market, all end-use sectors – including the chemical industry – will have to be cognisant of these supply disruptions and realign their sourcing strategies in a resource-constrained world.

## Volatile oil and gas prices

Crude oil and natural gas prices have risen to historic heights, fuelled by a pace of recovery in various parts of the world, which was not anticipated by the experts. The upward spiral of prices was further aided by supply disruptions – with the most recent one being the ongoing war and crises in the west. A recent announcement for production cuts by 2 million barrels per day (bpd) despite strong demand will also contribute towards the sustained high-price environment for the two energy commodities.

Therefore, it is expected that energy prices are likely to remain high as long as supply side uncertainties are prevalent – at least for the near to mid-term future. For the long term, in the event of lower or non-investments for further exploration and development of production assets and the growing demand – especially from the non-OECD economies – it will be very unlikely that the commodity prices reduce in a supply-constrained environment.

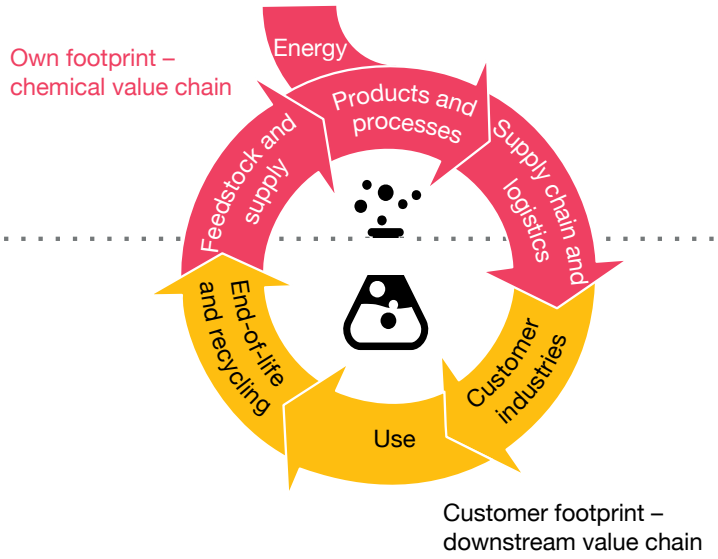
Eventually, it is to be determined which industries can afford such high input costs and continue to deliver sustained value to the consumers.

## How can the chemical industry enable sustainable solutioning?

The last two decades have seen global sustainability trends gather increasing momentum due to climate change, resource scarcity and development of digital technologies. These trends have also influenced customer buying behaviour. Climate change and resource scarcity have led to increased raw material price volatility and tighter environmental regulations. Further, advancements in digital technologies have enabled the development of affordable tracking tools/mechanisms and communication systems, which have now become the norm. Customers are increasingly demanding environment-friendly and socially responsible products which do not add to their carbon footprint. At the same time, they expect organisations to improve the overall performance and efficiency of their manufacturing setups.

The chemical industry is quite well positioned to respond to such trends and address sustainability issues pertaining to its own footprint. As a key intermediary, the chemical industry can influence sustainability and innovation across its value chain to respond to both regulatory and customer requirements. With its products, customer industries can drive innovation in their manufacturing processes and products.

Figure 8: Chemicals value chain




| Customer industries | Chemicals |
|---|---|
| **Nutrition supplements** | • Vitamins<br>• Amino acids |
| **Pharma and healthcare** | • Pharma excipients<br>• Specialty solvents |
| **Hygiene and cleaning** | • Emollients<br>• Emulsifiers |
| **Packaging** | • Pigments<br>• Polymers |
| **Agriculture** | • Surfactants<br>• Technicals |
| **Energy** | • Polysilicon/silicon<br>• Epoxy |
| **Construction** | • Pigments<br>• Polymers |
| **Automotive/transportation** | • Pigments<br>• Gearbox and motor oil |
| **Consumer products** (non-food) | • Dyes<br>• Polymers |

**Source:** PwC analysis

## Example: The automotive industry

The automotive industry is undergoing a rapid transition from internal combustion (IC) engines to electric engines/ hydrogen fuel cells. Chemicals are a crucial part of this transition, and have applications in various sustainable technologies such as lithium-ion batteries (polymeric liners, electrolytes), fuel cells (polymeric membranes), automotive catalysts (noble metal supports), particulate matter filters (carbon filters/molecular sieves), lightweight and recyclable materials (polyamides, carbon fibre reinforced plastics), thermoelectric engine insulation materials (conducting polymers) and low rolling resistance tires (precipitated silica).

**Table 1 describes the different ways in which chemicals can enable sustainable solutioning of key customer industries.**

Table 1: Potential contributions of chemicals in enabling sustainability in customer industries

Impact scale: High | Medium | Low | No impact

| Contribution to customer industry | Impact | | |
|---|---|---|---|
| | Make their existing products more sustainable by offering more sustainable chemicals. | Produce their products more sustainably. | Develop new products and solutions that are more sustainable when used. |
| **Construction** | Enhance long-term product safety for customers – e.g. minimise volatile organic compounds (VOC) emissions in flooring solutions. | Reduce CO2 emissions during cement production and construction process by mixing new additives. | Save energy and reduce associated costs by using super insulation construction materials. |
| **Metals and mining** | Enhance environmental safety of exploration chemicals to minimise residuals in soil. | Ensure mining wastewater is free of toxic residual when being reintegrated into the water cycle through chemical flocculants. | |
| **Public** | Enable safe access to toxin-free drinking water through professional wastewater treatment chemicals. | | Increase the availability of drinking water in locations with water scarcity through antiscalants and filtration technologies. |
| **Nutrition and health** | • Ensure food remains safe for the consumer for a longer period through innovative preservatives.<br>• Facilitate better public health through affordable vitamins. | Maximise the productivity of arable land through precision farming, environmental friendly pesticides, etc. | Facilitate the health optimisation of individuals by enabling personalised nutrition. |
| **Power and utilities** | | Enable or improve construction, generation, transmission and storage of renewable energy – e.g. materials used for wind turbines (coating), battery cells, liquid organic hydrogen carriers (LOHCs), etc. | Decrease cost of renewable energy by offering perovskite as an alternative for silicone in solar panels. |
| **Automotive and transportation** | Design recyclable interiors (e.g. seat foam, textiles) to eliminate waste and support the development of a fully circular car. | Make the coating process more sustainable by developing a solution that eliminates additional steps. | Reduce fuel and energy consumption by using lightweight materials. |

| | | | |
|---|---|---|---|
| Retails and consumer goods | Improve product safety by reducing or replacing residual toxic substances – e.g. concentration of nickel and mercury in tattoo inks, replace several types of carcinogenic colorants by less/non toxic alternatives. | | Improve customer experience and reduce packaging required by individually packaged laundry detergent in a water-soluble polyvinyl alcohol (PVA) film. |
| Packaging | • Establish bio based and biodegradable plastics.<br>• Replace single use packaging with recycled materials. | • Ensure that the desired paper strength can be achieved with less energy and wood consumption.<br>• Reduce the environmental impact by replacing conventional oxidative bleaching processes. | |

**Source:** PwC research and analysis

## Opportunities for the chemical industry in the climate-conscious world

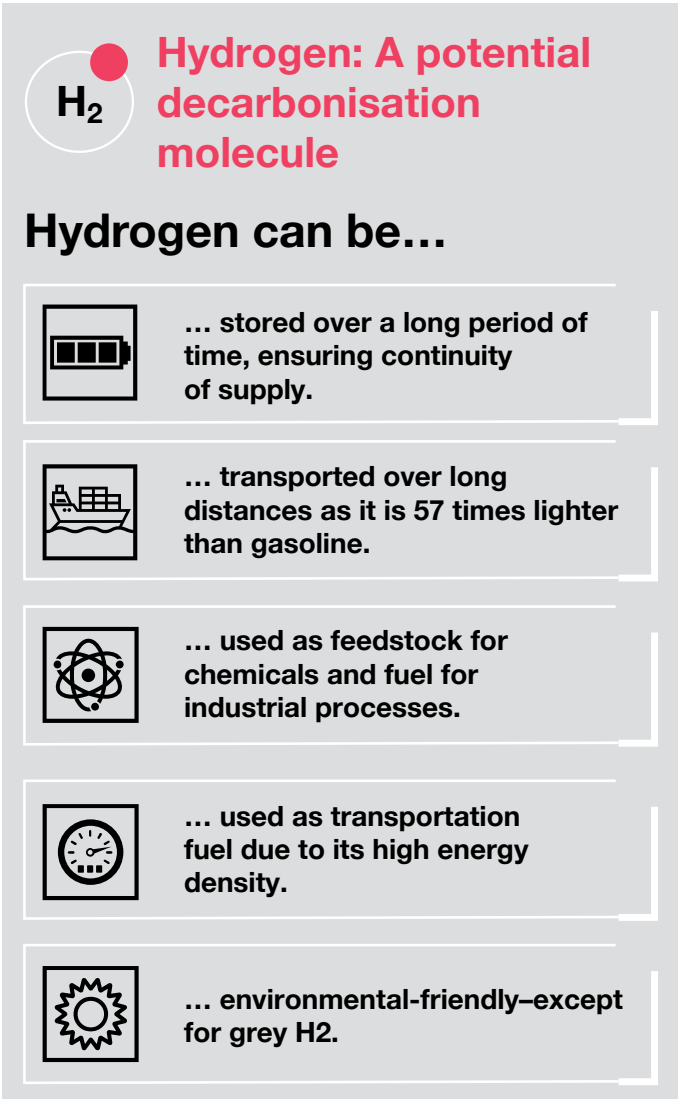
High energy intensity and dependence on fossil-based feedstocks are the key characteristics of the chemical industry. While the world is increasingly becoming conscious about the climate change and sustainability, transition towards clean energy and energy efficiency is making a significant impact on the chemical industry. On the other hand, end consumers and customer industries catered directly or indirectly by the chemical industry ]are also participating in the energy-transition drive, leading to additional pressure. Although this situation is challenging, it offers significantly important opportunities for the chemical sector to become a key partner in supporting customer industries in their energy transition and sustainability journeys. Below are some of the opportunities where chemical companies can play a crucial role to enable sustainability in their own footprint as well as of its customer industries.

