CHRONICLING PROCESS INDUSTRY INNOVATIONS SINCE 1966

VOL.57 | ISSUE 12 | December 2022

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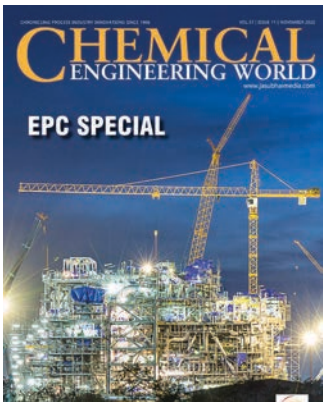

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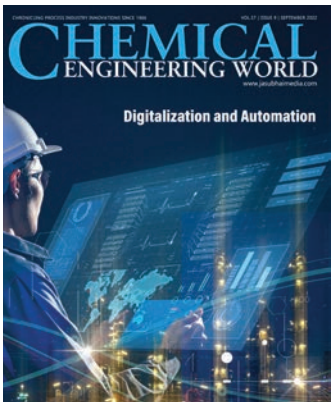

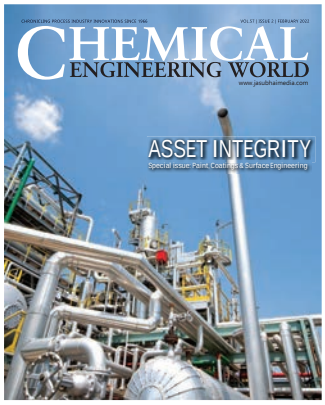

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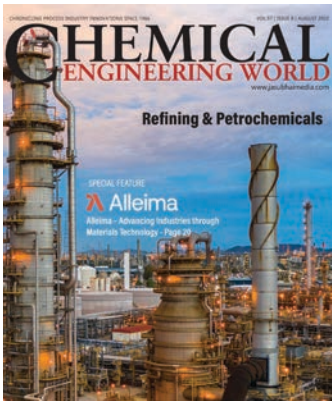

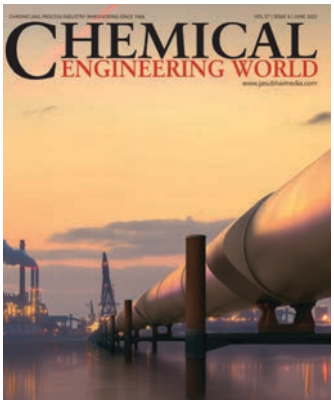

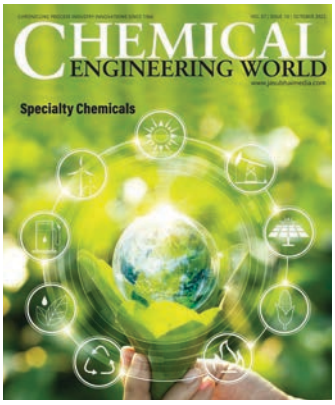

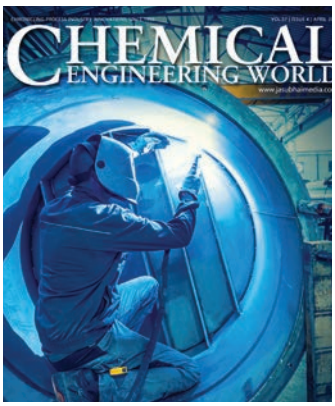

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A SUMMARY OF YEAR- END REVIEW 2022, GOVERNMENT OF INDIA

MINISTRY OF CHEMICALS & FERTILIZERS

Revival of the Chemical Fertilizer Plants:

Government of India has mandated revival of Talcher, Ramagundam, Gorakhpur and Sindri plants of Fertilizer Corporation of India Ltd (FCIL) and Barauni plant of Hindustan Fertilizer Corporation Ltd (HFCL) by forming Joint Venture Company of nominated PSUs.

Nano Urea: Government of India has recently notified the specifications of Nano nitrogen under Fertilizer Control Order, 1985. Nano Fertilizers hold great promise for application in plant nourishment because of the size-dependent qualities, high surface-volume ratio, and unique optical properties. Nano fertilizer releases plant nutrients in a controlled manner contributing to higher nutrient use efficiency.

MINISTRY OF COMMERCE, AND INDUSTRY

April - Oct 2022- 23	
Merchandise Export	USD 263.3 billion
Services Export	USD 181.39 billion
Overall Export (Merchandise Plus Services)	USD 444.74 billion
April-October, 2021-22	
Merchandise Export	USD 234.0 billion
Services Export	USD 138.01 billion
Overall Export (Merchandise Plus Services)	USD 371.98 billion

Courtesy: Department of Commerce, Ministry of Commerce, and Industry

New Foreign Trade Policy

The government has received requests from Export Promotion Councils and leading exporters that we should continue with current Foreign Trade Policy (2015-20), which had been extended from time to time. In recent days, exporters and industry bodies have strongly urged the government that in view of the prevailing, volatile global economic and geo-political situation, it would be advisable to extend the current policy for some time and undertake more consultations before coming out with the new policy.

The government has always involved all stakeholders in formulating policy. In view of this, it has been decided to extend the Foreign Trade Policy 2015-20, valid till Sept 30,

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2022, for a further period of six months, w.e.f. October 1st, 2022.

SCOMET – India's Export Control Framework

In consonance with the guidelines and control lists of the international conventions and obligations as well as multilateral export control regimes related to export of dual use goods and technologies, India has regulated the exports of dual use items, nuclear related items, including software and technology. SCOMET (Special Chemicals, Organisms, Materials, Equipment and Technologies) is India's National Export Control List of dual use items munitions and nuclear related items, including software and technology maintained under Foreign Trade Policy and is aligned to the control lists of the all the multilateral export control regimes and conventions including the Missile Technology Control Regime (MTCR), Wassenaar Arrangement and Australia Group. India's membership of different export control regimes demonstrated India's commitment to the global non-proliferation objectives and has enabled Indian companies access to the controlled new age technology and goods in the sectors such as Telecom, Aerospace, Defence sectors etc.

The SCOMET list was also updated as per the recent changes incorporated under various export control regimes in November 2022. Certain policy areas such as liberalising policy for export of SCOMET regulated UAVs/ Drones, expanding list of chemicals under GAEC, revising stock and sale policy etc are being looked into for changes in the near future.

MINISTRY OF ENVIRONMENT FOREST AND CLIMATE CHANGE

India at CoP27 on LiFE

At COP 27, India set up a Pavilion on the theme of LiFE – Lifestyle for Environment. A number of events, based on LiFE, were organised with the objective of spreading the message of LiFE. During the CoP27 proceedings, HMEFCC launched India's Long-Term Low-Carbon Development Strategy. With the submission of this document to UNFCCC, India joined the select group of fewer than 60 countries in the world to do so.

Ministry of New & Renewable Energy (MNRE) in conjunction with Ministry of Power; IREDA; Solar Energy Corporation of India (SECI); and Council on Energy, Environment and Water (CEEW) organized a side event on November 8, 2022, during which discussions were held on linking India's numerous initiatives on energy access, transition, and efficiency with the principles of LiFE in the run-up to India's G20 Presidency. On the same day, A joint event on energy transition anchored to the theme of LiFE was co-hosted by three organisations including Himadri Energy International, Shakti Sustainable Energy Foundation & ReNew Power. It stressed upon transition towards a low-carbon system that needs to be cautious and ambitious, accompanied by a closer

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look at the environmental advantages, policy interventions for minimal loss of livelihood, and preparing a skilled workforce. One of the outcomes was on integrating low-carbon targets into developmental goals which is essential for long-term sustained implementation of climate goals.

Prime Minister, Shri Narendra Modi, in his address to the nation on the occasion of 75th Independence Day on 15.08.2021, highlighted India's action on 'Mission Circular Economy.' NITI Aayog constituted 11 Committees for development of circular economy (CE) action plans for different categories of wastes.

Circular Economy Action Plans for 10 waste categories (Lithium-ion batteries; E-waste; Toxic and hazardous industrial waste; Scrap metal (ferrous and non-ferrous); Tyre and Rubber; End of Life Vehicles; Gypsum, Used Oil, Solar Panels and Municipal Solid Waste have been finalized, and are under implementation. Respective Nodal Ministries are coordinating on progress of implementation of these action plans. Ministry of Environment, Forest and Climate Change is the Nodal Ministry for Circular Economy Action Plan for Tyre and Rubber and stakeholder ministry in other CE Action Plans.

Regulations on market based Extended Producer Responsibility (EPR) principle have been notified for four categories of wastes i.e., plastic packaging waste, battery waste, e-waste and waste tyre.

MINISTRY OF HEAVY INDUSTRIES

Faster Adoption and Manufacturing of Electric Vehicles in India Phase II (FAME India II) Scheme

FAME India II Scheme has been launched with an outlay of Rs 10,000 crore to incentivize demand for Electric Vehicles (EVs) by providing upfront subsidies and creating EV charging infrastructure. 1 million Electric 2 Wheelers, 5 lakh Electric 3 Wheelers, 55,000 Electric Cars and 7,090 Electric Buses are to be supported under FAME II through subsidies. Allocation of Rs 1000 crore has also been made under FAME II for provision of EV charging stations.

FAME India II Scheme was redesigned in June 2021 based on experience particularly during Covid-19 pandemic and feedback from industry and users. The redesigned scheme aims at faster proliferation of Electric Vehicles by lowering the upfront costs. The scheme has been extended for a further period of 2 years i.e., up to March 31, 2024

National Programme on Advanced Chemistry Cell (ACC)

Union Cabinet on May 12, 2021, approved the National Programme on Advanced Chemistry

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Cell (ACC) with an outlay of Rs 18,100 crore to incentivize setting up of manufacturing facilities in the country for 50 Giga Watt Hour of ACC and 5 GWh of "Niche" ACC. The scheme was notified on June 9, 2021. Three of the approved firms under the scheme has signed the Programme Agreement to implement the PLI ACC programme for setting up manufacturing facilities of 30 GWh ACC capacity.

Through this Scheme, the Government intends to optimally incentivize potential investors, both domestic and overseas, to set- up Giga-scale ACC manufacturing facilities with emphasis on maximum value addition and quality output and achieving pre-committed capacity level within a pre-defined time-period. Total investment of Rs 27,000 crore is envisaged under this scheme. Net saving of Rs. 2,00,000.00 Crore to 2,50,000.00 crore on account of oil import bill reduction due to EV adoption.

MINISTRY OF MICRO, SMALL & MEDIUM ENTERPRISES

Credit Guarantee Scheme

Under Credit Guarantee Scheme for Micro and Small Enterprises (CGTMSE), collateral free loan up to a limit of Rs. 2 crore to MSEs is provided. In FY 2022-23, (up to 30.11.2022), 7.07 lakh guarantees have been approved involving Rs 60,376 crore, which is the highest since inception of the scheme in 2000-01. With effect from 01.12.2022, for credit ceiling up to Rs. 2 crore, the maximum extent of guaranteed cover has been enhanced up to 85%. Enterprises owned by women would be eligible for guarantee cover up to 85%.

Infrastructure & Capacity Building

Micro and Small Enterprises Cluster Development Programme (MSE-CDP) scheme is aimed at enhancing the productivity and competitiveness of Micro and Small Enterprises (MSEs) by extending financial assistance as Government of India (GoI) grant for establishment of Common Facility Centres (CFCs) in the existing clusters and for establishment of new / upgradation of existing Industrial Areas / Estates / Flatted Factory Complex.

24 projects with total project cost of Rs. 513.4 crore with GoI assistance of Rs. 364 crore have been approved and 5 projects have been completed from 01.01.2022 to 30.11.2022. Dedicated software has been developed by NIC for Geo tagging of projects under the Scheme.

MINISTRY OF SCIENCE & TECHNOLOGY

Inauguration of scaled-up plant for production of Hydrazine Hydrate

Shri Narendra Modi inaugurated the scaled-up plant for production of Hydrazine Hydrate (HH) developed in collaboration of CSIR-Indian Institute of Chemical Technology (IICT), Hyderabad and Gujarat Alkalies and Chemicals Ltd (GACL), Gujarat on October 10, 2022, as an initiative towards 'Atmanirbhar Bharat.' The plant developed is based on CSIR-IICT's and GACL's jointly patented technology for production of 10,000 tonnes per year of Hydrazine Hydrate. The collaboration of CSIR-IICT and GACL led the process development from laboratory scale to pilot scale, and then

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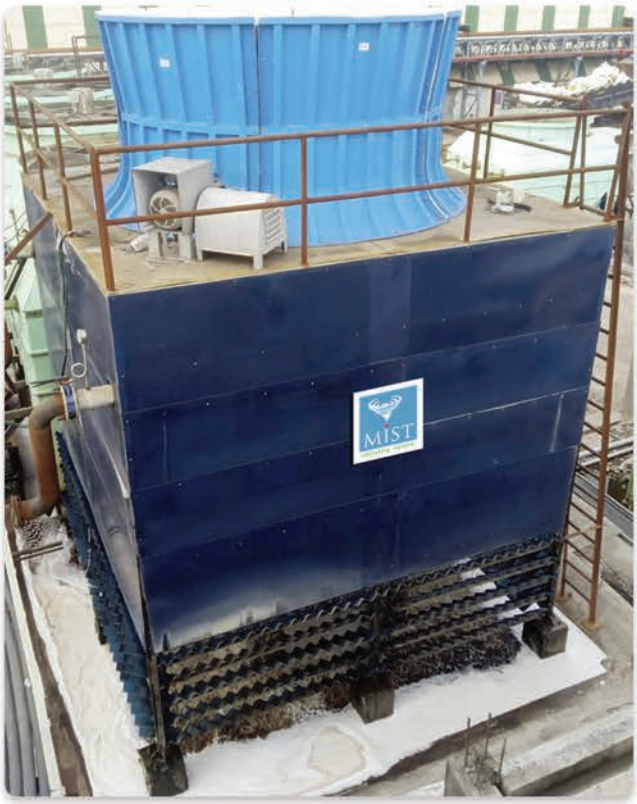

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to a commercial scale. The scale up ratio from pilot scale to commercial scale has been up to 100 times.

CSIR and iCreate signed MoU to harness India's tech strength

With the objective to foster rapid economic development and help create world-class start-ups, CSIR signed an MoU with the Government of Gujarat's flagship technology incubator - iCreate (International Centre for Entrepreneurship and Technology) on 25 April 2022. The MoU siging was presided over by The Chief Minister of Gujarat, Shri Bhupendra Patel. Under the MoU, CSIR and iCreate intend to establish a collaborative support system for promising tech start-ups by making combined resources available for entrepreneurs and innovators in the country. The partnership will also catalyse scientific innovation and the marketability of high-tech start-ups. Further, iCreate will help set up new incubators at identified CSIR labs. Such start-ups will access CSIR's equipment, facilities, and scientific manpower. CSIR will provide intellectual property support and explore methods of financially supporting innovative start-ups from India to boost emerging entrepreneurs.

Steel Slag Road: Steel Slag Valorisation Technology for Conversion of Steel Slag as Road Making Aggregates

India being the world's second largest steel producer also generates around 19 million tons of solid steel slag waste annually. CSIR-CRRI under a major research study sponsored by Ministry of Steel and four major steel industries in India, namely, JSW Steel, AMNS India, TATA Steel and Rashtriya Ispat Nigam Limited has developed the steel slag valorization technology to convert waste steel slag as road making aggregates. Processed steel slag aggregates as developed through waste steel slag has been successfully utilized in the construction of India's First Steel Slag Road at Hazira, Surat. Around one lakh ton processed steel slag aggregates were utilized as 100 % substitute of natural aggregate in steel slag road construction. Union Minister of Steel, Shri R.C.P Singh inaugurated, Steel slag road at Hazira Surat on 15th June 2022. Technology has been widely appreciated on National and International platforms. An MoU has been signed with different steel industries such as JSW Steel, AMNS India, and Rashtriya Ispat Nigam Limited for Technology Transfer.

MINISTRY OF STEEL

The Steel Sector plays a pivotal role for crucial sectors such as construction, infrastructure, automobile, engineering, and defence. Over the years the steel sector has witnessed a tremendous growth. The country is now a global force in steel production and the 2nd largest crude steel producer in the World.

Production Linked Incentive (PLI) Scheme

PLI Scheme for domestic production of specialty steel has been approved with an outlay of Rs.6322 crore by the Cabinet. The five broad categories of Specialty steel, identified under the scheme, are used in a variety of applications including white goods, automobile body and components, pipes for transportation of oil and gas, boilers, ballistic and armour sheets, high-speed railway lines, turbine components, distribution, and power transformers. The Scheme has been notified

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on 29.7.2021 and detailed Scheme Guidelines were published on 20.10.2021. The application process through online system was available from 29.12.2021 till 15.09.2022.

The scheme is set to commence from FY 2023-24 (PLI to be released in FY 2024-25). 67 applications from 30 companies have been selected under the Production Linked Incentive (PLI) Scheme for Specialty Steel. This will attract committed investment of ₹ 42500 Crore with a downstream capacity addition of 26 million tonne and employment generation potential of 70000.

Decarbonization in steel sector

The steel sector accounts for 12% of India's CO2 emission with an emission intensity of 2.55 t CO2/TCS compared to global average emission intensity of 1.85 t CO2/TCS. As a part of Glasgow commitments, India plans to achieve net zero emissions by 2070. Ministry of Steel is continuously engaging with the stakeholders from the steel industry and the concerned stakeholder Ministries/ Departments such as Ministry of Environment, Forests & Climate Change (MOEFCC), Ministry of Power, Bureau of Energy Efficiency (BEE), Ministry of New and Renewable Energy (MNRE), NITI Aayog etc. Detailed discussions on decarbonization and improvement of resource efficiency in Steel Sector were also held in meetings of Consultative Committees of Parliament on "Transition towards Low Carbon Steel-Green Steel on 6th May 2022" and "Roadmap for Circular Economy in Steel Sector on 1st July 2022". Further, Ministry of Steel hosted a session on the 6th Day of COP 27 event in Sharm-El-Sheikh, Egypt on 11th November 2022 wherein discussion was held on the issues of reducing carbon emissions hinging on technologies such as green hydrogen in steel making, Carbon Capture, Storage and Utilization (CCUS), Best Available Technologies on Energy Efficiency as well as transition to Renewable Energy.

MINISTRY OF COAL

Achieving record coal production and thereby ensuring adequate coal supply to thermal power plants and other sectors across the country, bringing about innovative policy reforms to give further fillip to India's energy security were some of the remarkable achievements of our Coal Sector during the year 2022. Under Asset Monetization, the Ministry achieved Rs.40,104.64 crore, way above NITI Aayog target of Rs. 3394 crore during 2021-22. In areas like land acquisition, adoption of new technology, stepped up focus on sustainable development & just transition, CSR initiatives etc Coal Ministry has recorded note-worthy achievements during the year 2022.

Coal linkages for gasification plants of the coal companies

CIL / SCCL have been allowed to provide long term allotment of coal to their own gasification

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plants at prices as may be decided by the coal company. This move will encourage coal gasification technology in the country and will help in early establishment of this new use of coal.

Mission Coking Coal

With these transformative measures taken by Ministry of Coal under 'Atmanirbhar Bharat' initiative of the Prime Minister, domestic raw Coking Coal production is likely to reach 140 Million Ton by 2030, CIL has planned to increase raw coking coal production from existing mines up to 26 MT and identified nine new mines with PRC of about 22 MT by FY 2025. Also, CIL has offered eight discontinued coking coal mines, out of the total 30 discontinued mines, on an innovative model of revenue sharing to the private sector with a Peak Rate Capacity of 2 MT.

The Ministry has also identified four coking coal blocks and the Central Mine Planning and Design Institute (CMPDI) also will finalize GR for 4 to 6 new coking coal blocks in the next two months. These blocks may be offered in subsequent rounds of auction for private sector to further step up domestic raw coking coal supply.

Greening Initiatives: Bio-Reclamation/ Plantation

Cumulative achievement of 7986Ha and plantation of 179 lakh saplings (up to Nov 2022) against the target of 7600 Ha & 176 lakh plants for FY2019-20 to FY2022-23. Coal/ Lignite PSUs have planted around 47 lakh saplings on 2300 Ha land during January 2022 to November 2022.

Mine water supply by coal/lignite PSUs for community use (for 2021-22) has grown to 3703 LKL (Lakh Kilo Litre) registering a rise of about 17% over the quantity achieved in 2020-21. In FY 2021-22, More than 16 lakh population spreads in 871 villages of 9 States have been benefitted by domestic/drinking water supply. Also, irrigation potential (@ 100 acres/LKL) of about 2.71 lakh acres has been created by community water supply irrigation. Potential created in FY 2021-22 for 49 Lakh People to use mine water for domestic/ drinking purpose @ 55 lpcd.

Energy Efficiency Measures

Efficient use of energy resources and their conservation assume tremendous significance as one unit of energy saved at the consumption level ultimately translates into equivalent reduction of carbon footprint. Coal/lignite PSUs are taking various energy conservation & efficiency measures such as use of LED lights, energy efficient ACs, E-vehicles, DC Super Fans, Efficient Water Heaters, Auto timers in streetlights, capacitor banks, installation of distributed and rooftop solar projects and promoting use of LNG in heavy duty mining machineries, etc.

Futuristic Agenda

With comfortable coal availability in the country, the Government of India has decided to promote gasification of coal in a big way. Coal gasification can yield multiple energy, chemical and Petro-chemical products, most of which are presently being imported. To set up four more Gasification projects and one lignite gasification project and to promote indigenous gasification technology, Coal India Limited has signed MOUs with BHEL, GAIL

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and IOCL on 12.10.2022 and NLCIL has signed MOU with BHEL under the aegis of Ministry of Coal to set up coal gasification projects at MCL Odisha to produce ammonium nitrate using high ash coal, Synthetic Natural Gas at ECL West Bengal with low ash coal and SNG/ Methanol/ DME at Jharkhand/Chhattisgarh and DME (Di-methyl Ether) from Lignite in Tamil Nādu respectively.

Coal to Hydrogen Mission

Roadmap of Coal to Hydrogen has been prepared by Expert Committee. Roadmap of Coal to Hydrogen has been lunched by Hon'ble Minister of Coal in May'2022 at Mumbai. Initiatives for the 500 TPD demo scale coal to hydrogen plant has been taken by M/s EIL with technically support from BHEL. The study would be conducted with indigenous gasification technology (M/s BHEL) as directed by the Ministry.

Arun Kumar Singh appointed as the Chairman, ONGC

Arun Kumar Singh, Chairman, ONGC Ltd

New Delhi, India: Government of India had set up a Search-cum-Selection Committee (SCSC) in February 2022 for filling up the post of CMD, ONGC. The SCSC was chaired by Chairperson, PESB with Secretary, Petroleum and Natural Gas and Shri B Ashok, ex-Chairman, IOCL as members. The SCSC subsequently submitted its recommendations.

The restructuring of the Board of ONGC has been approved in the context of emerging trends in the energy sector and national energy priorities. The medium- and long-term strategic goals of ONGC require it to deliver in respect of enhanced production, increased exploration with an emphasis on technology and pace of implementation, partnerships with reputed sectoral firms to leverage best in class technology, efficient and engaged management of JVs, partnerships and subsidiaries, effective capital allocation, portfolio review, management and expansion of overseas assets and development of a leadership pipeline.

IICA launches ESG Impact Leader Programme

Ms Leena Nandan, Secretary, Ministry of Environment, Forest and Climate Change, Govt. of India

New Delhi, India: Indian Institute of Corporate Affairs, an autonomous institution under

the aegis of the Ministry of Corporate Affairs, Government of India has launched a programme to create Impact Leaders in the areas of Environmental-Social-Governance (ESG). Secretary, Ministry of Environment, Forest and Climate Change, Govt. of India Ms Leena Nandan was the Chief Guest at the launch.

Addressing the gathering, Ms Nandan, emphasised the need for creating a cadre of ESG Professionals in India. She said that trained manpower is need of the hour and IICA under the Ministry of Corporate Affairs has taken timely initiatives to cater the needs of transformation in industries through building capacities of the corporate functionaries. She mentioned the clarion call by Prime Minister Shri Narendra Modi to create a Cadre Pro-Planet-People. IICA's initiatives are towards achieving these targets. She also emphasised need for mainstreaming not only climate agenda but social and gender aspects into core business philosophies and policies.

India Needs to Emerge as Responsible Producer of Steel: Jyotiraditya Scindia

New Delhi, India: The Union Minister of Steel and Civil Aviation, Jyotiraditya M. Scindia on Tuesday urged the Indian steel industry to move towards green and low carbon emitting production processes. Speaking at the launch of Kalyani Group's first green steel brand 'Kalyani FeRRESTA' in New Delhi, the hon'ble minister emphasized on the growing role of steel as the foundational force for the development of a nation.

Jyotiraditya M. Scindia, Union Minister of Steel and Civil Aviation

Minister Scindia added that as the fifth largest economy and second largest producer of steel, India needs to also become a responsible and sustainable producer of steel. Talking about the enhanced consumption and production capacities of the nation, the minister said that "We have ambitious expansion plans of doubling our production capacity by 2030 from the current level of 154 MT to 300 MT, as also envisaged in National Steel Policy 2017". He said that therefore there is a need to strike a balance between Steel Industry's ambitious capacity enhancement targets and work towards Prime Minister Narendra Modi's vision of achieving net zero target by 2070.

Sovereign green bonds and thematic funds for blended finance for climate action announced in the Union Budget 2022-23

Ashwini Kumar Choubey, Minister of State for Environment, Forest, and Climate Change

New Delhi, India: The Minister of State for Environment, Forest and Climate Change, Ashwini Kumar Choubey, today said that India's vision to achieve net zero emissions by 2070 has been carefully considered after considering the principles of United Nations Framework Convention on Climate Change (UNFCCC), in particular, the principle of common but differentiated responsibilities and respective capabilities in the light of national circumstances.

In a written reply to a question in the Rajya Sabha, Shri Choubey said that according to latest estimates in India's Long-Term Low-Carbon Development Strategy (LT-LEDS) document submitted to the UNFCCC in November 2022, it is envisaged that a transition to a low-carbon development pathway will entail costs, pertaining to the deployment of new technologies, development of new infrastructure, and other transaction costs. Several estimates regarding India's financial needs exist. Many of them focus on the energy sector, including industry, buildings, and transport. Estimates vary across studies due to differences in assumptions, coverage, and modelling approaches, but fall in "the range of trillions of dollars by 2050".

The written reply stated that as per the Securities Exchange Board of India (SEBI), green debt securities are created to fund projects that have positive environmental and/or climate benefits. Proceeds from these bonds are earmarked for green projects. The SEBI (Issue and Listing of Non-Convertible Securities) Regulations, defines green debt security as a debt security issued for raising funds that are to be utilised for project(s) and/or asset(s) falling under any of the following categories, subject to the conditions as may be specified by the Board from time to time:

Renewable and sustainable energy including wind, solar, bioenergy, other sources of

energy which use clean technology, Clean transportation including mass/ public transportation, Sustainable water management including clean and/or drinking water, water recycling, Climate change adaptation, Energy efficiency including efficient and green buildings, Sustainable waste management including recycling, waste to energy, efficient disposal of wastage, Sustainable land use including sustainable forestry and agriculture, afforestation, Biodiversity conservation, or a category as

may be specified by the Board, from time to time.

656 Start-ups Supported by Approved Incubators under Start-up India Seed Fund Scheme (SISFS)

New Delhi, India: The Start-up India Seed Fund Scheme (SISFS) has been approved for the period of 4 years starting from 2021-22. The Scheme aims to provide financial assistance to start-ups for proof of concept, prototype development, product trials, market entry and commercialization. It is implemented with effect from 1st April 2021 with a corpus of Rs. 945 crores.

As per provisions under SISFS, the Government has constituted an Experts Advisory Committee (EAC) which is responsible for the overall execution and monitoring of the SISFS. The EAC evaluates and selects incubators for funds under the Scheme. These incubators thereon select the start-ups based on certain parameters outlined in Scheme guidelines. 126 incubators have been approved and these incubators have selected 656 start-ups under the Scheme as on 30th November 2022.