### Green hydrogen as chemical feedstock

Hydrogen is an important feedstock for the chemical industry, having applications in the manufacturing of methanol, ammonia and its fertilisers, petrochemicals and chemical process industries. Methanol and ammonia account for over 50% of the global hydrogen demand.[15]

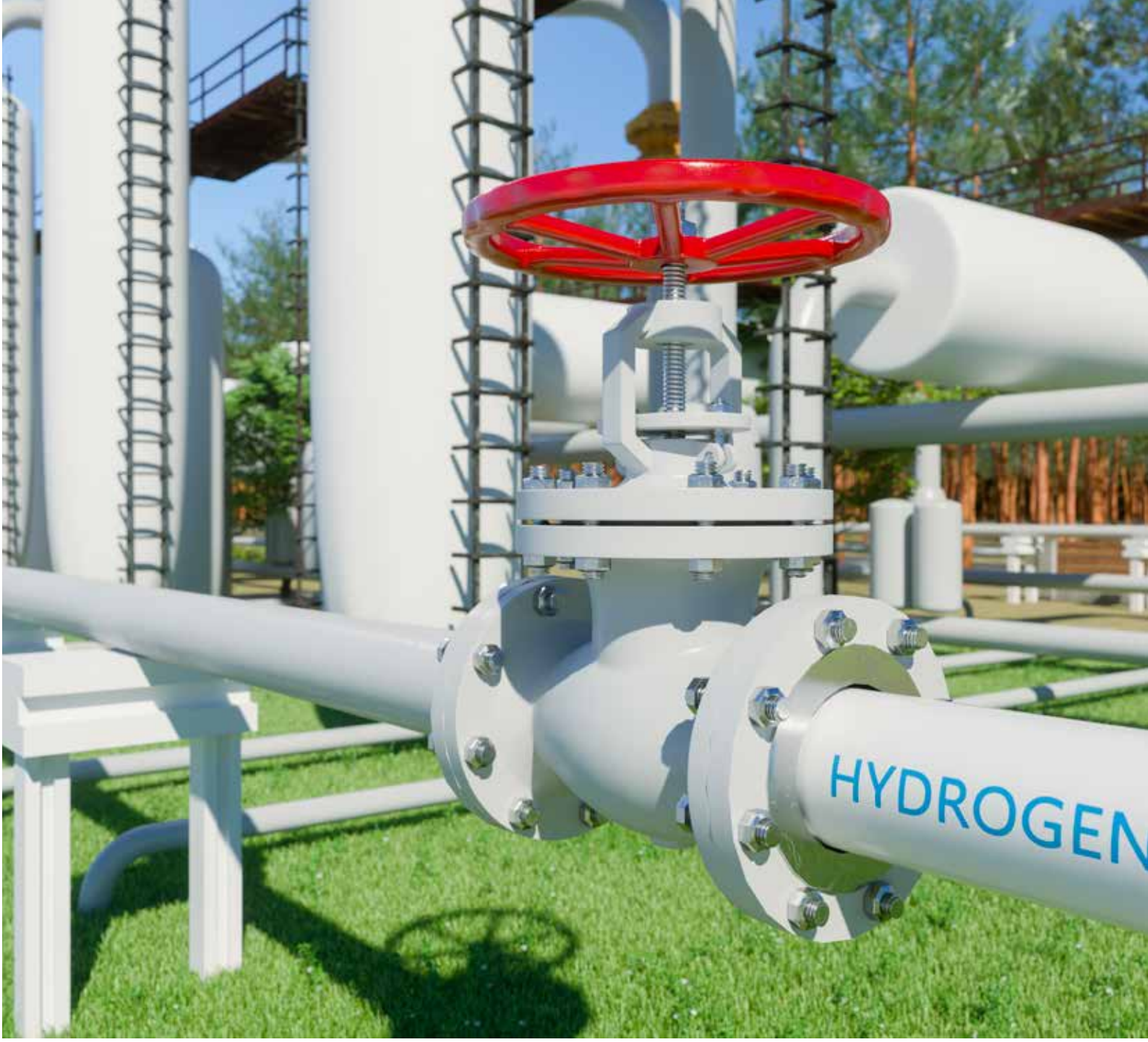
Hydrogen is primarily produced via steam methane reforming of natural gas or naphtha. This hydrogen is termed as grey. The same grey hydrogen is termed as blue if $CO_2$ emitted in the process is captured. Green hydrogen is produced by electrolysis of water using energy generated from solar, wind or other renewable sources resulting in zero $CO_2$ emissions. Although green hydrogen is a promising feedstock for the chemical and allied industries, favourable cost economics for its commercial production as a result of falling renewable energy costs and advancements in electrolyser technology will be the key deciding factor for its offtake.

Figure 9: Characteristics of hydrogen




**Source:** PwC analysis

15 https://www.iea.org/reports/hydrogen




## Manufacturing green ammonia

Ammonia is an important bulk commodity, primarily derived from hydrogen, which has a wide array of applications in the manufacturing of nitrogenous fertilisers, explosives, high-performance plastics, petrochemical intermediates and specialty chemicals. Ammonia is manufactured via the Haber–Bosch process utilising nitrogen from the air and hydrogen from the steam methane reforming of natural gas or gasification of coal. Ammonia production leads to the formation of approximately 1.6–1.8 tonnes of $CO_2$ as a by-product, depending on natural gas or coal as starting feedstock. The chemical industry can significantly reduce its dependence on fossil-based feedstocks by adopting green hydrogen in the manufacturing of ammonia and its derivatives.

Moreover, ammonia is also highly cited for its viability as a green hydrogen carrier. The technicalities and know-how about ammonia usage and handling, in addition to the existing infrastructure for storage and transportation, are the underpinning factors.

In general, a 100-kTpa green ammonia plant would cost around USD 100–150 million, including a polymer electrolyte membrane (PEM) electrolyser having 65% efficiency, and require about 1,050 MWh of renewable electricity. Chemical companies with heavy reliance on ammonia can set-up such facilities and hybrid renewable energy added with battery energy storage system (BESS) banking models can be evaluated for electricity supply.

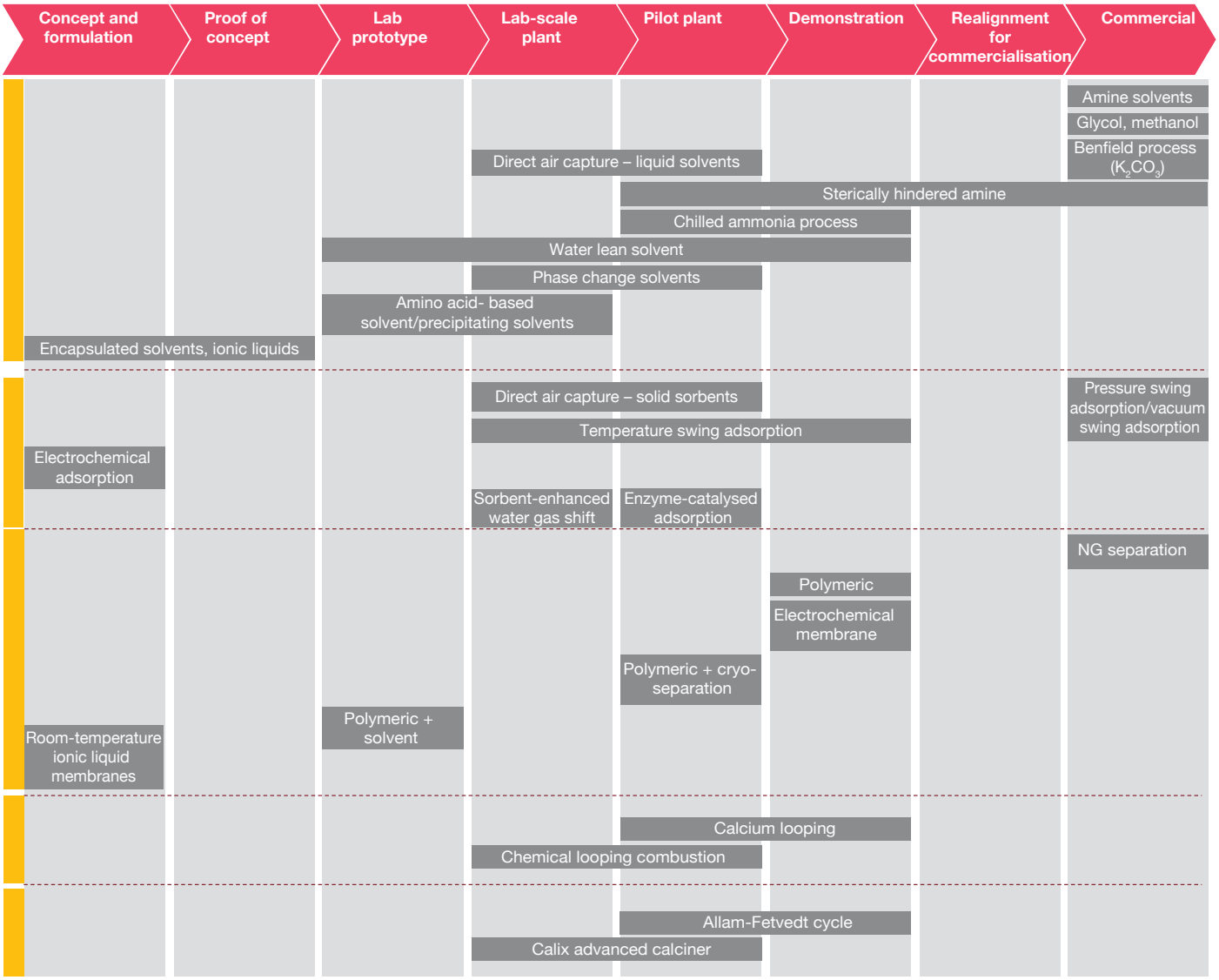
## Carbon capture

With increasing awareness on global warming and climate change, a series of voluntary commitments to net zero targets have echoed in the recent past. In addition to corporates, developed and developing economies are also participating in these commitments. EU and China committed to achieve net zero emissions by 2050 and 2060 respectively whereas, India has committed to achieve the same by 2070. This has led to an increased focus on and developments in carbon capture, sequestration and utilisation (CCSU) technologies. CCSU will play a critical role in enabling decarbonisation, and chemicals will act as an enabler for its successful implementation on a commercial scale.