Centre encouraging sugar mills to divert excess sugarcane to ethanol

New Delhi, India: The Union Minister of State for Consumer Affairs, Food and Public Distribution, Ms. Sadhvi Niranjan Jyoti in a written reply to a question in Lok Sabha today shared that in a normal sugar season, production of sugar is around 320-360 Lakh Metric Tonne (LMT) as against the domestic consumption of 260 LMT which used to result in huge carry over stock of sugar with mills. This excess stock used to lead to blockage of funds & affected the liquidity of sugar mills resulting in delayed payment of cane dues & resulting in accumulation of cane arrears. In order to find a long-term solution to address the problem of excess sugar, Government is encouraging sugar mills to divert excess sugarcane to ethanol.

Government has fixed target of 20% blending of fuel grade ethanol with petrol by 2025. In sugar seasons 2018-19, 2019-20, 2020-21& 2021-22 about 3.37, 9.26, 22 & 36 LMT of sugar respectively has been diverted to ethanol. In current sugar season 2022-23, about 45-50 LMT of excess sugar is targeted to be diverted to ethanol. By 2025, it is targeted to divert 60 LMT of excess sugar to ethanol, which would solve the problem of high inventories of sugar, improve liquidity of mills thereby help in timely payment of cane dues of farmers

Aramco and TotalEnergies to build petrochemical complex in Saudi Arabia

Dhahran, Saudi Arabia: The Saudi Arabian Oil Company ("Aramco") and TotalEnergies have taken the final investment decision for the construction of a world scale petrochemical facility in Saudi Arabia. The 'Amiral' complex will be owned, operated, and integrated with the existing SATORP refinery located in Jubail on Saudi Arabia's eastern

coast. The investment decision is subject to customary closing conditions and approvals.

The petrochemical facility will enable SATORP to convert internally produced refinery off-gases and naphtha, as well as ethane and natural gasoline supplied by Aramco, into higher value chemicals, helping to advance Aramco's liquids to chemicals strategy. The complex will comprise of a mixed feed cracker capable of producing 1.65 million tons per annum of ethylene, the first in the region to be integrated with a refinery. It will also include two state-of-the-art polyethylene units using Advanced Dual Loop technology, a butadiene extraction unit, and other associated derivatives units.

The project alone represents an investment of around $11 billion, of which $4 billion will be funded through equity by Aramco (62.5%) and TotalEnergies (37.5%). Its construction is scheduled to begin during the first quarter of 2023 with commercial operation targeted to start in 2027.

Deepak Fertilisers Announces Demerger of its Mining Chemicals & Fertiliser Businesses

Pune, India: The Board of Directors of Smartchem Technologies Limited ('STL') at its meeting held today approved a Corporate Restructuring Plan with the objective of unlocking growth potential of each of the businesses. STL is a wholly owned subsidiary of Deepak Fertilisers and Petrochemicals Corporation Limited, one of India's leading producers of industrial chemicals and fertilisers ('DFPCL').

Sailesh C. Mehta, Chairman & Managing Director, Deepak Fertilisers & Petrochemical Ltd

Commenting on this important development, Sailesh C. Mehta, Chairman & Managing Director said: "Over past few years, DFPCL group has significantly improved its operational performance, generated cash flows, and strengthened balance sheet whilst focusing on increasing investments in Greenfield expansions. The proposed corporate restructuring shall considerably help create strong independent business platforms within the larger DFPCL brand umbrella, hence enhancing stakeholders' value over time." Earlier, DFPCL Group's strategy was primarily focused on production, cost optimization, capacity utilisations and efficiency improvement.

Shell signs agreement with Alfa Laval to develop a Gas Combustion Unit (GCU) for hydrogen boil-off gas

David Jung, Business Development Manager, Alfa Laval and Carl Henrickson, General Manager of Shipping Technology, Shell

London, England: Shell International Trading and Shipping Company Limited has signed a memorandum of understanding (MOU) with Alfa Laval regarding the development of a new Gas Combustion Unit (GCU) for use on liquid hydrogen carriers. By paving the way for the safe transport of hydrogen by sea, the project is an important step on the path to global decarbonization.

Under the MOU, Alfa Laval will develop a system to safely combust hydrogen boil-off gas (BOG) from a vessel's storage tank, as part of a new liquid hydrogen carrier. Because the venting of cargo is restricted, a GCU offers a means of controlling tank pressure/temperature when the BOG poses safety risks beyond the tank's design conditions. Renewable hydrogen will likely be a key fuel in tomorrow's decarbonization mix, but accessibility will determine its impact," says Carl Henrickson, General Manager of Shipping Technology, Shell.

As the leader in gas combustion on LNG carriers, Alfa Laval has insights and technology that will act as a springboard. The design of the new GCU system for hydrogen will be based on the existing Alfa Laval GCU for LNG. More than 200 of these units have been installed in just over a decade, and an additional 100 units have been ordered during 2022. The challenges in hydrogen combustion, however, are significantly greater than those involved with LNG.

CCUS Market Set for Growth in Key Industries, Finds IDTechEx New Report

Recognized as one of the key technologies essential to achieving net-zero emissions targets, the momentum behind carbon capture, utilization, and storage (CCUS) deployment is building up. The new IDTechEx report, "Carbon Capture, Utilization, and Storage (CCUS) Markets 2023-2043", highlights what the CCUS industry has been doing to overcome historical challenges and position itself to reach the scale required for net-zero emissions, a bold goal set by more than 70 countries and recently reinforced at the UN's Climate Change Conference (COP27).

IDTechEx's updated report brings the latest developments across the CCUS industry that have shaped the current market landscape, including regulatory incentives, business models, project delivery strategy, technological innovation, and more. Based on the drivers and hurdles for CCUS uptake, IDTechEx's latest forecast expects the global CCUS capacity to reach 1.8 gigatonnes per annum by 2043. Although still a modest capacity compared to what is needed for countries to achieve their net-zero commitments, attaining the gigatonne level of CCUS deployment will mean unprecedented growth to the industry and large amounts of investments. ■

The State of Industrial Decarbonisation

Decarbonisation, simply put, is the process of reducing human-caused carbon emissions. As governments, businesses, and communities worldwide seek to reduce their dependence on fossil fuels, they realize that achieving decarbonization is a principal challenge. Why? Because over the years, many decarbonization initiatives have been implemented and produced both good and bad outcomes. The purpose of this article is to share what has been learned about decarbonisation initiatives that maximize economic and environmental benefits while minimizing social and financial costs.

Decarbonisation is the buzz these days but where did it start, where are we now, and what lies ahead?

The Past

The European Emission Trading System (EU ETS), launched in 2005, was the first large scale initiative attempt to put a price on industrial CO2 emissions. Other schemes followed in various countries ranging from Canada and the USA to China and South Korea. Despite these efforts, the impact was limited. The initiatives failed to provide a high carbon price signal to generate significant action. As far as the EU ETS is concerned, this was due to an oversupply of emission permits in the market and the fact that nearly all emissions permits were distributed at no cost, basically rendering the system obsolete. According to Emissions Trading Extra, the EU ETS main beneficiaries were the financial sector and some of the polluting industries (Ref. 2). Refineries were granted emission permits at no cost between 2008 and 2010 that exceeded actual emissions by about 14 million tonnes (Refs. 3, 7). Some actors in the highly carbon intensive steel sector extracted even higher benefits from the EU ETS, which ultimately were funded by the households' electricity bills. The European Commission realised its credibility was at stake and reduced the volume of emission

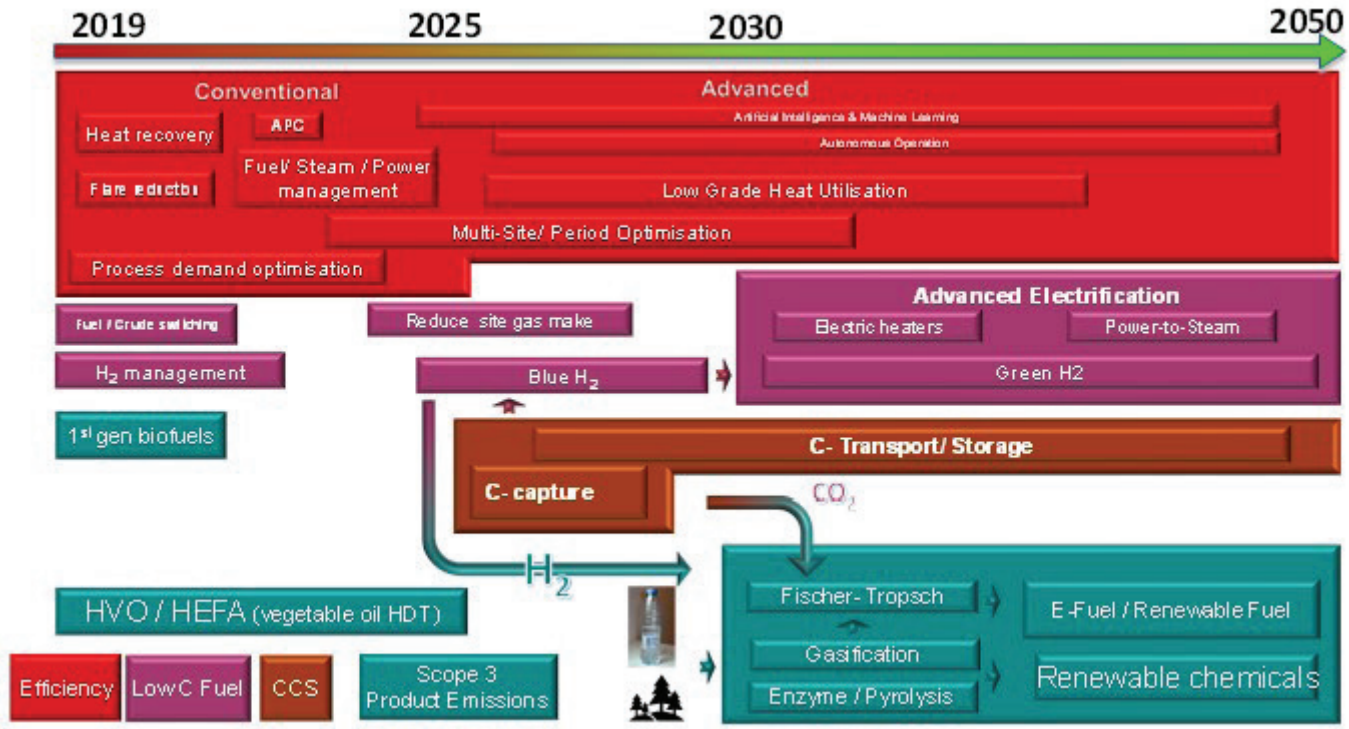

Figure 1. Decarbonisation technologies

permits in the market, which began having an impact on the European carbon price from 2017 onwards.

So far, the scope of industrial climate action was largely limited to the Scope 1, or direct, emissions. Scope 3 emissions caused by road fuels have been addressed to some extent during that period by the first-generation biofuels – ethanol and FAME- which, however, were generally not produced by traditional oil refineries.

The Present

SCOPE I to SCOPE III

Although the 2015 Paris Agreement does not force countries to submit and abide by a clearly defined decarbonisation roadmap, the accord does catalyse action. The ensuing plans submitted, and pledges made since 2019 have moved decarbonisation to the forefront of the industrial debate. According to the European Council, the EU's Fit for 55 package, for example, bundles more ambitious versions of existing climate initiatives with new initiatives such as developing a hydrogen economy (Ref. 1).

In 2019, KBC compiled the decarbonisation technologies shown in Figure 1. The challenge lies in choosing which of these to implement and how fast to do it. Energy efficiency is the first driver. A refinery in

SCOPE I Emission Reduction		
Strategies	High Performance Hardware Digitalisation Energy Management Systems	Economically justifiable & Technically developed
Emission reduction achieved	**3% per quartile**	
SCOPE I Emission Reduction Beyond 3% per quartile		
Strategies	CCUS Low level heat recovery Electrification	Economically unjustifiable & Technically undeveloped (as of now)

the 4th quartile emits 65% more CO2 than similar plants in the 1st quartile. If the refinery drops one quartile, emissions have been shown to decrease by roughly 15% percent.

Most industries have already been working on this initiative for several decades. In the case of best-in-class sites with high performance hardware, digitalisation with an energy management system that connects the management of different energy-carrying utilities such as steam, electricity, fuel and hydrogen, and CO2 can be expected to further reduce emissions by 3% per quartile.

Further reductions of Scope 1 site emissions will require investments that have been historically either economically unjustifiable or technically undeveloped, such as CCUS, low level heat recovery, and electrification.

International institutions and nations are primarily driving industry's decarbonisation, for example by setting road and aviation fuel emission standards. Focusing on technological solutions risks overlooking the fact that gasoline and diesel demand will decline substantially, especially in more prosperous regions with plans to decarbonise road fuels by 2050. Combine this with the International Maritime Organisation plans for decarbonisation, and the refinery carbon intake could drop by 60%, leaving only a demand for petrochemical feedstocks, heavy duty vehicles, and aviation fuel unaffected. That forecast could prove to be optimistic with legislation in place in the EU and USA to also displace fossil jet fuel with sustainable aviation fuel (SAF) and initiatives related to petrochemical feedstocks and products.

Market assessment companies predict

that global annual plastics production will increase from nearly 400 million tonnes to over one billion tonnes per year by 2050. Considering most plastics end up in the environment, this is an unsustainable industrial model. Despite the lack of concrete regulation regarding petrochemicals, the industry actively looks at means to recycle waste plastics and reduce the carbon intensity of its products.

Strict Scope 3 product emission targets will severely disrupt the operating model of the refining industry and, in the longer run, the petrochemical industry (Ref. 6). SAF production is gradually taking second generation biodiesel as refinery Scope 3 investment focus. Pacesetters in the petrochemical industry are exploring the possibility of recycling plastics through gasification combined with synthesis, or pyrolysis. In 2019, KBC expected this would not become significant until at least 2030, but the first plants are now under construction, albeit not uncontested (Ref. 8). Currently, the use of lignocellulosic material as feedstock seems to be less intensely investigated, possibly because it does not contribute to the plastics pollution issue.

KBC assessed nine carbon utilisation technologies during the strategic decarbonisation study of the Goi industrial area in the Chiba Prefecture at Tokyo Bay (Ref. 9). Figure 2 shows a cash flow breakdown for the nine technologies in a scenario where green hydrogen is inexpensive, and CO2 usage generates high revenues (Refs. 4, 5). The economically viable options at high hydrogen costs will be limited to those technologies that consume little or no hydrogen, unless low carbon chemicals can be sold at significantly higher prices than their fossil fuel counterparts, as is already

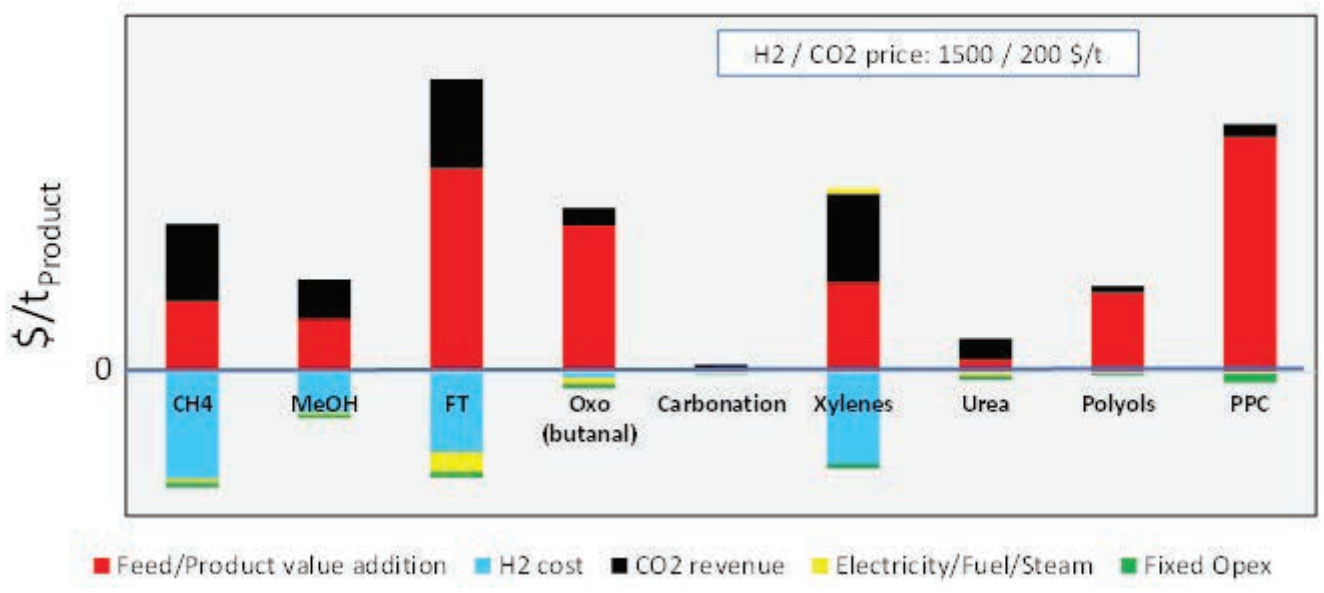

Figure 2: Carbon utilisation technology cash flow comparison

the case for SAF, which results in favourable economics for the Fischer Tropsch (FT) path. Clearly, regulation plays a crucial role in establishing separate markets for low carbon intensity chemicals and fuels.

In summary, development of a decarbonisation investment strategy requires process and utility simulation capacities, high level cost estimating capabilities, and a vision for how market and economics will evolve. Compared to the current economy, a low carbon economy will be more constrained by resource availability and logistics. Green electricity and hydrogen will be available less abundantly and the supply more perturbed than fossil feeds. The availability of biomethane and lignocellulosic feeds sourced from wastes will also be limited, while low carbon lipid feeds are already in short supply.

The Future

Industrial symbiosis

Clusters of different industrial sites owned by different operators are better positioned to successfully decarbonise because of their higher potential to optimise the use of the scarce and fluctuating low carbon resources.

System optimisation has three dimensions: frequency, scale, and scope. Each dimension indicates a higher optimisation potential as it moves up the scale. Minimising capital and operating costs while optimising resources of industrial clusters can be achieved by creating a System of Systems (SOS), where select operational information sourced from various industrial sites is shared in a safe environment to optimise the overall flexibility. To accomplish this, the infrastructure could either be a centralised structure or an information backbone that connects different subsystems.

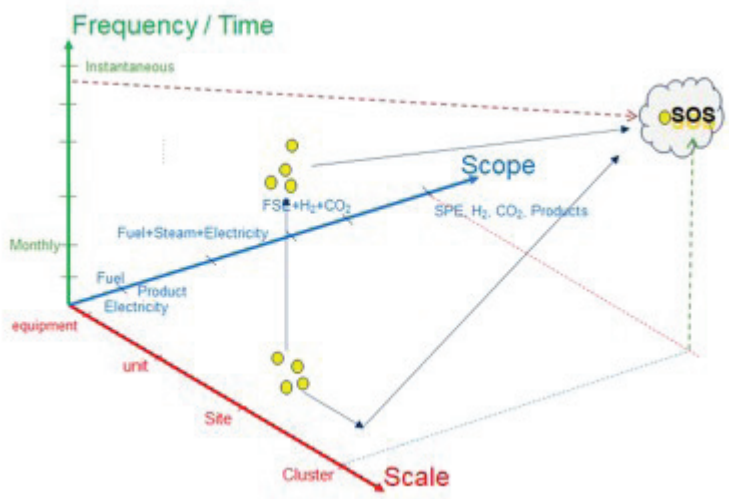

Figure 3: System of System optimisation

Yokogawa and KBC are jointly involved in transforming this conceptual model into reality in the Goi/Chiba industrial cluster (Refs. 4, 5) and are also conducting a conceptual study for an industrial cluster in Europe. We believe that these studies will set a standard for industrial cluster decarbonisation worldwide.

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Avenues of sustainable utility solutions for the chemical industry

Chemical industries are one of the most energy-demanding technologies and require different forms of energy like heating, cooling and power. The selection of energy sources is the function of the availability of resources, location, technology, cost, and environmental effects. Fossil fuels like coal, oil, and natural gas are still the primary source of energy in the chemical industries while the application of renewable sources like biomass, solar and wind are still not common. Because of the rapid growth and the continued use of fossil fuels, chemical industries are today one of the biggest contributors to carbon emissions.

The problem of carbon emission in chemical plants can be dealt with through simultaneous efforts on both the generation and utilisation sides. Some of the popular options to reduce carbon emissions in the chemical industries are as follows.

Efficiency of the boiler and heater

The chemical industry requires a boiler and heater, and common heating mediums are steam, thermal oil, and hot water. The efficiency of boilers and heaters plays a very important role in fuel input and carbon emissions. The efficiency of the boiler and heater can be increased by the selection of appropriate combustion technology, boiler & heater design, heat recovery units and integration of heat recovery across the different heat generation units. The efficiency of the boiler and heater can be further increased by employing condensing heat exchanger technology.

Biomass as fuel

Biomass is a non-fossil fuel and is derived from wood, wood waste, and agriculture residue like bagasse, rice husk, coconut shell, groundnut shell, coffee husk etc. Biomass, being a carbon-neutral fuel, does not contribute to carbon emissions.

The lower cost and higher availability of biomass fuels make them a viable alternative to fossil fuel, even though it has several commercial and technological challenges. The availability of biomass is quite inconsistent, and the characteristics of these fuels keep on changing. Biomass fuels normally have lower bulk density, lower calorific value, higher moisture and ash with lower ash fusion temperature that is responsible for slagging and fouling. Biomass is converted into useful energy either by combustion or gasification.

Combustion

Biomass boilers should be designed to handle wide varieties of fuel to counter problems like inconsistent supply and quality. These boilers should be able to burn high moisture fuel and have a lower level of slagging and fouling problems. Reciprocating grate combustion proves to be the right combustion technology to deal with the problems associated with biomass combustion like lower calorific value, lower density, higher moisture, and fouling. The pulsating grate or reciprocating grate utilizes successive oscillation of grate linkage to achieve continuous movement of the fuel. Significant improvements in the reciprocating grate technology have taken place over time to provide the required fuel flexibility that helps deal with inconsistency in fuel supply. These grates utilize multiple trolleys with different speeds and independent air dampers to burn a wide range of fuels.

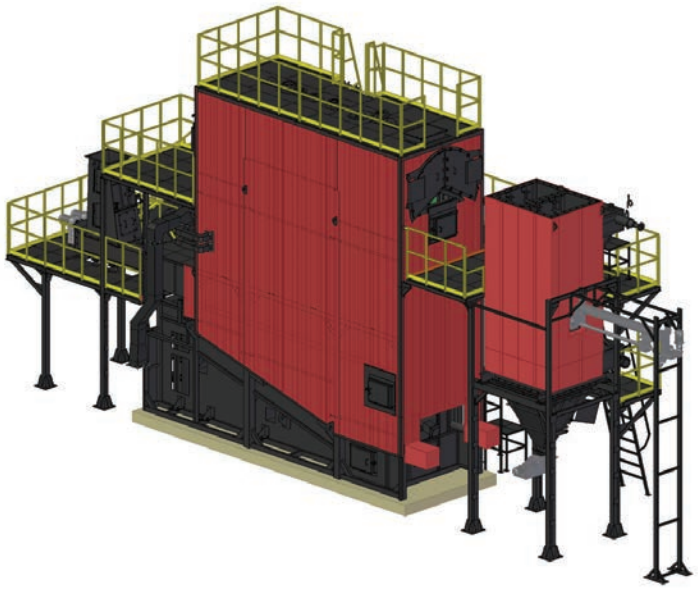

Fig.1. Biomass-fired reciprocating grate boiler

Gasification

Gasification is a partial oxidation process, which converts coal or biomass into a mixture of combustible gases. Various technologies employed for gasification are downdraft, updraft, fluidised bed, and entrained flow gasifiers. The appropriate technology is selected based on fuel availability and the relative benefits and limitations of the various gasification technologies. The performance of gasifiers depends on the fuel, type of gasifiers, gasification temperature and oxidising agent.

While combustion is the easiest process for the utilisation of fossil or biomass fuel to produce energy, gasification is slowly growing

in popularity due to it being a clean technology, having wider applications, and offering a higher fuel flexibility. Gasification is a cleaner method for utilisation of biomass, as it results in lower dust, CO, NOx and greenhouse gas emissions. Gasification also helps to increase the efficiency of the power plant cycle. It offers wide applications such as gas engines, gas turbines, combined cycles, process heating, hydrogen production and fuel cell. Gasification is getting popular for the utilisation of a wide range of biomass, as it offers higher flexibility in terms of different feedstock materials being used.

Evolution of cleaner fuel

Hydrogen and ammonia are being explored as the future substitute for conventional fossil fuels, as they can provide a clean and carbon-free solution. Methanol can also replace conventional fossil fuels to provide a cleaner option for industries. Many chemical process-generated combustible wastes too, can act as a fuel source.

Electric boiler and heater

The role of renewable energy has increased in power generation due to the rise in wind and solar energy. This is helping in the reduction of the cost of electricity generation. The lower cost of electricity from a renewable source will provide a great impetus in shifting energy source from fossil fuels to electricity. The use of electric boilers will provide an alternative to reduce carbon emissions in the chemical industries.

The hybridisation of energy source

Due to inconsistency in the availability of solar energy, and fluctuation in the supply and cost of electricity, a hybrid boiler with multiple energy sources like fuel, solar energy and electricity provides an appropriate solution to minimise carbon emission in a process plant.

Improvement of the system efficiency

Boilers and heaters are normally classified into closed-loop and open-loop systems. Hot water and thermal oil are utilised in a closed loop, wherein hot water or hot thermal oil generated in the heater rejects heat in the process heat exchanger and relatively cooled thermal oil returns back to the heater. Steam is used in an open loop, where steam condensation takes place in a process heat exchanger and condensate is rejected to the atmosphere with a loss of heat and water in a form of flash steam. The open loop system has less efficiency in comparison with the closed loop system. An appropriate selection of heating medium and system can play a major role in minimising the energy demand of a chemical plant. Steam is a popular heating medium, as it offers several benefits like simplicity in the steam distribution system, uniform heating, and higher heat transfer performance. The design of an appropriate condensate recovery system can reduce the losses

and maximise the efficiency of the heating system.

Low-temperature heat recovery

The absorption technology-based cooling and heating system is an ideal choice for the chemical industry as it uses waste heat energy (low-grade heat) for the refrigeration cycle. The abundant heat from steam, hot water, vapour, or any other sources, produced mostly as a by-product from various chemical processes, can be recovered and utilised to achieve the required cooling and heating utilities.

The organic Rankine cycle is another option for the utilisation of low-grade heat. The organic Rankine cycle utilizes organic fluid with low boiling temperature to recover the low-grade heat for evaporation and the organic vapour is used to run the expander to generate power.

Integration of energy generation and demands (Cogeneration and trigeneration)

As the chemical industries require heating, cooling and power, cogeneration and trigeneration plant can play an important role in the improvement of the efficiency of a plant. This also includes the integration of energy demand and supply, where optimum operation of the cogeneration and trigeneration plants is achieved by meeting supply and demand.