Chemical solvents and reagents such as methanol, monoethanolamine, potassium carbonate and dimethyl ethers of polyethylene glycol (DEPG) have been in commercial use since decades to capture $CO_2$ during the process of manufacturing ammonia through steam reforming of natural gas or coal gasification. Ammonia manufacturers have been utilising solvent-based $CO_2$ capture methods to produce urea, ammonium bicarbonate or melamine, in which $CO_2$ is a raw material in addition to ammonia. Purification of natural gas and biogas are other applications where $CO_2$ is separated on a commercial scale using cellulose acetate-based membranes and molecular sieves (pressure swing adsorption) respectively.

With a marked focus on decarbonisation, the carbon capture space has witnessed significant developments in the technologies based on the principles of physical or chemical absorption, adsorption and filtration. Although choosing the right carbon capture technology depends on the partial pressure and concentration of $CO_2$ in the inlet gas, liquid chemical solvents, polymeric membranes and inorganic materials/chemicals also have an important role to play in improving the efficiencies and cost of carbon capture.

**Figure 10:** Technology readiness levels of different carbon capture technologies




**Source:** PwC analysis

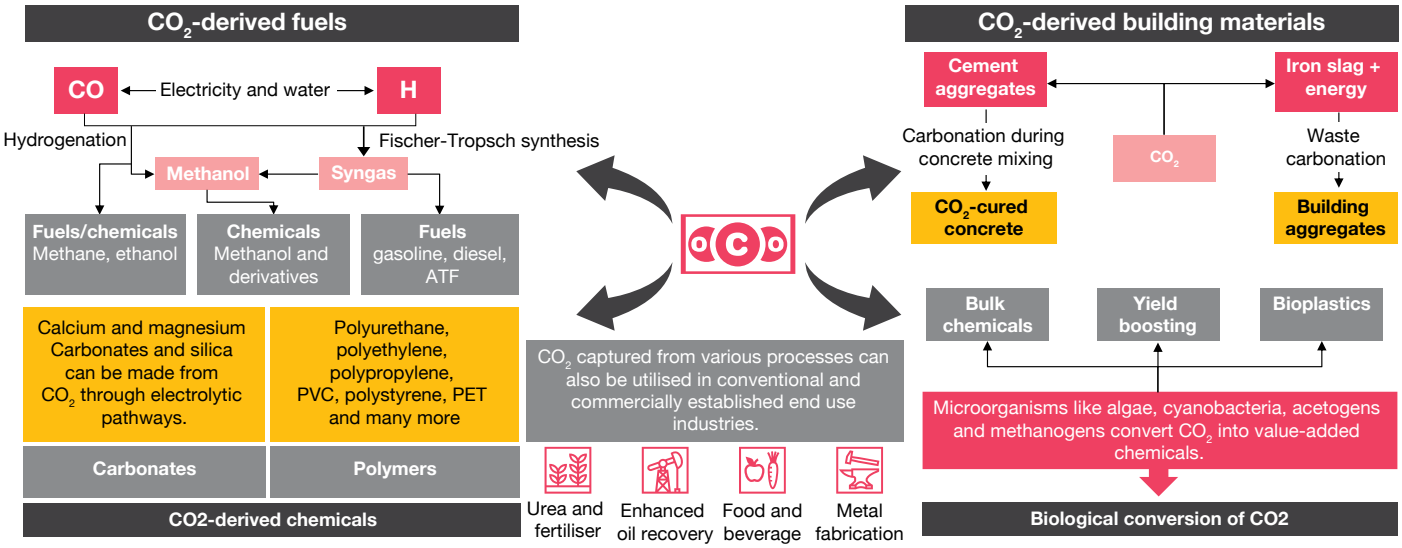
## $CO_2$ conversion to chemicals/products

$CO_2$, which is necessary for the survival of plants and animals, is one of the crucial constituents of nature. About 230 million tonnes of $CO_2$ is consumed annually across the world, with fertilisers and oil and gas (enhanced oil recovery) accounting for approximately 57% and 33% of the total consumption respectively.[16] In the fertiliser segment, $CO_2$ generated during ammonia production is used on-site to make urea, whereas for enhanced oil recovery, it is externally sourced. Carbonated beverages, food (preservatives, refrigerants, packaging, etc.), metal welding, chemical production, healthcare, etc. account for the remaining 10% of the total global demand.

With CCSU emerging as an important option to control global warming and climate change, a new source for $CO_2$ has emerged, inducing renewed interest in $CO_2$ usage. While $CO_2$ usage does not necessarily mean the reduction of $CO_2$ emissions, the scalability of a relevant application that uses low carbon energy and displaces a product having higher lifecycle emissions can be termed as successful use of $CO_2$. There are various pathways for the conversion of $CO_2$ into valuable products such as fuels, carbonates and polymers and building materials. However, these pathways are either in the premature stages of technology readiness, or commercially unviable or hindered by regulatory challenges. From the chemicals standpoint, the conversion of $CO_2$ to methanol and polymers has been highlighted in this paper.

$CO_2$ can be converted into methanol in two ways. One of the methods includes reducing $CO_2$ to carbon monoxide, followed by its reduction with hydrogen. The second method involves the thermos catalytic hydrogenation of $CO_2$ with green hydrogen over a metal oxide catalyst. The second method has proven to be commercially viable, in a 110,000-tonne capacity plant in Iceland.[17] Green hydrogen is used as a reactant here and manufactured using renewable power-based electrolysis. Capturing $CO_2$ emissions, combining it with green hydrogen to produce methanol and feeding it back into the industrial processes as a renewable energy source/ feedstock can enable the circular economy path. The cost of green hydrogen and development of efficient catalysts are the key factors that determine this conversion route. While catalyst development is progressing at a steady pace, chemical companies can proactively participate in contributing to the $CO_2$ to methanol conversion method.

**Figure 11:** Pathways for CO2 conversion to value-added products




**Source:** PwC analysis

The carbon embedded in $CO_2$ can act as a monomer to develop copolymers, replacing the fossil-based raw materials in part/full (e.g. epoxides). Incorporating this, chemical companies are at the forefront to commercialise this use of $CO_2$ to manufacture polycarbonates, poly (propylene carbonate) blend with starch, polyols for polyurethane production, etc. The conversion of $CO_2$ to polymers may be cost competitive as compared to the traditional fossil-based polymers due to the low energy requirements in the process. Moreover, if the cost of $CO_2$ is lowered (compared to the fossil-based feedstocks), this will become yet another factor that contributes to the market competitiveness of the resultant polymers. Today, the market potential for these polymers is quite negligible. However, with increasing consumer awareness, rising decarbonisation drives and developments in CCUS technologies, the future looks promising.

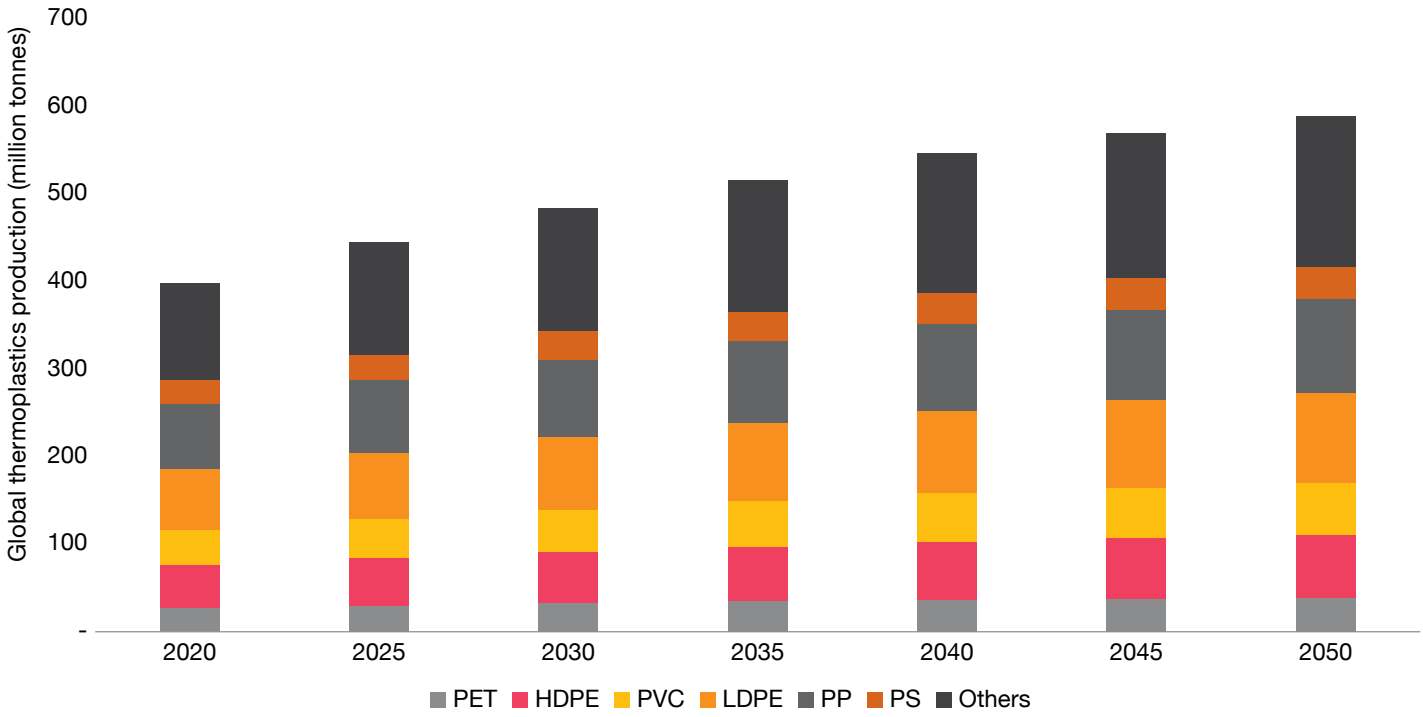
16 https://iea.blob.core.windows.net/assets/50652405-26db-4c41-82dc-c23657893059/Putting_CO2_to_Use.pdf