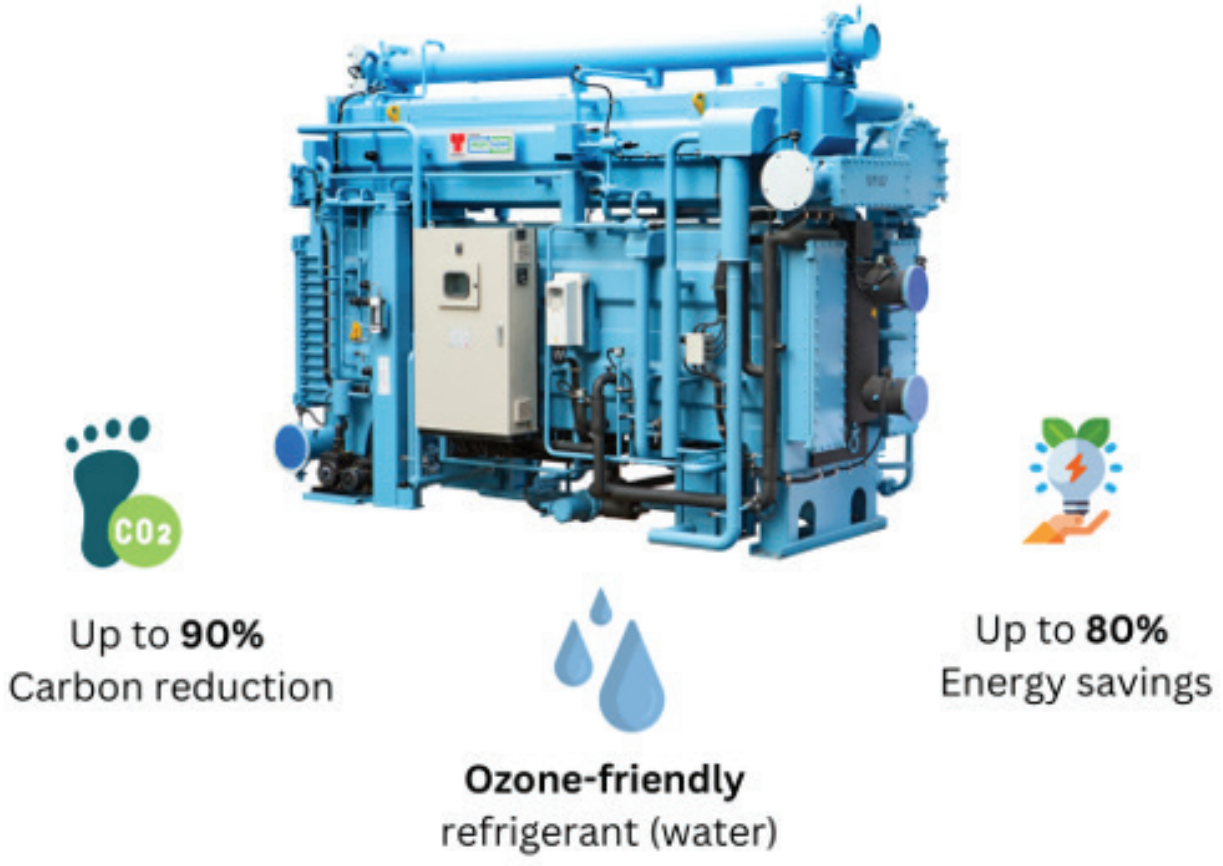

Fig.2. Absorption chiller

Improvements in the process efficiency

Improvement in the plant efficiency can help reduce the energy demand of the chemical industries. Some of the common methods for the improvement of process efficiency are waste heat recovery, the development of energy-efficient equipment and process intensification.

Employment of energy integration

The heating and cooling requirement of a chemical plant can be minimised by planning and designing an appropriate heat exchanger network for heat recovery from various chemical processes. Pinch technology provides a systematic thermodynamic approach for designing an optimum heat exchanger synthesis to minimise the plant's heating and cooling utilities. The application of pinch technology is slowly getting popular for process design.

Sharing utilities (Energy and water) across industries to maximise efficiency, reduce waste and minimise emissions.

Currently sharing utilities is not very common in industries but it provides a huge opportunity for the minimisation of energy demand and carbon emissions. It can also help to reduce waste generation. This sharing can be done in an industrial area or region.

Process control and digitalisation

Efficient process control helps to achieve higher productivity and energy efficiency in a chemical plant. Model-based control can play a major role in minimising the energy consumption in the process plant. Digitalisation will play a major role in process control, as the application of data analytics, machine learning, artificial intelligence, and digital twin technology will grow in the control of energy systems and process plants.

Conclusion

The development of sustainable technologies for carbon capture, carbon sequestration and conversion of carbon into useful products can lead to zero or negative emission. Sustainability in chemical industries cannot be achieved by simply focusing on energy demand, supply and utilization. It also requires major efforts on waste minimisation and the use of green feedstocks. ■

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Green Recovery – Addressing Climate Change

The prosperity and wellbeing of the society and future generations mainly depends on the current actions towards the preservation of earth and eco system. Since the Industrial Revolution, human activities, especially the accumulated carbon dioxide emission from the intensive fossil fuels consumption of developed countries, are the main causes of global climate change and pose a huge threat to ecosystem security and economic and social development in the world, especially in developing countries like India.

Climate change refers to long term shifts in temperatures and weather patterns mainly caused by human activities, especially burning fossil fuels. Major risks such as frequent extreme weather events, species extinction, sea level rises, and crop yields reduction brought by climate change seriously threaten human survival and sustainable development.

Decarbonisation

The battle against climate change is gaining momentum and governments around the world are looking towards rebooting from the global COVID-19 crisis with a 'green recovery. Global leaders gathered at COP26 to agree the critical actions that are needed to save our planet with decarbonisation and net zero goals. Net zero targets can be achieved with deployment of multi directional approaches such as

- Innovation and adaption of new technologies to minimise the emission at the source
- Aggressive development of green belts
- Carbon capture, Storage and Utilization.

Carbon capture, utilization, and storage (CCUS) refers to a bundle of technologies that can play significant and diverse role in meeting global energy and climate goals.

Carbon Capture

CCUS involves the capture of CO2 from large point sources, including power generation or industrial facilities that use

either fossil fuels or biomass for fuel. The CO2 can also be captured directly from the atmosphere. If not being used on-site, the captured CO2 is compressed and transported by pipeline, ship, rail or truck to be used in a range of applications or injected into deep geological formations (including depleted oil and gas reservoirs or saline formations) which trap the CO2 for permanent storage.

Carbon capture can prevent over 90% of carbon emissions from entering the atmosphere, helping hard-to-abate industries play their part in mitigating climate change. Carbon capture helps companies seize new revenue-generating opportunities within the circular carbon economy. To reach climate targets set out in the Paris Agreement, the world needs to move towards 'net zero' carbon emissions by 2050. Scaling carbon capture is key to mitigating climate change.
It is a proven and affordable solution, aimed at delivering rapid, cost-effective decarbonisation of key global industries. Ultimate goal is limiting global warming within 1.5deg compared to pre- Industrial period.

Capture processes can be grouped in three categories, whereby the suitability of each approach depends on the industrial process or type of power plant in question.

1. **Post-combustion:** CO2 is removed from the flue gas resulting from the combustion of a fossil fuel. Post-combustion separation involves the use of a solvent to capture the CO2. Typical applications for this technology include pulverized coal (PC) plants, and natural gas combined cycle plants (NGCC). This technology is particularly suited to retrofit applications.

2. **Pre-combustion:** The primary fuel in the process is reacted with steam and air or oxygen and is converted to a mix of carbon monoxide and hydrogen, often called a 'syngas'. The carbon monoxide is subsequently converted to CO2 in a 'shift reactor'. The CO2 can then be separated, and the hydrogen is used to generate power and/or heat. This technology is particularly suitable to be applied to integrated gasification combined cycle (IGCC) power plants.

3. **Oxy-fuel combustion:** The primary fuel is combusted in oxygen instead of air, which produces a flue gas containing mainly water vapour and a high concentration of CO2 (80%). The flue gas is then cooled to condense the water vapour, which leaves an almost pure stream of CO2. Additional equipment is required for the in-situ production of oxygen from air.

Transportation and Storage

During the capture process, carbon dioxide is separated from various gases. CO2 is transported through pipelines to a suitable site for its storage. CO2 is most efficiently transported when it is compressed to a pressure above 7.4 MPa, and a temperature above approximately

Carbon Capture Processes		
	Process Description	**Typical Application**
Post- Combustion	CO2 is removed from the flue gas resulting from the combustion of a fossil fuel using a solvent	Pulverized Coal (PC) Plants; Natural Gas Combined Cycle (NGCC) Plants
Pre- Combustion	Primary fuel is reacted with steam & air/ oxygen and is converted to syngas. The CO in syngas is converted to CO2 via 'shift reactor'. The CO2 can then be separated, and the hydrogen is used to generate power and/or heat.	Integrated Gasification Combined Cycle (IGCC) Plants
Oxy-fuel combustion	Primary fuel is combusted in O2 which produces a flue gas containing mainly water vapour and a high concentration of CO2 (80%), when cooled to condense the water vapour, leaving an almost pure stream of CO2.	In-situ production of O2 from Air.

31˚C. Under these conditions, the CO2 displays supercritical properties; it is a liquid with gas characteristics. Thus, CO2 would normally be transported at high pressures in pipelines made of carbon steel

Suitable CO2 storage locations include abandoned oil and gas fields or deep saline formations, with an expected minimum depth of 800 m, where the ambient temperature and pressures are sufficiently high to keep the CO2 in a liquid or supercritical state. The CO2 is prevented from migrating from the storage reservoir through a combination of physical and geophysical trapping mechanisms. The technologies used to inject the CO2 are similar to those used in the oil and gas industry. While certain injection technologies are known, improvements specifically for CO2 storage are still under development. Once the injection phase has been completed, the well will need to be sealed by using a suitable (usually cement) 'plug', placed at an adequate depth to prevent the CO2 rising up the well and possibly escaping or contaminating groundwater.

CO2 Utilization

Though carbon capturing prevents emission entering the atmosphere, it can be converted as revenue generating opportunity only with utilization of

captured CO2. The concept of carbon capture and utilization represents a technological solution that aims to prevent CO2 emissions by converting them into value-added chemicals.

There is a growing market for captured CO2. It can be used in household goods, such as methanol, chemicals, and value-added products. The CO2 utilization industry has gained momentum as a solution to achieve the world's ambitious climate goals. Many pre-commercial projects are currently operating or under construction with more in the pipeline supported by public and private investments. Although still in its infancy, the market pull is coming from the users - businesses and individuals are reportedly creating demand for low-carbon products.

Around 230 Mt of CO2 are currently used each year, mainly in direct use pathways in the fertiliser industry for urea manufacturing (~130 Mt) and for enhanced oil recovery (~80 Mt). New utilization pathways in the production of CO2-based synthetic fuels, chemicals and building aggregates are gaining momentum.

For numerous industries in the 'hard to abate' sector, CCUS technologies are the indispensable prerequisite for successfully working toward the global 'net zero' goal. The process of refining crude oil results in the production of large quantities of CO2, an undesirable greenhouse gas. Also, the cement production alone, which emits large amounts of carbon dioxide (CO2) into the atmosphere from the chemical reaction that turns limestone into cement, is responsible for 8 percent of all CO2 emissions.

If industries can't help but produce the gas, is there any way of utilizing it? The captured carbon can be combined with green hydrogen to create climate-neutral methane fuel or methanol. Technologies have been developed to produce acetates from CO2 and acetates are fed to grow algae from which Omega-3 fatty acids and lipids are made, thus make the project economically viable.

Conclusion

We need to rebuild our energy systems to become less dependent on fossil fuels. This includes renewable energy and green hydrogen, but also carbon capture, utilization and storage, which allows us to reduce emissions and leverage CO2 as an important feedstock for climate-neutral fuels. ■

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"For us, all investment decisions are impact driven: Balancing the three dimensions people, planet and last, but not least, profit is a core value for Heubach."

Ravi Kapoor
Chairman & CMD, Heubach Colour Pvt. Ltd.

Ravi Kapoor, Chairman & CMD, Heubach Colour Pvt. Ltd., India articulates the development of an economically & ecologically sensible growth trajectory enabled via ceaseless R & D towards reducing energy, water & raw material consumption- improving the entire production process. Such growth trajectories inculcate sustainability aspects at fundamental levels- bringing value not only to customers, suppliers, employees, and shareholders but all stake holders specially society at large.

How is your organization balancing sustainability with profitability for future growth?

Economically sensible actions (i.e., driving profitable future growth) must always be ecologically sensible as well. To give you one example: The production of pigments and pigments preparations is particularly energy intensive. The increase of energy efficiency and the switch to renewables energies is therefore one of our top priorities. We work continuously on production and process technology and innovations to reduce our use of energy and resources while lowering our emissions. One key initiative we have is to avoid drying of pigments for use in preparations and use press cake directly wherever possible. This saves energy and improves quality in a classic case of a win-win situation. To lower our emissions, we purchase green energy where available and use self-generated wind and solar energy wherever possible. Heubach is a strong believer that Ecology and Economy go hand in hand.

New technologies under consideration, challenges in implementing and possible solutions.

One of the key areas of focus is recycling and reuse of raw material using state of art technologies. We have a specific key input where this process is under development and will result in substantial financial gains with drastic reduced carbon footprint. Heubach has a strong history in this area in the Phthalo Green and Blue production with Aluminum Chloride and Ammonia recycling which we aim to continue as strong initiatives. One new and exciting development is a green Azo pigment which we are working on intensively at present.

Tell us about the steps taken by your organization in the direction of mitigating emissions and improving energy efficiency?

We are taking steps in different areas to mitigate emissions and we continuously improve our production processes to save resources and to improve our environmental footprint. One example is the introduction of a vacuum filling technology that allows to reduce packaging by 50%. This leads to a minimized use of paper bags, less storage space, less waste, reduced transportation and therewith a reduction of CO2 emissions. The above example of press cake use is another instance of energy saving but more than all we are pushing an intensive program to cut use of energy across all production sites and move to green energy wherever possible. Recent case of success is our sites in India where a large percentage of energy use comes from renewable energy whether in ownership of wind power directly or long-term contracts with hybrid and solar power sources.

Another very recent example is related to green energy: Heubach colorants (India) Limited, one of India's leading producers of pigments and pigment dispersions, has

announced its first hybrid energy and solar projects in India.

How are you collaborating with the vendors & suppliers to reduce SCOPE III emissions.

We are actively working on our Scope III emissions. Heubach's "Green" pink is a great example for a product innovation that would not be possible without looking at the entire chain: Our Quinacridone pigments can be partially made with bio-based raw materials while maintaining the same high quality and performance. The usage of bio-based raw materials reduces CO2 emissions by up to 33%. As mentioned above, we are developing a green Azo on similar lines and will continue to work with our vendors in this regard.

Thoughts on "Impact driven Investments" & plans of your organization in this direction

For us, all investment decisions are impact driven: Balancing the three dimensions people, planet and last, but not least, profit is a core value for Heubach, and we evaluate all investment opportunities against those three aspects. Our major investment in the Ultramarine Blue plant is a classic example as also our investment in hybrid renewable energy sourcing in our Indian facilities. Our previous investments in a Hydroxide plant and ammonia concentration plant bear testimony to this philosophy.

"The most important aspect from our standpoint is Responsible and Sustainable growth bringing value not only to customers, suppliers, employees, and shareholders but all stake holders specially society at large."

Future plans (investments in expansions, new facilities, and key markets)

Heubach is on a clear growth trajectory and as such, we are constantly evaluating new opportunities. Heubach has over the years been in a constant state of growth, expansion, and development. At present we have the ongoing projects like a global size UMB plant, expansion of our QA in India, new capacity in the speciality Phthalos. In the pipeline is a significant increase in our anticorrosive pigment capacities in Germany where we are global leaders and in our high performance Anthanthrone red where again are a dominant player. As you are aware we are the only pigment company with a truly global manufacturing footprint as also market presence which we aim to enhance further in the coming years in APAC and the Americas specially apart from consolidating our position in Europe which is our traditional base. But the most important aspect from our standpoint is Responsible and Sustainable growth bringing value not only to customers, suppliers, employees, and shareholders but all stake holders specially society at large. ■

Automating Industrial Motors

Automation encompasses a vast range of practices and ideas. It is not only about using automatic machine and robots to get the job done. Automation basically refers to the use of machines to automatically perform tasks that were initially being done manually. However, these require proper strategies, routes, equipment, controllers, and many other aspects are required to efficiently implement automation.

Need for Automation

In the earlier days people made use of manual control systems to do different tasks and overtime they introduced pneumatic control systems. But both these methods took up lot of space and expenses along with a high-risk factor. Then came the hardwired systems and the electromechnical systems that proved to be a better alternative. With the introduction of electronic equipment process control automation jumped to a new level thus paving way to the introduction of Programmable Logic Controllers (PLC). PLCs allowed the many tasks that were previous manually or remotely controlled to be fully automated. This allowed to reduce the need for more labours and reduce the operation cost. Moreover, the operators can collect digital data of the process and store or transfer the data over multiple platforms. Much equipment involved helped improved the durability of equipment and safety of the operators.

Industrial automation is made possible by making use of input devices that would allow the process to start and modify and output devices that are controlled by the controllers. Input components can be of digital type (push buttons, photo sensors, float switch, select switch, etc.) and of analog type (pressure transducer, flowmeter, thermocouple, level transmitter, etc.). Output components can be of digital type (lamps, alarms, relays, etc.) and of analog type (control valves, pressure regulators, etc.). The control devices such as a PLC would take in commands from the input devices and provide appropriate control for the output devices on accordance to the program provided in the PLC.

So in short, industrial automation can help in reducing the labour costs, productivity, improve worker safety and product quality and can reduce or eliminate the need for routine manual and clerical tasks.

Levels of Automation

The automation structure can be divided into Field, Control, Supervisory, Planning, and Management levels.

The field level is the lowest of them all. They are the devices, actuators, sensors that are seen in the field or production floor. They do the physical work and monitoring. Electric motors, hydraulic and pneumatic actuators that moves machinery, proximity switches used to detect movement or certain materials, photoelectric switches for detection etc. are all categorized under the field level. The next level is the Control level. This level consists of the controllers such as PLCs and PIDs. The control level uses these devices to control and run the devices in the field level that actually do the physical work. They take in information from all the switches, sensors, and input devices to make decision on what output devices to turn on to complete the programmed task. Usually, a PID controller is embedded in the PLC that allows to keep a control variable within a set of parameters. For example, an

industrial heater can be controlled with the PID block in the PLC that allows the temperature to remain within a given set point. The next level is the Supervisory level. It uses the Supervisory Control And Data Acquisition (SCADA). It is used to access data from the previous level and control systems from a single location. It usually adds a Graphical User Interface (GUI) or a Human Machine Interface (HMI) to control functions remotely. For example, Water plants usually employ this technology s to remotely control their systems. SCADA allows to monitor and control multiple systems from a single location while HMI is dedicated to a single machine. The next level is the Planning level. It uses a computer management system called Manufacturing Execution System (MES). MES monitors the entire manufacturing process in a plant or factor from the raw materials to the finished product. It allows management to see exactly what is happening and allows them to make decisions based on that information. The top level is the Management level. It uses the company's integrated management system known as the Enterprise Resource Planning (ERP). The company's top management can see and control their operations. It uses lot of software's and the previous levels to monitor the all levels of the business from manufacture to sales, to purchasing, to finance and payroll and many others. We are now at the new age of automation called Industry 4.0 which makes use of all the previously discussed systems and latest technologies like IIOT

to drive the industries more efficiently and productively..

Motor Protection

The electric motor is the most essential drive in the modern era of industrialization. From fractional Hp AC motor used for different home appliances to giant synchronous motor and induction motor of up to 10,000 Hp are used for different industrial applications. It should be protected against different electrical and mechanical faults for serving its purposes smoothly. The motor characteristics must be very carefully considered in selecting the right motor protection scheme. Unbalanced supply voltages, under-voltage, reversed-phase sequence and loss of synchronism (in the case of synchronous motor), bearing failures, stator winding faults, motor earth faults and overload etc. are some of the causes for motor faults. The degree of motor protection system depends on the costs and applications of the electrical motor.

Motor Control Centre (MCC)

A motor is a device that utilizes electrical energy to do mechanical operations such as rotating a pump, fan, blower, etc. Due to industrial development, the requirement for the automation and mechanization of the different industrial processes is increased. The mechanization of the different industrial processes requires many motors, so in order to control all these motors, MCC's are required. MCC is a big enclosure that would house the major motor control equipment. The MCC has the ability to plug in the control components, these components can be plugged in or unplug and thus there is no need for wiring the devices. The MCC would be composed of a busbar and other control equipment which can be utilized to control the operation of the motor and also to place the components in an integrated panel. The MCC also has different motor starting methods such as the DOL and star-delta starter.

Major components in MCC are 1. Bus bar 2. Circuit breaker 3. Magnetic contactor 4. Contactor auxiliary contact 5. Relay control 6. Control transformer 7. Cable installation control panel enclosure 8. Limit switch. A bus bar is a bar that would be made up of brass, copper, etc, the major function of a bus bar is to provide or distribute the required power to the electrical equipment. So, in an MCC, the bus bar would act as a power distributor. The major advantage of using a bus bar in an MCC is that we can eliminate the wiring of several components, so because of this, the size of the MCC would be reduced and also the number of parts in it. So, we can easily connect the electrical equipment in an MCC with the help of a bus bar and this would also be useful to locate the error. We can easily troubleshoot the problems in an MCC with the help of a bus bar. Overload relays would protect the

motor from overheating, the overheating could be caused due to the overload of the driven machinery. It can also be caused due to the low voltage level or if there is an open phase in a three-phase system. So, when the excessive current is drawn for a specified amount of time the overload relay would open and the motor will be disconnected from the power source. This relay would allow the temporary overload which could not cause any damage to the motor and block the over-load which could damage the motor. The purpose of the MCB is to disconnect a circuit in case if there is an excessive current flow in the circuit, or in case if there is an electrical load that exceeds capacity. Sometimes it would be necessary to operate the control circuit at low voltages than the power circuit. So, to decrease the voltage level we can use a control transformer. A magnetic contactor is used in an MCC to start or stop a motor. Mostly there would be a remote-control device to start and stop the motor and for this purpose, we can use a contactor. The operation of the magnetic contactor would be based on the electromagnetic principle. The limit switch is used to provide a signal in case if a specified limit is reached like if there is an excess overload. The limit could be the rotating speed of the machine, position of the machine part, etc. We can use this device as a replacement to the human operator and it can be used where it is not possible for a human operator to operate.

Motor Starter

A motor starter is an electrical device that is used to start & stop a motor safely. Similar to a relay, the motor starter switches the power ON/OFF & unlike a relay, it also provides a low voltage and overcurrent protection. The main function of a motor starter is 1. to safely start a motor 2. to safely stop a motor 3.to reverse the direction of a motor 4. to protect the motor from low voltage and overcurrent.

A motor starter is essential for starting an induction motor. It is because of its low rotor impedance. The rotor impedance depends on the slip of the induction motor which is the relative speed between the rotor and stator. The impedance varies inversely with the slip. The slip of the induction motor is at maximum i.e., at standstill (rest position), thus the impedance is at its minimum and it draws a huge amount of current called inrush current. The high inrush current magnetizes the air gap between the rotor and stator that induces an EMF in the rotor winding. This EMF produces an electrical current in rotor winding that creates a magnetic field to generate torque in the rotor. As the rotor speed increases the slip of the motor decreases and the current drawn by the motor is reduced. The high inrush current is 5-8 times the normal rated full load current. So, such amount of current can damage or burn the windings of the motor that will render the machine useless and it can cause a huge dip in

voltage of the supply line that can damage other appliances connected to the same line. Some of the motor starters used are Direct Online Starter (DOL), Stator Resistance starter, Rotor Resistance or Slip Ring Motor Starter, Autotransformer Starter, Star Delta Starter, Soft Starter, Variable frequency drive (VFD). DOL is the simplest form of motor starter that connects the motor directly to the power supply. It consists of a magnetic contactor that connects the motor with a supply line & an overload relay for protection against overcurrent. There is no voltage reduction for safe starting a motor. Therefore, the motor used with such starters has below 5 Hp rating. It has two simple push buttons that start & stop the motor. In stator resistance starter an external resistance is added in series with each phase of a 3-phase induction motor's stator. The resistor's job is to reduce the line voltage (subsequently reducing the initial current) applied to the stator. Rotor resistance motor starter works on a full voltage motor starting technique. It works only on a slip ring induction motor that is why it is also known as a slip ring motor starter. External resistances are connected with the rotor in star combination through the slip ring. These resistors limit the rotor current & increase the torque. This, in turn, reduces the starting stator current. It also helps in improving the power factor. Autotransformer starter is used as a step-down transformer to reduce the voltage applied to the stator during the starting stage. It can be connected to both star and delta connected motors. This is another common starting method used in industries for large motors. The windings of 3 phase induction motor are switched between star and delta connection to start the motor. To start the induction motor, it is connected in star using a triple pole double throw relay. The phase voltage in star connection is reduced by the factor $1/\sqrt{3}$ & it reduces the starting current as well as the starting torque by 1/3 of the normal rated value. A soft starter provides a gradual and smooth increase/decrease in the voltage, current as well as the torque during starting and stopping of the motor. It uses the semiconductor switches to control the voltage as well as the starting current supplied to the induction motor. A VFD provides the operation of a soft starter along with provision for motor speed control.

Variable Frequency Drive

A Variable Frequency Drive is a motor control device that protects and controls the speed of AC induction motors. A VFD can control the speed of the motor during the start and stop cycle, as well as throughout the running cycle by outputting adjustable frequency. It also refers to as Variable Speed Drives (VSD), Adjustable Speed drive (ASD) and frequency inverter. Its function is to control output voltage i.e., voltage vector of inverter being fed to motor and maintain a constant ratio of voltage to frequency (V/Hz). It consists of an electronic circuit which receives feedback information from the driven motor and adjusts the output

voltage or frequency to the desired values. Control system may be based on SPWM (Sine Wave PWM), SVPWM (Space Vector modulated PWM) or some soft computing-based algorithm. VFDs can improve energy savings, provide speed variations, soft starting, and better power factor.

Harmonics and its effects

Harmonics are current or voltage waveforms that are having frequencies that are multiples of the fundamental frequency. Harmonics can be caused by equipment such as UPS, servers, PC, video monitors, printer, photocopiers, fluorescent lights, VSDs, rectifiers, SMPS, compressors, freezers, chillers, air conditioners etc. In industrial environment, static converters such as rectifiers causes odd order harmonics. Lighting equipment such as discharge/ fluorescent lamps and rotating machines causes 3rd harmonics. Arc furnaces and reactors produce harmonics.

Harmonic voltages and currents exist three sequences – positive, negative and zero. The 4th, 7th, 10th, etc. harmonics are of positive sequence and the 2nd,5th,8th,etc are of negative sequence. The phase sequence of these two rotates in opposite directions. The triple harmonics are caused by zero sequences. Triple harmonics the harmonics that have the multiples of three. The positive sequence components can cause heating in equipment while the negative sequence components cause motor torque problems. The zero sequence causes harmonic currents to build up in the neutral wire and can cause heating and damage the distribution transformers.

The harmonic components can cause mains voltage distortions, can cause negative power that are returned to the supple causing losses in components and the circuits, can increase the apparent power and sizing of components, can damage capacitors. It can cause parallel resonance between capacitor banks and the transformers, increased neutral conductor size, skin effect losses, negative sequence rotation in motors, transformer overheating, nuisance tripping of protection devices, and failure of stand by generating sets.

Harmonics have become a growing concern due to the above-mentioned issues. Harmonic filters such as passive and active harmonic filters are used to minimize the effect of harmonic currents. Introduction of detuned reactors in APFC panels can help reduce harmonics that can affect capacitor banks. ■

Author

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Leveraging Data to Mitigate SCOPE III Emissions

Natalie Henfrey
Director – Consulting, GEP Worldwide

The daunting task of implementation of SCOPE III monitoring & reduction strategies has been a roadblock on Chemical & Petrochemical Industry's pathway towards carbon neutrality from over a decade. Natalie Henfrey, Director – Consulting, GEP Worldwide articulates how deploying digital transformation in procurement methodologies will give organizations, shareholders & stakeholders- the confidence that the investments and actions can have a meaningful impact on climate goals, clearing the way for a smooth & rapid pathway towards Carbon Neutrality.

What business opportunities can be leveraged by the industry through the implementation of scope 3 monitoring and reduction strategies?

There are two spectrums of business that are expected to be affected by the implementation of scope 3. The implementation of scope 3 offers an opportunity to market products or services as a specialty or as a premium grade with added margins for those who want to lower their emissions. On the other hand, carbon-intensive manufacturers of the same product will struggle to sustain or grow their businesses until their high carbon footprint is compensated for by lower pricing. In the chemicals industry, such stratification already exists based on material purity, with higher purity grades commanding higher prices.