17 https://www.carbonrecycling.is/technology

## Plastic recycling

Plastics have become an inevitable part of human life and society. Owing to their light weight, durability, water resistance, low cost and mouldable nature, plastics have proved to be essential for mankind, having replaced metal, glass, ceramics, paper and cloth from a wide range of applications. However, an important characteristic of the same – i.e. its low cost – has been the primary reason for its negligent and wasteful handling, which often results in various forms of environmental pollution. A majority of crude-based plastics are non-biodegradable and release gases when burnt in the atmosphere. Therefore, the main problem does not lie in the widespread use of plastics but in its improper segregation and disposal.

Figure 12: World production of thermoplastics, 2020–2050 (million tonnes)




**Source:** https://www.iea.org/data-and-statistics/charts/production-of-key-thermoplastics-1980-2050

The demand for thermoplastics (polyethylene terephthalate [PET], high density polyethylene [HDPE], poly vinyl chloride [PVC], low-density polyethylene [LDPE], polypropylene [PP], polystyrene [PS], etc.) was estimated to be over 400 million tons in 2020. This demand is expected to increase and become close to 600 million tonnes in 2050, growing at a CAGR of nearly 1.5%. Although there are substitutes to plastics – such as biodegradable plastics and biomass-derived polymers – most of them are expensive and not manufactured on a large scale. Moreover, an important challenge faced by the industry in replacing crude-based plastics is the inability to bring down the costs of the environment-friendly alternatives. Therefore, instead of accelerating and scaling up the production of these alternatives, nations around the world are proactively working on ways to reduce the pollution caused by the improper segregation and disposal of plastics. One such initiative is the Extended Producer Responsibility (EPR) defined in the 2001 OECD Guidance as 'an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle'.[18] Today, the EPR policy mandates the producers, brand owners and importers in majority of the countries for the environmental-friendly disposal or recycling of post-consumer plastic waste.

18 https://www.oecd.org/env/extended-producer-responsibility-9789264256385-en.htm

## Key drivers for plastic recycling

**Regulatory push**

- Ambitious binding and non-binding target setting (e.g. India net zero target 2070)
- Limited (even banned) usage of single-use plastic (e.g. ban on single-use plastic from July 2022)
- Increasingly strict regulations on recycling (e.g. compliance with EPR)
- Increasing policies on energy production (e.g. efficiency and usage)

**Changing customer preferences**

- Growing customer markets for substitutes
- Increasing sustainability awareness
- Rising demands of sustainability solutions

## EPR: Strict regulations on recycling

For the first time in early 1990s, the requirements of EPR appeared in Germany, France, Sweden and other European countries. However, the actual implementation of the same took a while due to the inherent challenges of plastic waste collection and segregation and unavailability of scalable technologies to recycle the plastics. Today, at the EU level, all the countries have implemented EPR policy for the four waste streams – packaging, batteries, end-of life vehicles, and electrical and electronic equipment. Moreover, a few additional schemes for recycling of oil, tires, paper, medical waste, etc., are also implemented voluntarily on the top of EPR policy.

The implementation of EPR in the US and Canada is not governed by federal law and is practiced at the state or province level taking into consideration the respective local conditions and political dynamics.

The adoption of EPR in Asia significantly varies across the countries and regions. Among the OECD countries, Japan and the Republic of Korea have established EPR policies supported by stringent monitoring and enforcement frameworks. High-growth economies such as China, Indonesia, India and a few others have recently implemented the EPR policies. However, they are yet to be functional. In India, producers, importers and brand owners are mandated for EPR registration. UAE, Malaysia, Thailand and African countries are also beginning their EPR implementation journeys, although its adoption is purely on a voluntary basis.

## Implications for polymer companies

- The surging demand for petrochemicals is due to an increase in possible applications (e.g. lightweight materials).
- Increasing sustainability awareness and commitment towards ambitious targets (especially the reduction of GHG emissions and waste along the value chain) is leading to a rise in the demand for sustainability solutions.
- The need for disruptive innovations to meet ambitious internal and external targets requires ecosystem collaborations across the supply chain.

Figure 13: Sustainability approaches to prevent plastic pollution


**Source:** PwC analysis

**Figure 14:** Potential applications of recycled thermoplastics


**Source:** PwC

Predominantly, $C_2$ and $C_3$ derivatives can be recovered in different ways to generate environmental and economic value. However, the main issue is the improper segregation and disposal of plastic waste.

# ASPIRE: The mantra to drive the sustainability agenda

## Adapt and adopt sustainability frameworks

In 1985, the International Council of Chemical Associations (ICAA) started the Responsible Care programme. The objective for the same was mainly to promote safe chemical management, environmental health and safety, and encourage chemical companies to contribute to sustainable development. The Responsible Care programme has been adopted globally, and regional chemical associations have taken the lead for the successful implementation of the same. For example, in March 2012, the European Chemical Industry Council (CEFIC) introduced the Sustainable Development Vision based on the principles of the Responsible Care programme. Today, CEFIC is leading the sustainability agenda for the European chemical industry, having further developed sustainability frameworks and a roadmap for implementation.

In India, presently, some chemical companies comply with the principles of Responsible Care. While the journey to sustainability is challenging, a good starting point for the Indian chemical industry could be to align with the Responsible Care programme, along with the National Voluntary Guidelines (NVG) on Social, Environmental and Economic Responsibilities of Business. Some of the areas defined in the Responsible Care programme already overlap with the present NVG. Thus, a chemical industry-specific NVG can be formulated by the Ministry of Corporate Affairs in collaboration with the Ministry of Chemicals and Fertilizers and other industry associations. The same could later be regulated by the Securities and Exchange Board of India (SEBI) and state pollution control boards (PCBs) by appointing a dedicated taskforce. Such initiatives and frameworks can enable companies to engage in and deepen their sustainability commitments.

Figure 15: Mantra to drive the sustainability agenda

| Mantra to drive the sustainability agenda | |
|---|---|
| A | Adapt and adopt sustainability frameworks |
| S | Engage stakeholders |
| P | Prioritise material issues |
| I | Integrate sustainability with core business |
| RE | REport, disclose and communicate |

**Source:** https://www.pwc.in/assets/pdfs/publications/2013/chemical-industry-leadership-on-sustainability-aspire.pdfC

## Engage stakeholders

Currently, sustainability is a popular topic with substantial impact on any company and its stakeholders. Engaging with the internal and external stakeholders of any organisation, beyond routine business needs, helps gather insights around material issues, key requirements and changing preferences. When considering a chemical-specific organisation, it is even more important to deeply engage with stakeholders, owing to the widespread influence of the chemical industry on various customer industries (such as consumer, packaging, agriculture, automotive and construction).

Therefore, keeping track of stakeholder expectations, needs and pain points of an industry's customers/end consumers helps to identify unanticipated risks and untapped opportunities, which forms the basis for future action plans and sustainability strategies.

## Prioritise material issues

Chemical companies must evaluate and prioritise the material issues which are presently affecting or expected to affect a company and its value chain. Although Indian chemical companies are relatively early on their sustainability journey, they should be mindful of the material issues other than those which are prevalent in the domestic market. Thus, it is necessary to account for the sustainability frameworks in order to address the issues which have affected companies in other international markets.

For example, the availability of petrochemical feedstock is presently a challenge for the downstream industries in India. With the shifting focus towards renewable feedstocks in the global markets, feedstock procurement may be an emerging issue. Indian chemical companies looking for diversification should consider such issues while developing their sustainability strategy.

## Integrate sustainability with core business

To sustain a long-lasting and successful business in these changing times, it is imperative for chemical companies to integrate sustainability values in their long-term business strategies, business policies, operational processes and procedures. This will shape and prepare companies to address the changing behaviour and expectations of the internal and external stakeholders, and at the same times, improve competition and profitability.

## Report, disclose, communicate

When companies are in the drive towards sustainability, it is important for them to disclose their sustainability goals and ongoing initiatives to the stakeholders – consumers, investors or value chain partners. Disclosure of such information will help to improve stakeholder relationships and make it easier to manage them. Similarly, reporting sustainability and emissions-related information will enable transparency and create trust between the stakeholders and the organisation. Such organisations are able to build a strong reputation over time, which translates into strong business performance. An organisation that reports, discloses and clearly communicates its sustainability action plan and vision has a clear advantage over others that do not consider these aspects.