Scope 3 emissions can help companies identify supply chain risks and assess product performance. If the company intends to use this data only for disclosure purposes, it might miss out on the underlined value beneath the data that can provide greater visibility into the entire supply chain and the opportunity to use this data to make critical decisions about the future direction of the business.

From when and where should an organization begin its long-standing journey of scope 3 monitoring and subsequent implementation of reduction strategies?

For most organizations, starting the scope 3 emission monitoring journey could be a daunting prospect as they are required to reach out to their entire supplier base and collect data regarding scope 3 emissions. This is where leveraging S2P and P2P solutions come into play. They utilize spend data to model organizations' scope 3 emissions based on what they are buying, the source of purchase and its final usage. By analyzing such data, organizations can visualize their suppliers who need correction in terms of reducing their carbon footprint. This is a more efficient process as organizations might not need to reach out to their entire supplier base.

Data collection using the right methodology and supplier engagement is one of the most critical aspects of tackling scope 3 emissions. One way to calculate scope 3 emissions is measuring the product carbon footprint, which is the sum of all the emissions during the lifecycle of a product moving through the supply chain, up to the final delivery. It has therefore become important for companies to ascertain how much of these emissions come already with the material they purchase. This has currently been estimated using global databases. However, to show meaningful year-on-year reduction and draw business value from it, data collection is needed at the supplier level so that everyone in the value chain can benefit and actuals can be computed and passed on to the customer.

However, once the data is available, calculating scope 3 emissions can still be particularly challenging in the chemicals industry arising out of the complexity in production as it may involve thousands of products, processes, and specific technologies. Companies need to identify a bigger lever that contributes to carbon emissions and understand which categories among the 15 categories under scope 3 emissions are relevant. Companies can then use a framework like the ones in the GHG Protocol — the Corporate Value Chain; Technical Guidance for Calculating Scope 3 Emissions; and EPA Scope 3 Inventory Guidance — to further estimate scope 3 emissions.

The most notable development that can aid the chemicals industry is the launch of guideline set out in the Together for Sustainability (TfS) initiative, which can enable chemical enterprises to tackle scope 3 emissions at a granular level.

How would a data-driven approach backed by AI and ML enable an organization to gain actionable insights into its emissions and chart a reduction pathway?

Procurement is a likely candidate to apply for the data-driven approach as approximately 80% of scope 3 emissions come from purchased goods and services. Leveraging existing digital infrastructure, like integrated S2P procurement software, along with advancements in AI and ML, companies can build greater visibility in the supply chain. One particular use case can be supplier selection criteria — sustainability KPI in scorecards can create the process of continuous improvement. However, collecting this data from the heap of unstructured data can be challenging. This is where AI and ML technologies will come into play.

Another way to look at it is that these technologies can help to understand whether decisions taken to reduce the scope 3 emissions are right. Purpose-built forecasting and modeling algorithms can help to decide whether the decisions like changing to a new supplier or transforming your value chain can really impact scope 3 emissions. These proposed technological or operational changes can give organizations as well as shareholders the confidence that the investments and actions can have a meaningful impact on the goals, paving the way toward smooth implementation.

What insights from the global scenario can the Indian industry gain toward the deployment of scope 3 reduction technologies?

Globally, calls for scope 3 emissions have been driven by two fundamental factors — regulatory frameworks and companies recognizing their role in optimizing the supply chain environmentally due to demand from customers as well

"Globally, calls for scope 3 emissions have been driven by two fundamental factors — regulatory frameworks and companies recognizing their role in optimizing the supply chain environmentally due to demand from customers as well as investors."

as investors. Some of these scope 3 reductions can even have tangible benefits to the organization. One such example is where GEP partnered with a fortune Global 500 chemicals manufacturer to optimize the logistics network and reduce scope 3 emissions. The broad objective of this exercise was to reduce the fragmented distribution footprint in EMEA due to multiple M&As while maintaining current service levels. To achieve this, Dynamic Solver Engine was used to optimize the network and create multiple scenarios based on inbound and outbound shipments analysis and scope 3 emissions. Using the data generated, the company was able to take the decision to shift two of its distribution centers as well as achieve saving in terms of carbon emissions and distribution spend.

Therefore, the most important aspect that has been demonstrated globally for successful implementation of scope 3 emissions is the identification of the right lever within the organization, which can bring maximum benefits.

The Indian market being highly cost-sensitive and cost-competitive, can medium and small-scale companies generate a positive return on investment after implementation of scope 3 monitoring and reduction technologies?

It's really not about ROI, but the benefit will be in terms of readiness for scope 3 compliances, which are already in discussion in the U.S. and Europe. We will see some ripple effects of this legislation on the Indian market as the end user will try to align its supply chain as per compliance. Even if there is no regulatory framework, we have seen an example where companies are being refused access to key financial products in the international market, like insurance, because of their unclear road map on ESG policies. Another factor that is expected in the future is the reputational risk, which can restrict investments in projects if companies don't comply with scope 3 emissions. It might be very early for the Indian market to comply with stricter domestic regulations in the immediate future. However, we still might see phase-wise implementation based on the international requirements set for procurement. ■

Water & Environment management technologies

Overview of chemical sector:

The Indian chemical sector is growing rapidly and with the increase in production, the water requirement would also increase. Government through the Make in India campaign plans to increase overall manufacturing share of GDP over the next five years. The sector provides the building block for many downstream industries, such as finished drugs, dyestuffs, paper, textiles, synthetic rubber, plastics, polyester, paints, pesticides, fertilizers, and detergents. The largest use of water in the chemical industry is for cooling, with steam (e.g., heating) and process water (for mixing, dilution, reactants, wash, or rinse water).

Industrial waste management is a relatively new practice in India. Traditionally, the state did not have means to off-take hazardous waste and businesses are required to treat it in-house. Companies continue to inject wastewater into the ground posing huge risks and liabilities from soil and groundwater contamination. Companies should initiate efforts to assess potential groundwater contamination from past waste disposal practices and start working on a long-term, cost-effective plan to remediate the contamination.

Chemical industrial wastewaters usually contain organic and inorganic matter in varying concentrations. Many materials in the chemical industry are toxic, carcinogenic and contain a wide range of substances that cannot be easily degraded. These industries face formidable environmental regulatory challenges in treating their wastewater

Primary Challenges faced by Industry

- Improving Energy efficiency
- Lower operating costs
- Improving the quality of wastewater & reducing the environmental impact
- Water recycling

effluents. Treating the effluent to safe limits and disposal remains a major challenge for the sector.

Water management solutions for chemical Industry

In chemical companies, there is a huge opportunity of recycling/ reuse of wastewater after necessary treatment.

Reduction of effluent can be categorized into 4 key stages:

- **Replace:** Replacement of inefficient processes and adoption of efficient technologies (pumps, advanced treatment solutions ozone oxidation / UV, water meters, leak detection solutions)

- **Reduce:** Adopt technologies to minimize water, chemical and energy usage

- **Recycle/ Re-use:** Implement recycle/ re-use water practices to conserve water.

- **Zero-Liquid discharge solutions**: to reduce discharge of harmful contaminants and comply with regulatory requirements to protect the environment.

Highlighted below is a snapshot of broad technological solutions available across chemical industry value chain that can help improve energy efficiency by adopting efficient pumps, leverage meters and analytical solutions to monitor & conserve water, improve quality of effluent at source and promote re-use/ recycle.

- **Sequencing batch reactor technology (SBR):** SBR is a continuous flow biological treatment system that provides multiple advantages versus conventional activated sludge and other SBRs by bringing together process, aeration, decanting, and control in a single treatment tank. It includes a completely integrated process design consisting of the aeration system, blowers, pumps, mixers, effluent decanters, monitoring and control equipment, and a comprehensive process control system. Unlike conventional activated sludge plants, there is no need for primary or secondary settlement tanks as all treatment is done in a single basin. The SBR process can also be designed to remove nitrogen and phosphorus from

4 Key Strategies for Reduction of Effluent	
Replace	Inefficient process with efficient alternatives
Reduce	Water, Chemical & Energy use
Recycle/ Re-use	Water to conserve fresh water
Zero-Liquid Discharge (ZLD) solutions	To reduce discharge of harmful contaminants

Solutions / Application	Treatment and supply of water	Transfer of process water	Cooling systems	Wastewater	Treatment of effluent
Oxidation	●		●		●
UV disinfection	●		●		●
Single-stage pumps	●	●	●		
Multi-stage pumps	●	●	●		
Pressure tank systems	●		●		
Hydrovar variable speed pump controller	●		●		
Wastewater pumps	●	●	●	●	●
Submersible stainless steel pumps for corrosive water	●	●		●	●
Mixers					●
Aeration systems					●
Filtration systems					●
Portable drainage pumps	●	●		●	
Monitoring and control	●	●	●	●	●

● Indicates solutions which can be available across value chain to conserve water & energy usage.

wastewater through biological nutrient removal (BNR) processes.

▪ **UV disinfection solutions:** UV Disinfection System is an extremely effective way to combat microbial contamination in water. It is recognized as a safer and more cost-effective way to disinfect water for industrial applications. UV water disinfection technology is used for the disinfection of bacteria, viruses, algae, and other microorganisms, which multiply and grow. Its technology can be used for process water and wastewater disinfection and requires small footprint. For smarter water utility management of UV systems and other plant assets, real-time remote monitoring and control solutions monitors and supports maintain the optimal operation of connected assets and sends alerts and data-driven insights to customers to make informed decisions.

▪ **Ozone Oxidation system:** Classical, conventional biological wastewater treatment processes are long term established and are typically the most economical way to treat large flows and reduce the organic load (expressed as chemical oxygen demand, COD) by more than 90%. There are recalcitrant organic compounds that cannot be eliminated by biological processes only. For these substances the strong oxidation power of ozone can be applied to further reduce problematic substances below the given thresholds.

List of ozone application for industrial wastewater treatment:

- Discoloration of wastewater (i.e., from textile processing or dye manufacturing)
- Removal of hard (recalcitrant) COD from refineries, chemical production sites, pulp & paper processing, coke plants, steel processing
- Cyanide elimination from refinery wastewater streams (AOP needed)
- Elimination of aromatic substances from Hydrocarbons processing
- Removal of pharmaceutical residues from Pharmaceutical producers
- Removal of other stable organic molecules or aromatic structures
- Disinfection of water and wastewater

▪ **Energy Efficient pumps:** Pumping systems consist of the pump itself, a motor, piping, valves and instrumentation. It accounts for more than 20% of the world's electrical energy demand, and in certain industrial plant operations they can be responsible for between 25% and 90% of the energy usage. Improving the energy efficiency of the pumping system will reduce production costs and support green credentials. The best efficiency and further energy savings can be achieved by driving the pump with a variable speed drive (VSD). This allows the rotational speed of the pump to be adjusted to achieve the desired head and flow for the process application. A VSD can also be added to existing pumps and once installed it can accommodate changing system demands, including potential future expansion plans without changing the pump.

▪ **Digital solutions for improving overall operational efficiency:**

Condition monitoring solutions provides health guidance and predictive maintenance advice for rotating and fixed assets such as pumps and motors. It periodically monitors system vibration and temperature and allows everyday users to access simple-to-use monitoring tools from iOS or Android mobile devices. Using predictive analysis, the solution identifies potential problems with the equipment before they occur. It allows users to understand the current health and historical trends of your assets, create maintenance reminders and generate detailed reports.

24/7 Remote Monitoring & Control solutions help provide alerts and data-driven insights from a device connected to your water infrastructure assets. It allows users to connect their assets to cloud, get insights on their operational status remotely, thus significantly reducing the need of physical inspections. It collects and analyzes data from assets to give live data, trends and alerts via the web and mobile app data and helps make smarter decisions about how resources are used.

Conclusion

Availability of water can become a limiting factor for the chemical sector. There is a need to encourage technologies which are water efficient to facilitate sustainable growth of the industry. Efforts to conserve water, wastewater treatment and reuse need to be encouraged. It should be imperative for chemical companies to replace inefficient processes & equipment's by implementing (1) Energy efficient pumps along with monitoring & control solutions; (2) Reduce water & energy consumption and (3) recycle/ reuse the treated effluent by implementing advanced wastewater treatment solutions and adopting zero liquid discharge practices. ■

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Solstice HFOs: Reducing CO2 Equivalent Emissions of refrigerants from 1:1500 to 1:1

Hitesh Mehta
General Manager, Advanced Materials
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Rapid reduction in use of HFC based refrigerants & their replacement with novel technologies such as HFOs is poised to significantly decelerate the pace of global warming and consequently take a major share in efforts directed towards not exceeding the global warming beyond 5 degC in this century. With this landscape in hindsight, ***Hitesh Mehta, General Manager, Advanced Materials, Honeywell India*** *articulates in this Interview, how an innovative technology: Solstice range of refrigerants would accelerate industry journey towards meeting Carbon Neutrality targets & regulatory compliance & societal welfare.*

What is the is the underlining background for developing product lines that would accelerate the industry's journey towards sustainability?

The underlining background towards the efforts we do is Honeywell's philosophy which has sustainability, digitalization, life sciences as the key pillars. A lot of initiatives, investments in Honeywell's business verticals are towards bringing about products which have sustainability as a key area of focus. Some of these verticals are product packaging which goes into medical packaging, the specialty chemicals that go into pharma R &D, we are in semiconductor space, we have digitalization as a key focus area in the advanced materials industry.

What are the innovations that Honeywell has in its arsenal that will enable industry to rapidly phase out Hydrofluorocarbons (HFCs)- ultimately decelerating the rate of global warming?

Honeywell enables organization of all scales across industry spectrum to achieve their ESG goals with the breakthrough technologies that we are constantly developing and are focused towards increasing process excellence, resilience & quality of life of the global society. In 2023 nearly 60% of our R & D expenditure was directed towards developing products that help our customer & their end-users to reduce environmental footprint. Honeywell has been deploying its future ready solutions-Sustainability offerings, Carbon Capture, H2 tech, Refrigerants et cetera in the global markets for more than a decade. Of all these products the most recent offering of Honeywell which already is in the market: Solstice range of refrigerants. These refrigerants are based on Hydrofluoro olefin chemistry, we call them as HFOs, these have an Ultra-low Global Warming Potential, ULGWP for short.