# Key success factors to enable sustainability

## Market awareness

- With sustainable chemicals still being in the early stages, a real-time intelligence of the market requirements is required to understand customers' expectations, needs and pain points in order to create a sustained competitive advantage.
- A deep and complex sense of the market will help one to understand how market trends and innovations impact existing and new customers in future.

## Focus on technology

- It is important that chemical companies have a clear focus on **enabling digital solutions to have the transparency,** coordination and insights required to quickly adapt to market changes driven by sustainability transformations.
- Targeted investing in technology will enable and strengthen the capability to **fulfil rapidly changing customer requirements** based on a future value proposition.

## Agile approach

- Chemical companies must develop an **agile approach** to create sustainability plans for evolving target customer circuits.
- A nimble stance will help to **identify other related industries** that are impacted by sustainability change-drivers and **deliver sustained value.**

# India's promise to the global chemical industry

## Robust GDP growth

India is one of the fastest-growing economies in the world and is playing an increasingly important role in global growth. India's current GDP stands at USD 3.5 trillion. In the 75th year of its independence, India overtook the UK to become fifth-largest economy in nominal GDP terms, and is forecasted to surpass Japan as the third-largest economy by 2036.[19] India's share in the global GDP now stands at 3.5%, and is likely to cross 4% by 2027, which is the current share of Germany in the global GDP in nominal terms as per a recent State Bank of India (SBI) report.[20] India's economic growth and strong policy reforms have created a positive outlook on its future. India's ranking moved to the 63rd position in the Ease of Doing Business ranking among 190 economies.

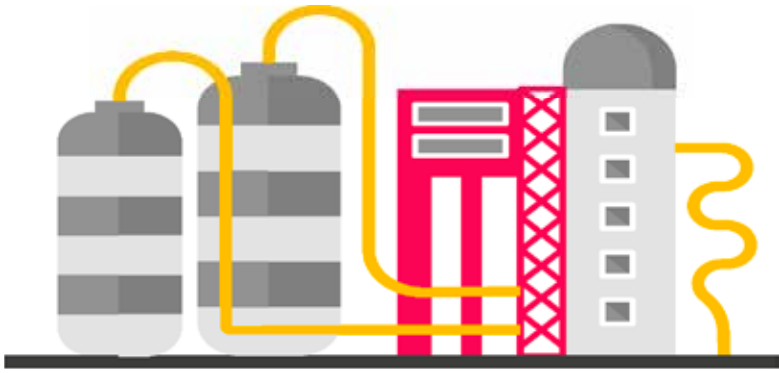
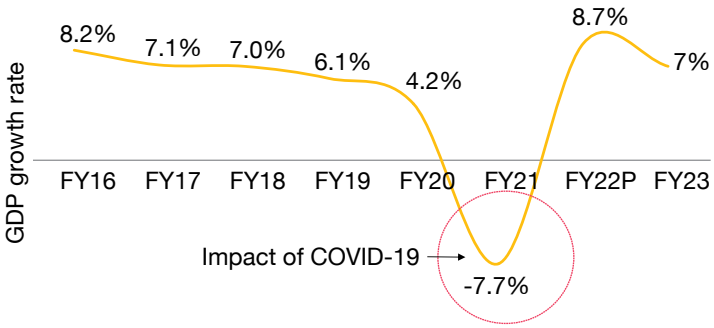


Figure 16: India's real GDP growth rate (FY 2016–22)




**Source:** Reserve Bank of India

In the wake of the COVID-19 pandemic, the country's economic activities were brought to a grinding halt due to countrywide lockdowns. Due to the dip in demand, India's GDP witnessed a sharp contraction by 7.7% in FY 2020–21. However, post that, India's economy is expected to become more resilient and recover gradually by growing at 8.7% in FY 2021–22 and 7% in FY 2022–23 as per projections provided by the Reserve Bank of India.[21]

The chemical industry contributes significantly to the nation's GDP and is anticipated to reach approximately USD 300 billion in demand terms by 2025. The GoI is cognisant of the potential of the industry and has taken multiple measures to promote the sector, such as 100% allowance of FDI, PLI scheme for bulk drugs and launching of Petroleum, Chemical and Petrochemical Investment Regions (PCPIRs) in different parts of the country.

19 https://cebr.com/

20 SBI

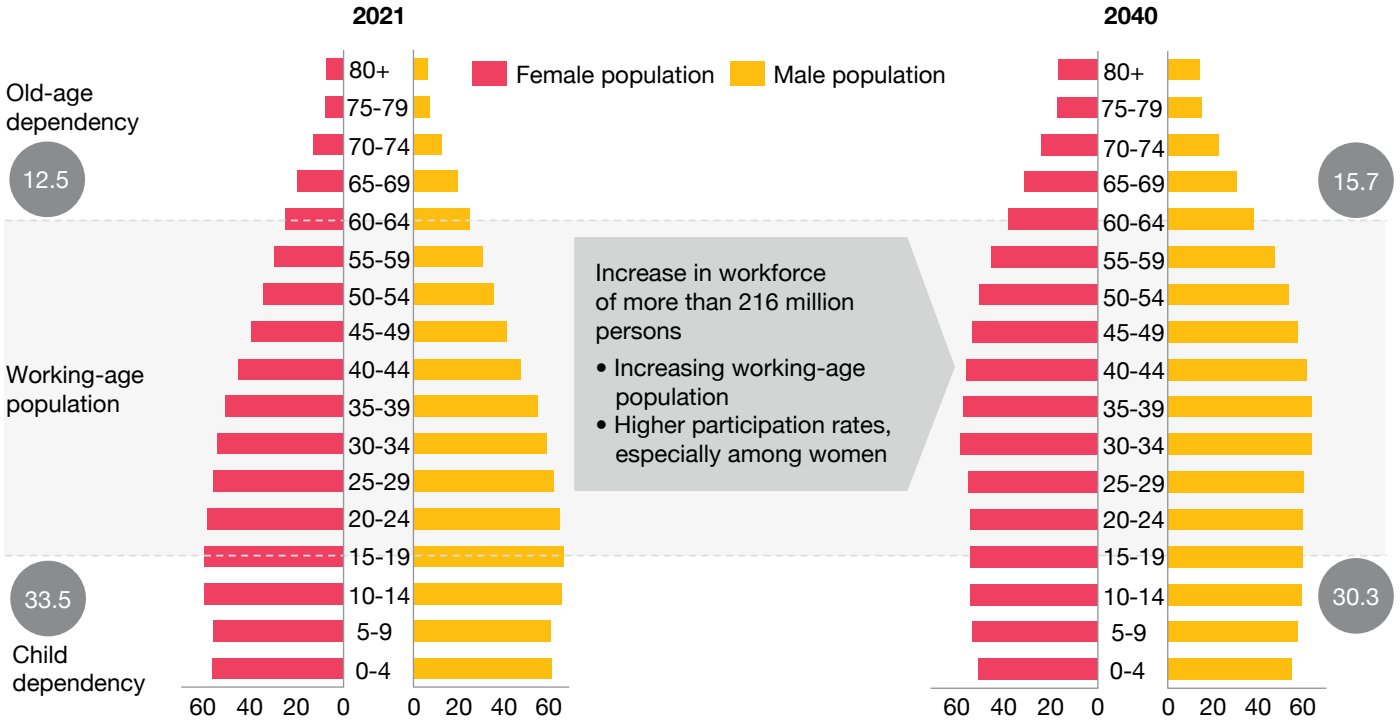
21 https://pib.gov.in/PressReleasePage.aspx?PRID=1847122#:~:text=Giving%20more%20details%2C%20the%20Minister,real%20GDP%20of%202019%2D20.

## Demographic advantage

India is home to a fifth of the world's youth population, with median age of 28 years. In 2020, over 900 million individuals in India were of the working age group (15–64 years), making up 67% of the country's total population.[22] By 2030, this number is projected to increase by another 101 million, which suggests that India will account for 24.3% of the global workforce differential in the coming next decade. This will allow the country to continue to experience the demographic window of opportunity, which indicates accelerated economic growth and increased productivity.

The consistently improving education system in India will provide for a skilled workforce required by the chemical industry as the global chemical supply chain realigns to the pre-pandemic state and investments and the industry grows in the country.

Figure 17: India's age structure (population in million/age group)




**Source:** UN World Population Prospects

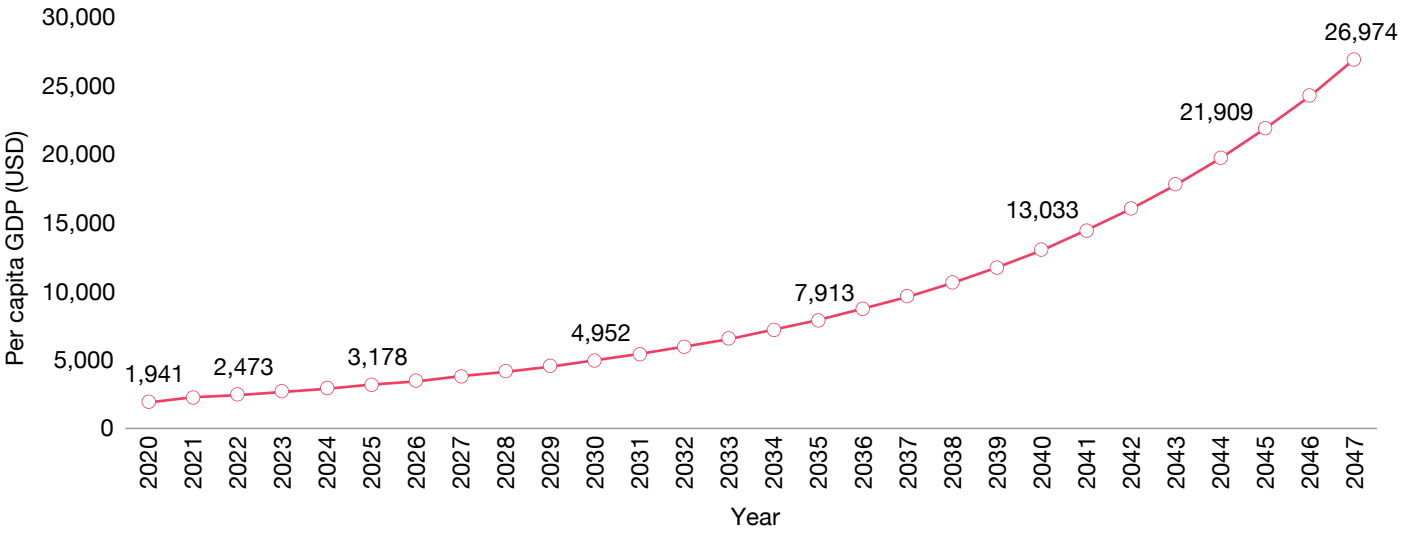
22 https://population.un.org/wpp/

## Increasing consumption expenditure

India is an internal consumption-driven economy. Nearly 60% of the GDP is powered by private domestic consumption. Rising incomes, large working-age population and expanding middle- and high-class segments are boosting consumption in India. India's per capita GDP is estimated to grow by 14 times to reach USD 26,974 in 2047.[23] By 2030, nearly 110 million working-age population, 140 million middle-income households and 21 million high-income households will further increase the consumption expenditure.[24] India's favourable demographics will boost consumption, and supportive policy frameworks will fuel investments in production and expansion.

As incomes increase and the working middle class grows, many end-use industries for chemicals like packaged food, plastics, paints and construction will also adapt to the consumption and aspirational spends, owing to the growing economic affluence. This will have a multiplier effect on the growth of the chemical industry.

Figure 18: India's per capita GDP forecast




**Source:** PwC analysis

## Significant headroom for per capita consumption

The per capita consumption of polymers and paints in India is about one-third and one-fourth of the global average respectively. Whereas the per capita consumption of fast moving consumer goods (FMCG) products and agrochemicals in China is almost four times that in India. The per capita consumption of dyes in India is one-sixth of that of Europe and one fifth of that of Japan.[25] The overall per capita consumption of chemical products in India is one-fifth of the global average in terms of value, leaving headroom for a fivefold increase in consumption.[26]

## Favourable investment destination

Despite the slight decrease in FDI equity inflows, India's rank improved to the seventh position among the top recipients of FDI in 2021.[27] Total FDI inflow has increased by almost 20 times from 2000–01 to 2021–22 and was approximately USD 83 billion in FY 2021–22. Moreover, India is expected to attract USD 100 billion in FDI inflows in 2022–23.[28] FDI trends show that India is increasingly becoming a popular choice for international investors.

Particularly in the chemical industry, there has been a global shift towards Asia as the world's chemical manufacturing hub. The GoI has realised the importance of the chemical industry and also prioritised it as a key growth driver by liberalising the FDI policy and allowing 100% FDI in the sector via automatic route. FDI equity inflow in the chemical sector (other than fertilisers) has increased to USD 966 million in FY 2021–22 as compared to USD 847 million in FY 2020–21.

23 PwC's estimate based on India's population in 2020 (World Bank) and assumption of 12% growth for nominal GDP and 1% growth for population.

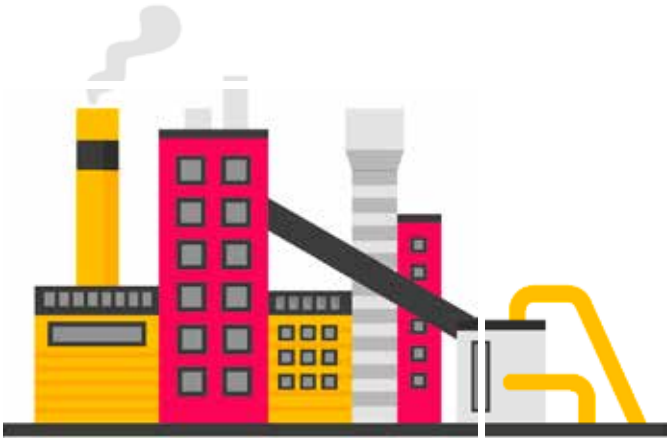
24 World Economic Forum's report

25 http://ama-india.org/wp-content/uploads/2022/04/Amai-Bulletin-Jan-2022.pdf

26 PwC - FICCI India Chem 2021 Knowledge Paper

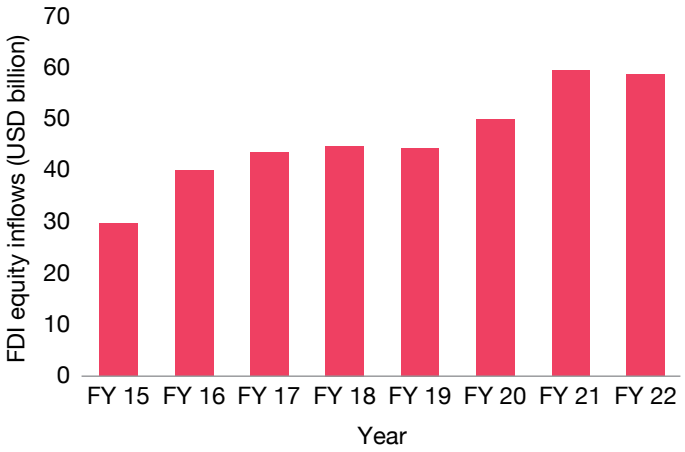
27 UNCTAD, world investment report 2022

28 PHD Chamber of Commerce and Industry (PHDCCI)



Furthermore, the Government is establishing four PCPIRs around the nation to encourage investments in the industry. These clustered PCPIRs benefit investors by providing them with transparent and investment-friendly policy and facility regimes.

Figure 19: India's FDI equity inflows (USD billion)

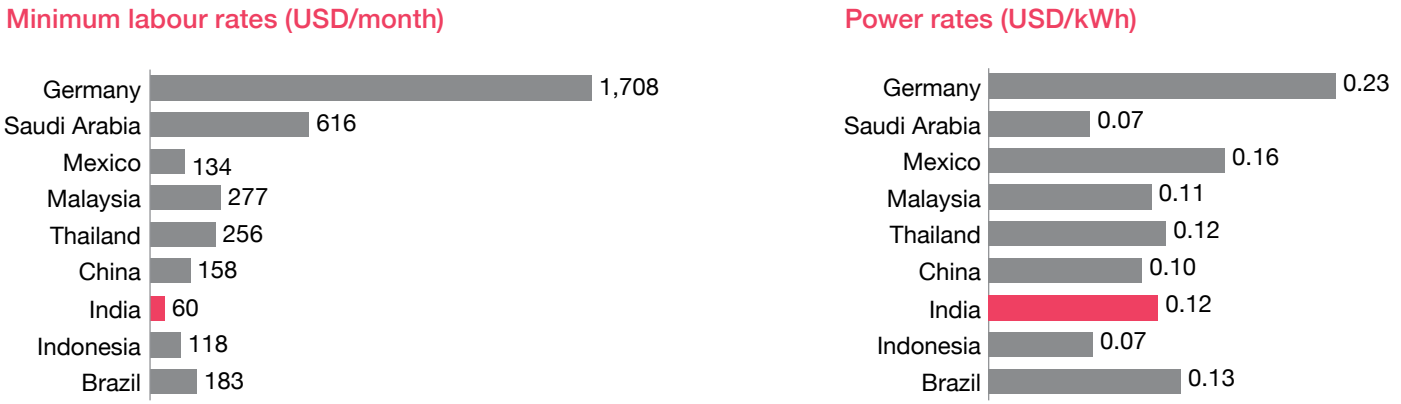



**Source:** Department for Promotion of Industry and Internal Trade

## Competitive cost and skills

- India is an attractive manufacturing destination due to its competitive labour and plant-building costs.
- The country witnessed a six-position jump from 43 in 2021 to 37 in 2022 in the World Competitiveness Index by the Institute for Management Development.
- The Indian specialty chemical players have distinctive capabilities and established supply relationships with global networks.
- India's ranking improved to 46 in 2021 from 81 in 2015 in the Global Innovation Index.

Figure 20: Minimum labour rates and power rates




**Source:** Data on minimum monthly wages was collected from various sources including: India (Nagaland - Department of Labour, Delhi - Govt of NCT of Delhi State Govt), Asean Briefing, Nov 2019 (Indonesia, Central Java, DKI Jakarta), Vietnam Briefing, Nov 2019 (Vietnam, Region IV, Region I), Reuters, Dec 2019 (Mexico, Non-border, Border Zone), MOHRSS, Jun 2018 (China, Liaoning, Shanghai), Bangkok Post, Dec 2019 (Thailand, Yala, Chon Buri and Phuket), Bloomberg, Jan 2020 (Brazil, National), Asean Briefing, Feb 2020 (Malaysia, National), US Department of Labor, Wage Indicator Foundation, World Bank

Data on electricity charges was sourced from GlobalPetrolPrices.com as accessed on 11 November 2021.

## Ease of doing business

**India ranked 63 in 2019 as per the World Bank's Ease of Doing Business report, moving up 79 places from its ranking of 142 in 2014.[29] Below are some of the important measures undertaken by the GoI:**

**Regulatory:** Adopted increasingly liberal regulatory frameworks in line with international practices with relaxation in FDI norms, single form for company formation and fast-track approval for construction permits.

**Tax:** Recent changes made to corporate tax rates shaped a more supportive ecosystem for both manufacturing and services sectors.

**Trade:** Implemented Indian customs single-window project, enabling importers and exporters to lodge their clearance documents online at a single point.

**Legal:** Established commercial courts and appellate division of high courts, implemented the Insolvency and Bankruptcy Code 2016 to resolve insolvency and enable smooth exit formalities.

Figure 21: World Bank's Ease of Doing Business rankings

**Ease of Doing Business: Top parameter-wise rankings***
**For India #, 2019; (#), 2014**

| | Overall rank | Getting credit | Trading across borders | Resolving insolvency | Getting electricity |
|---|---|---|---|---|---|
| India | 63 (142) | 25 (36) | 68 (126) | 52 (137) | 22 (186) |
| Vietnam | 70 | 25 | 104 | 122 | 27 |
| Brazil | 124 | 104 | 108 | 77 | 98 |
| Mexico | 60 | 11 | 69 | 33 | 106 |
| Indonesia | 73 | 48 | 116 | 38 | 33 |

*** Lower rank in a given parameter represents better positioning of the respective country.**

**Source:** World Bank

29 World Bank's Ease of Doing Business index

# Conclusion

**The economic development agenda will continue to revolve around sustainability. To this end, the chemical industry's role in creating a sustainable future will be pivotal, given its deep and extensive imprint on almost all aspects of modern living. The chemical ecosystem and industry's discussion on sustainability are broadly shaped by three key factors:**

**Regulatory:** Compliance with stringent regulations – such as the gradual ban on single-use plastic, EPR rules and regulations governing potentially hazardous substances – necessitate investments in innovative alternative materials and processes.

**Technology:** New technologies are emerging at a rapid pace. Biotechnologies or chemolysis used in recycling or renewable raw materials for use in production are a few examples. In order to be successful, these need to be scalable and competitively priced.

**Ecosystems:** Established value chains are being reconfigured with new players entering the ecosystem, such as recyclers, preprocessors and tech start-ups. Thus, companies will have to collaborate, re-evaluate and potentially reposition themselves.

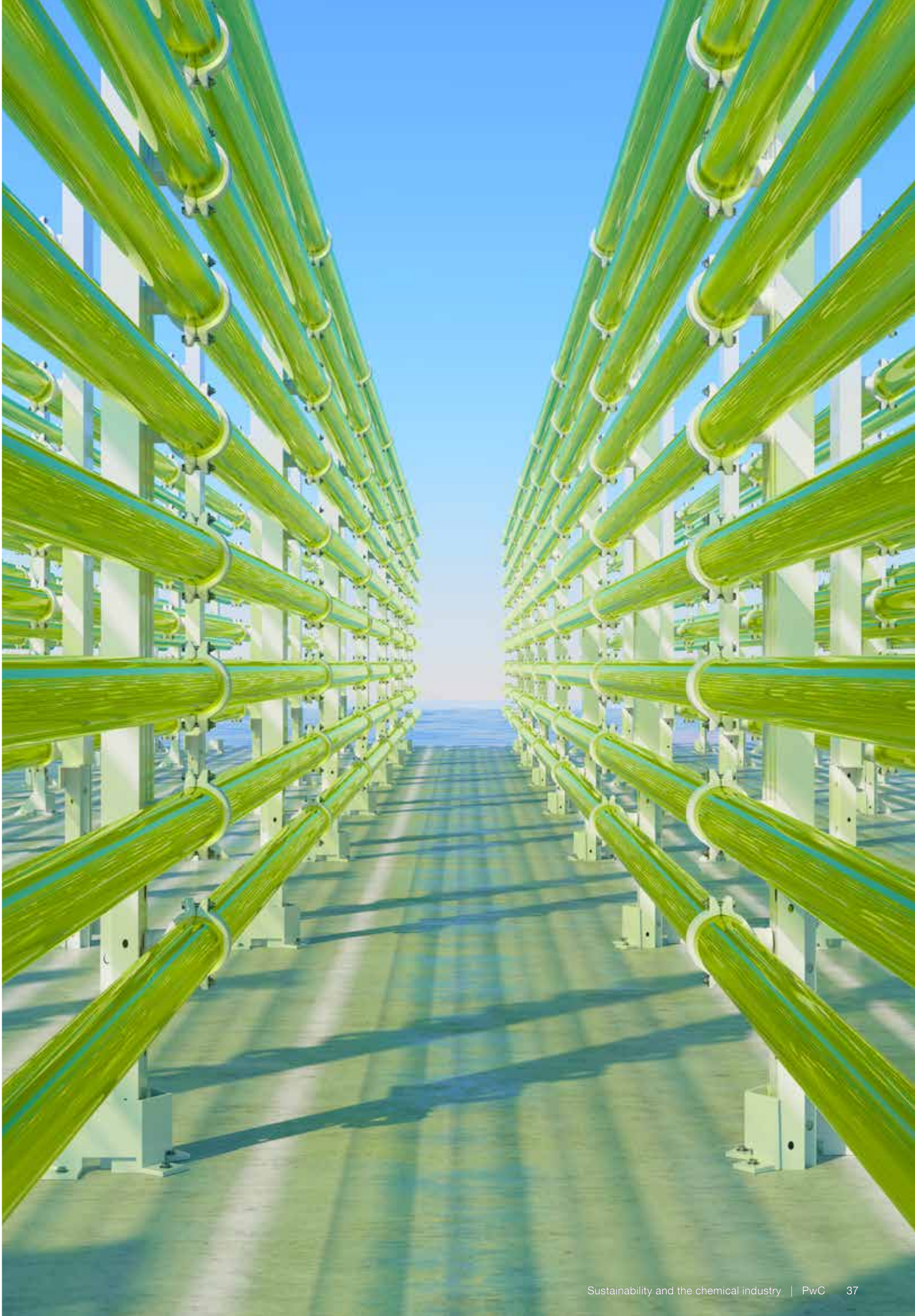
Chemical companies that actively participate in the debate around sustainability and find solutions to these issues are, and will be, at a clear advantage. These companies can actively leverage growth opportunities instead of merely reacting to developments to avoid jeopardising their licences to operate. Innovation will play a significant role in achieving climate change goals by enabling sustainability strategies. To reach net zero, the chemical industry will need to innovate across all value-chain segments. This means that companies will have to develop new processes that are either carbon neutral or low carbon, which will involve leveraging greener energy sources and sourcing sustainable raw materials.

Green hydrogen will be the cornerstone of the shift away from fossil fuels. Its active role in ammonia and methanol production could prove to be a starting point in enabling the decarbonisation of the chemical industry. By 2030, the cost of green hydrogen production is expected to decline by 60% from the current USD 4–5.5 per kg. The main factors behind this would be cost-effective electrolyser technologies, the decreasing levellised cost of renewable electricity, and increasing levels of utilisation fuelled by centralisation of production, design optimisation and a better mix of renewables. These developments will pave the way for scalable production and commercial scale utilisation of green hydrogen/ammonia.

India is expected to be the growth engine of the global economy in this decade, owing to a mix of intrinsic demographic, macroeconomic and policy factors. While a skilled and young working populace with growing income levels and aspirations will continue to drive internal consumption, the Government's initiatives towards creating a favourable investment environment and cost-competitive workforce are what will continue to attract global businesses into the country.

The chemical industry will grow in tandem with the country's end-use sectors. With the Government introducing policy measures to aid the industry – such as 100% FDI to boost investments, creation of PCPIR zones, PLI schemes, the Green Hydrogen Policy – the chemical industry is poised to usher in a sustainable future and support the country's growth trajectory.

The pace of the country's energy transition in line with the 2070 net zero announcement will be exciting to witness. Industries will need to align themselves with the national agenda on sustainability as they plan for further growth, and the chemical industry will play a vital role in achieving this transition.



# Insights from industry leaders

## Rajesh Srivastava

CEO and Managing Director
Jubilant Ingrevia Limited

The growing trajectory of the chemical industry is evident over past the few years. With the sector's enormous potential, the industry is indeed one of the world's largest. India's chemical story looks promising and attractive. With more than 80,000 commercial products, this diversified industry stood at USD 178 billion in 2019 and is expected to reach USD 304 billion by 2025 at a CAGR of 9.3%.

The chemical industry's role as a value creator with a positive outlook in India's growth path is substantial. The Government is keen on providing a conducive environment to increase the share of the chemical sector to approximately 25% of the GDP in the manufacturing sector by 2025. This industry in India is positioned to capitalise on near-term opportunities. Import substitution policies, PLI, RoDTEP, encouraging 'Atmanirbhar Bharat', are some of the incentives and policies undertaken by the Government to boost sectoral growth. Over the past few years, engagements between industry stakeholders and decision makers in the Government have increased significantly while framing policies and long-term roadmap for the sector.

Safety should be a top priority for sustainable businesses. Therefore, risk assessment studies at the design stage, hazard-identification activities and process assessments to discover the associated risks should be undertaken as preventive measures. In addition, safety training programmes should be conducted to align the employees to safe work practices, set up dedicated emergency response teams and a well-equipped occupational health centre to handle any mishaps on-premises.

It is time that the industry focuses on protecting the long-term value of the sector. This industry is critical and integral to India's economic and inclusive-development growth path. Chemicals are an essential part of our everyday lives. They impact agricultural and industrial development and act as the building block for various other downstream industries. At the core of the chemical industry are huge, highly capitalised installations, where millions of tonnes of basic chemicals are produced as feedstocks for the thousands of chemicals that make up the chemical market. It is thus the onus of the industry to nurture an effective and sustainable growth for the sector.

With governments across the globe setting net zero targets, businesses will need to react quickly and transform strategies, operations and supply chains to align with net zero trajectories at the earliest. Adopting ESG norms and carbon-abatement approaches will act as enablers for the same. For organisations to chart out climate risk-mitigation plans, setting emission reduction targets is of immense significance.

Digitisation and adoption of Industry-4.0 technologies to harness economies of scale would be key accelerators for this industry. This should be followed by the implementation of Responsible Care norms with a focus on improving knowledge and adherence to safety practices. Nurturing human capital through skill-development programmes, effective industry–academia linkages and R&D would enable holistic development of the sector.

India Chem 2022 – Vision 2030, which is being jointly organised by the Department of Chemicals and Petrochemicals, GoI, and FICCI, is a great platform for CPC sector stakeholders to collaborate. I take this opportunity to wish the event a grand success.

## Rajendra Gogri

Chairman and Managing Director
Aarti Industries Limited

Although the past two years have been a testing time for the global community, the world has collectively and successfully managed the pandemic and its cascading socioeconomic impacts. In 2021, the global GDP increased by 5.8%,[30] showing reassuring signs of recovery and growth.

The global value chains are undergoing a significant transition. Three pre-pandemic megatrends – i.e. emerging technologies, climate change and environmental sustainability – were already driving this shift. Post-pandemic, with the reconfiguration of the global supply chain, companies are now realigning their manufacturing and supply chain strategies to build resilience, and therefore, a window of opportunities has opened up for emerging markets and manufacturing hubs like India.

Significant domestic demand potential, the Government's push to boost manufacturing and a unique demographic edge make India a potential contender to capitalise on this opportunity. By 2030, India is expected to become the world's third-largest economy. India's consumer market is projected to grow by 300% from USD 1.5 trillion in 2019 to about USD 6.0 trillion by 2030, with a rising middle-income group shaping this growth in domestic consumption.[31]

The per capita chemical consumption level in India is one-tenth of the global average, providing significant opportunities to the Indian chemical industry. Additionally, rapid urbanisation and a growing young population with disposable income will convert into rising discretionary demand, adding to the chemical sector's growth. It is important to note that 30% of India's chemical requirements are met by imports, which indicates ample opportunities for import substitution.

The expected future growth of India, particularly that of the Indian chemical industry, cannot be achieved without adopting sustainable practices. As an industry, it is our moral responsibility to contribute towards achieving the global goal of sustainable and inclusive development.

At Aarti Industries, we practice a sustainable and value-driven chemical manufacturing business. We strive to leverage growth opportunities through our robust business model and thoughtfully formulated comprehensive and responsible approach. Reflecting on our sustainability journey, we have conducted a comprehensive analysis to understand the impact of various physical and transitional climate change risks and opportunities on our businesses. We have also developed appropriate mitigation strategies to manage risks and leverage opportunities for achieving sustained competitive advantage.

We believe that upcoming technologies dealing with energy efficiency and alternative sources of energy will not only enable organisations to improve environmental performance but also achieve reductions in the cost of operations. On this front, we have developed and adopted plans to increase the share of renewable energy in our energy mix through onsite generation and an open-access model. Presently, we have a 697-kW rooftop solar power plant which produced 400+ MWh of renewable energy in FY 2021–22. Further, to improve our energy mix, we have entered into a power purchase agreement of 147.8 MWh/day of hybrid renewable energy through a group captive model. We plan to invest INR 18 crore for this initiative, leading to a reduction in $CO_2$ emissions by 38,394 $tCO_2e$/annum.

We constantly focus on strengthening our safety culture through different interventions. One such intervention is the 'listening tours' that enable our leaders to set expectations and build culture through actions.

In our endeavour to ensure impeccable workplace safety, we have adopted a comprehensive initiative directed at augmenting process safety at our manufacturing locations and research centres. This initiative includes management of the integrity of operating systems, designing of innovations and responsible chemistry. Furthermore, we have developed round-the-clock robust logistics control centres to mitigate the risk of hazardous material spillages across our logistics network.

Based on our efforts to augment our eco-efficiency through process chemistry and design reengineering, we have reduced our specific energy by 5% and GHG intensity by 3% in FY 2021–22. Further, we are also preparing to commit to a science-based target initiative (SBTi) as a step towards reducing our carbon emissions and contributing towards climate actions. We are committed to manufacturing products in a safe, secure and sustainable manner, and in this endeavour, we are developing plans to adopt the principles of green chemistry.

We are taking a proactive role in addressing sustainability risks and decisively moving from being a part of the problem to a key driver of solutions through the development of sustainable products, practices and leadership. The industry should strive for collaborative growth, continual improvement and an inclusive approach. Therefore, I invite all our stakeholders to join us in co-creating a sustainable future and ushering in a golden era for the chemical industry.

I wish everyone all the best for India Chem 2022.

30 World Bank

31 World Economic Forum

## Jayant Dhobley

Business Head and CEO – Global Chemicals, Fashion Yarn and Insulators, Grasim Industries Limited, Aditya Birla Group

India has emerged as the world's fifth-largest economy and is gearing up to become a USD 5 trillion economy by FY29. The Indian chemicals and petrochemicals industry is valued at around USD 178 billion and is the sixth largest globally. The industry needs to grow at a CAGR of nearly 9.3% in order to become worth USD 300 billion by 2025.[32] The various types of transformation that chemical and petrochemical companies in the country have adopted have paved the way for the industry's success.

Over the last decade, and specially over the last few years, one area where the Indian chemical industry has undergone a renaissance is in its approach to sustainability. Today, there is high level of focus on decarbonisation, reduction of emissions in air and water, and elimination of waste in landfills. These changes are being driven by better engineering standards, process intensification and adoption of renewable energy sources. Moreover, there's a growing focus on increasing process and personnel safety, which is an integral part of any sustainability journey.

The areas mentioned above are foundational and will provide the industry its 'licence to operate' from not just a regulatory viewpoint but also a social one. However, these are just the first steps towards making the industry sustainable across the entire value chain.

This is particularly true for the specialty chemicals industry in India which constitutes 22% of the total chemical and petrochemical market in India.[33] This industry is expected to grow at a CAGR of 11–12%, reaching an estimated USD 64 billion by 2025.[34] In addition, it can prove to be a game changer by accelerating sustainability across the value chain through innovation and forward-looking industries like semiconductors, EV batteries, advanced polymer materials, nutraceuticals, food and feed additives.

Here is an example of the sustainability-driven megatrends in the automotive industry, which is a huge end user of the products manufactured by the chemical industry.

- Lightweight
- Reduced friction
- Cleaner burning fuels
- Solvent-free coatings
- Low-emission fuel tanks
- Battery technology
- Smart electronic systems
- Circularity

The actual solutions to each of these megatrends are enabled by innovation in the chemical and material industries. Let us take an example from epoxy chemistry, of which Aditya Birla Chemicals is an active proponent.

Epoxy-reinforced carbon fibre composites are known to offer some of the best strength-to-weight ratios. Further, the ability to play with the directionality of the fibre is used to produce an isotropic composite. This enables automotive engineers to design even lower weight parts of a vehicle, which substantially lowers the total weight of vehicles, reduces fuel consumption and improves overall performance.

One of the challenges in the wider adoption of carbon-reinforced epoxy in the automotive sector has been its 'end of life' disposal. Aditya Birla Chemicals is now commercialising a pioneering innovation – recyclamine technology – which will enable epoxies to be recycled and help recover thermoplastic resins and carbon fibre reinforcements. This will enable several end use industries to improve the circularity of the product.

It is important for the chemical industry to remember that the molecules we make are not an end in itself. These molecules serve a purpose by providing a set of properties to the end user, which enable sustainability.

As the Indian chemical industry moves forward, R&D-led innovation will play a critical role in driving sustainable growth across the value chain.

**Source:** Aditya Birla Chemicals

32 https://www.pwc.in/assets/pdfs/publications/2021/india-a-global-manufacturing-hub-for-chemicals-and-petrochemicals.pdf

33 https://www.pwc.in/assets/pdfs/publications/2021/india-a-global-manufacturing-hub-for-chemicals-and-petrochemicals.pdf

34 FICCI

## Janardhanan Ramanujalu

Janardhanan Ramanujalu, Vice President, Regional Head – South Asia and Australia, SABIC India

The Indian chemical and petrochemical industry has withstood many economic cycles and contributed significantly to the overall growth of the economy by catering to multiple sectors. The growth rate of the chemical and petrochemical sector has been remarkable, exceeding the overall GDP growth rates for over two decades.

Over the years, 'India Chem' has offered various opportunities for global markets as well investors into this sector.

Additionally, with the Government's growing focus on increasing the share of manufacturing in the GDP and PLIs, India is set to take a huge leap in manufacturing. As a beneficiary of these developments, both directly and indirectly, the chemical industry is also poised to grow at a faster pace and contribute towards the goal of a USD 5 trillion economy.

PCPIR with major land banks can help in accelerating land acquisition for this critical industry. Such acquisitions will also facilitate relocation and capacity expansions of the existing industry, apart from new industries. Multiple plastic processing parks distributed around the country will help in urbanisation and create jobs in the rural and semi-rural areas. As next steps, the focus needs to be on the growth of the organised recycling industry by incorporating industrial packaging rules.

The chemical sector not only plays a key role in GDP growth but also in sustainability – as nearly half of the UN Sustainable Development Goals are enabled by the chemical industry. Currently, the sector is driving sustainable innovations within its own manufacturing processes, such as carbon capture and reuse and chemical recycling of polymer waste. In addition, it is also developing innovative solutions for the generation and storage of renewable energy materials.

# About FICCI

Established in 1927, FICCI is the largest and oldest apex business organisation in India. Its history is closely interwoven with India's struggle for independence, its industrialization, and its emergence as one of the most rapidly growing global economies.

A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate and engaging with policymakers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, and reaching out to over 2,50,000 companies.

FICCI provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policymakers and the international business community.

## Contact us

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# About PwC

At PwC, our purpose is to build trust in society and solve important problems. We're a network of firms in 155 countries with over 327,000 people who are committed to delivering quality in assurance, advisory and tax services. Find out more and tell us what matters to you by visiting us at www.pwc.com.

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