The Solstice refrigerants have better performance as they provide better cooling, consume less energy, leading to lesser fuel consumption and reduced operating costs as compared to traditionally used HFCs. Since the launch of the Solstice technology in the market, Green House gases impact equivalent to 295MMT of CO2 have been reduced which are equivalent to emissions from 688 million barrels of oil have been abated by our users. By end of 2022, Solstice is poised to achieve the Automotive Grade Refrigerant Standard, paving the way for Solstice to be used in around 185 million vehicles globally.

What are the different use-cases of Solstice across various industries?

Answer: Solstice has an array of use-cases in both commercial as well domestic applications. It can be used as a refrigerant in supermarkets air conditioning systems, as a blowing agent in foam-based insulants production, personal care products, as solvent in cleaning solutions, and the pharmaceutical potential of Solstice as a propellent in metered-dose

inhalers is being explored by our R & D team. While domestic applications of Solstice are for District heating and cooling, refrigerant in residential apartment air conditioning systems et cetera.

How can Solstice reduce SCOPE III emissions of Industrial value-chains?

Technologies for addressing SCOPE I & SCOPE II emission are being rapidly developed and deployed across the industrial spectrum as these emission in terms of their sources, monitoring, assessment & abatement are well understood. However, as we look towards addressing SCOPE III emissions, it becomes a massive challenge for the industry as these to even being with these are very complex to monitor & assess. With Solstice having an Ultra-low Global Warming Potential, its CO2 emission equivalent to 1:1 i.e., every kg of HFO emission is equivalent to 1kg of CO2 emission comparatively these HFCs have a CO2 equivalent of 1:3000 although newer HCFs have managed to reduce it to 1000 to 1500 range.

With such drastic drop in CO2 equivalent greenhouse gases with HFO based refrigerants such as Solstice, they are poised to replace HFCs across the entire industrial value-chain. In addition, our continuous R & D in Solstice line of products is sure to bring about more uses case of it in near future.

What are investments required by the end-users: commercial and domestic when they decide to replace HFCs with Solstice HFOs in their daily processes?

Investment required for replacing HFCs with Solstice HFOs as a refrigerant in Automotive industry are none as, they can be deployed without any modifications in the existing air conditioning system. For their use in replacing ZE, ZD type of refrigerants some modifications in existing systems are required so, to develop the enabling technologies we are actively working with Original Equipment Manufacturers across the globe and some of them have come with product lines that can be used to deploy Solstice in ZE, ZD refrigerant systems.

Also, as industry is moving towards digitalization, increasing process efficiency, and decreasing energy consumption, large scale replacements & upgradation projects are cropping up. These projects are also aligned towards Carbon Neutrality, the upgrades could incorporate the ZE & ZD refrigerant replacement technologies enabling Solstice to replace HFCs.

How is the competition emerging in this space of Ultra Low Global Warming Potential refrigerants?

Various large companies have entered in ULGWP refrigerants development & manufacturing space, and there are competitive products out there in the market. However, the leaps that Honeywell has made, supply chains have been resiliently established, we continue to be a global leader in this space.

We are constantly focused on expanding our manufacturing footprint across the globe, across various geographies. This will help us stay ahead of the competition and support our efforts to continuously offer future-ready solutions to our customers.

What is market response towards Solstice HFO based refrigerants?

There are multiple channels through which consumers are finding the potential business opportunities, capital gains by implementing Solstice in their processes. Amplifying the process gains of Solstice are the regulatory compliances to which industries are required to adhere and regions such as US & Europe are ahead of the curve in terms of regulatory policies which bind the organization to limit and reduce their environmental footprint.

In markets where the regulatory policies are still taking shape and discussion around emission reduction is increasing, we are actively involved in helping early adopters, early movers in such markets to incorporate HFOs in their processes while ensuring that a resilient supply chain is developed to maintain sufficient stockage of Solstice in that region.

What are the key markets that Honeywell sees for Solstice line of refrigerants?

As by the current use-cases of Solstice, regions who have industries specializing in manufacturing foam-based insulants, automotive manufacturers, regions who have district heating & cooling infrastructure are the key markets. As more use-cases are being discovered & regulatory policies taking shape across the globe in hindsight: we are expanding to newer markets.

In terms of geographies, our largest markets are US, Europe & Japan, next big market will be the APAC region for sure and some of the developing market which we are constantly monitoring for venturing are countries in the Middle East.

What are your thoughts on Solstice being introduced in Indian market?

The key growth areas for Solstice HFOs that Honeywell notices in India, echo pretty much the same that we have noticed across our major markets. India is poised to be the Life sciences hub, pace of digitalization in India is catching up with the likes the US & Europe post-COVID-19 pandemic. So, these areas in Indian Industry where Solstice HFOs find major applications are in-sync with the global markets and also sync with what Honeywell has to offer.

And the entire APAC region we have observed has a huge demand potential for such ULGWP technologies, with reforms in regulatory policies and industrial practices accelerating their pace we are looking forward towards introducing Solstice. ■

"Once A SealMan Always A SealMan"

Umar AK Balwa
Managing Director, Sealmatic

The Indian economy had not yet opened up in the 90s. Technical information was scarcely available to the general public and the Indian industrial landscape was in its formative years. At that time, ***Mr. Umar AK Balwa – Managing Director, Sealmatic*** *realized the urgency to develop a mechanical seal manufacturing facility; a component poised to be in high demand in the near future. In this interview interaction, he will walk us through his undertaking of building a globally renowned mechanical seal manufacturing unit- a dynamic, challenging and highly competitive arena.*

Tell us how you got into the business of mechanical seals?

My journey in the business of mechanical seals started by chance. After graduating from the University of Bombay (as Mumbai was known back then) in the year 1988, I originally wanted to branch out of the family business of real estate and hospitality to set up a garment manufacturing unit in the city of Bombay. Back in the days Bombay was one of the largest export hubs to Europe and USA for ready-made garments. As luck would have it, my father –after initially expressing encouragement and support towards my independent garments export business plan- decided against it. Much to my disappointment and even after I spent ample time reasoning with him, my efforts to convince him did not bear fruit. I felt dejected and sulked for weeks.

While I was brooding, my older brother Hussein Balwa had decided to make a foray into the mechanical seal business and founded A K Engineering to honour our father Abdul Karim Balwa whose initials it bore. It was a small engineering enterprise. Much to my chagrin, I had neither heard about this line of work in the past and nor was I familiar with its market or its functioning.

It was on May 18th 1989, when I was sitting idle- my daily routine in those days- as I had become redundant and had no work other than performing menial jobs for my father and my older brothers who thought I was whiling away my time and being unproductive that they made an announcement to me: I was to report to A K Engineering from May 19th 1989 at 9:00 AM every day. Hence, I reached the office on May 19th, 1989, and began my journey in the business of "Mechanical Seals."

Back in the days getting a collaboration was extremely difficult. What were the challenges you faced in doing so?

The world was different in those days. Information was sacred and secret and there was no readily available data base that I could access for the names of good international companies to collaborate with. I went to a technical bookstore in Bombay and purchased a book - titled Seals and Sealing Handbook by Elsevier Publishers. That book changed everything for my mechanical seal business.

I wrote incessantly to every company whose name and address was mentioned in that book, and followed those letters with badgering phone calls. I can candidly say that I often found myself at the receiving end of terribly rude and curt answers because it was difficult for a company in Europe or USA to understand the requirement and urgency of setting up a mechanical seal company in India.

Understandably so, because the Indian economy had not yet opened up and nobody cared enough about the potential

that lay for any such foreign company in India. The Indian market was considered a very protected one with heavy bureaucracy and there were many other problems that made it unattractive for a company to set up a joint venture in India.

How did Sealmatic happen?

In those years – period 2007, I took a hiatus and did not want to start anything new. My experience of starting a mechanical seal company remained etched in my mind. Much work goes into building a new enterprise, so much labour and so much heart burn that, I, smarting from my experience, vowed never to enter the mechanical seal business again.

In my own way, I had come to terms with it. I was keeping myself occupied with the family business of realty and hospitality when one evening in December 2011, an old colleague – Hanif Chaudhary walked in. Hanif, who incidentally was my first colleague in A K Engineering – and has always been my confidant and well-wisher- made an unexpected suggestion to me. Why don't we start a mechanical seal business? I looked at him with a quizzical expression and answered, "Do you know what it takes to start a mechanical seal company?" He said, "Yes." I asked him if he was willing to go through the grind and the pain of starting out again. I pointed out that we were merely 22 when we started out in 1989 as opposed to our current age. We were both in our mid-forties and so I wondered aloud if our energy levels had abated. Even as I posed these rhetorical questions, I knew that Hanif Chaudhary and I didn't really have any doubt in one another's abilities. In reality, from that moment on, a new idea had begun to germinate in our minds.

Can you tell us in brief about mechanical seals?

The field of mechanical seals is a dynamic, challenging and highly competitive arena. Every new application invites innovation and demands solutions. The subject involves physics, chemistry, mathematics, and most importantly common sense. I developed an abiding respect for the mechanical seal business. It is a business that is critical to every industry.

A mechanical seal is a vital component of rotary equipment. It employs my personal philosophy- if you set the small things straight, the big things will fall into place.

How was the journey to bring Sealmatic where it is today?

As for me, I soon realized that I had more to lose in my second innings. In 1989 I had my entire career ahead of me but this time around I had an immensely successful history in the business of mechanical seals behind me, and the expectations of others as well as my own were high. Moreover, I had to swallow my ego and my pride, and

reintroduce myself to customers as if I were a beginner, which I was not. I had decades of experience behind me but no badge to wear on my shirt. I was back again from where I had begun.

On the autobahn, the autostrada, the highway, the motorway- whatever name you call the road- I was there, bag in hand, and aspirations on my sleeves. Every so often I received a rude reply by someone who had never heard of us and didn't care enough to give me a few minutes of their time. Yet, I had little choice but to persist. It was a commitment I had made to our respective families and our employees. The financial aspect of any enterprise only comes into play after a long period of time. Over the span of the last several years I had to undertake long arduous tours to scout for customers.

I drove through cities, big and small, crossed states and countries and traversed the world to make Sealmatic a company that is worthy of international recognition. I have come a long way from the boyish young man of 1989 who came to Germany and wondered if he would ever drive on the autobahn. Today I have clocked more than 200,000 kms behind the wheel on foreign roads and yet I feel as though I have merely scratched the surface. There is so much more to explore, earn and experience.

What are the future plans for Sealmatic?

Over the years Sealmatic has become synonymous to mechanical seals with deliveries to more than 45 countries. It has the distinction of being the only Indian mechanical seal company to have the API Q1 and ATEX certification and a long list of satisfied customers. We shifted to our new factory which is a state-of-the-art building in the year 2017.

The date to be precise was the 19th of May which made for an interesting coincidence; it was on the same date 28 years ago that I had stepped into the mechanical seal business. I felt as though my life had completed a full circle and I stood at the threshold of a new one.

The modern plant of Sealmatic has grown exponentially since the 220 square meters it was at its nascent stage. Above all, every colleague is proud to be a part of this journey and the company. Anything more I add here about a company such as Sealmatic which is growing every day will be premature. Sealmatic is the sum total of the efforts of all the people associated with it and a vision that Hanif and I shared.

It's proven to us that a dream that is pursued with dedication earns the right to be called a vision. To future generations I would like to say that a seed in the name of my respected father via a relatively obscure company called A K Engineering proves to us that the name of a company

can changes over the years, as well as the hands running it, but its goals remain intact. I was given the privilege of watering this seed and nurturing it to its full potential, a process that is ongoing, but I trust that when its heirs enjoy the fruits they will remember where it all began.

Before we finally close our interview, any anecdote you would like to share?

A learned and experienced person from the mechanical seal industry cautioned me once. He was aware of my family's well-established presence in hospitality and realty.

He wondered why I would choose to venture again into a very difficult field such as the mechanical seal business instead of resting on my previous laurels in the same. Certainly, it was a well-meaning concern from a gentleman who only bore goodwill towards me. "Why are you entering the mechanical seal business again?" he had asked.

What could I say? I was 22 when I found my way to this industry after experiments in various other lines of work. In that era boys had to earn their place in the family business by the time they were 20. I dabbled with hospitality and realty, then spun dreams and made plans about establishing other businesses. But once I set foot into the mechanical seal business, I knew that I had found my calling.

Sometimes, we meet our fate when we least expect to.

I returned to the struggle after 23 years out of my own volition and realized that for someone who has spent years in the mechanical seal business, the staid and easy would not appeal. I had no other way to express my choice. The explanation I gave him had made both of us smile.

"Once A SealMan Always A SealMan," was my simple reply. ■

Clean Water & Sanitation Sustainable Development Goal 6 - Challenges in India

Human Being & Environment

Carrying capacity of the environment has supporting and assimilative capacity. All animals live within the carrying capacity of the Environment. All living beings including man and their environment are mutually reactive, affecting each other in a number of ways and a dynamic equilibrium is possible in between the two. However on-going aspiration to have economic growth coupled with the better quality of life results in overexploitation of resources from the supporting capacity and the overburdening of assimilative capacity with generated wastes. Human beings have considered themself different from other animals living on earth. They started changing the environment to make their life safe & more comfortable. The first change was converting the natural forest into agricultural land to grow their food. That has made a great impact on the ecosystem.

International Efforts to Save Environment

The nations of the world felt that there is a need for global partnership for sustainable development to improve human lives and protect the environment. The beginning was made in 1992 in June 1992, at the Earth Summit in Rio de Janeiro, Brazil, by adopting Agenda 21, a comprehensive plan of action to build a global partnership. In the 2000 Millennium Summit held in September 2000 at UN Headquarters in New York, Member States unanimously adopted the eight Millennium Development Goals (MDGs) to reduce extreme poverty by 2015. The Johannesburg Declaration on Sustainable Development and the Plan of Implementation, adopted at the World Summit on Sustainable Development in South Africa in 2002, reaffirmed the global community's commitments to poverty eradication and the environment, and built on Agenda 21 and the Millennium

Declaration by including more emphasis on multilateral partnerships. At the United Nations Conference on Sustainable Development (Rio+20) in Rio de Janeiro, Brazil, in June 2012, member States adopted the outcome document "The Future We Want" in which they decided, inter alia, to launch a process to develop a set of SDGs to build upon the MDGs and to establish the UN High-level Political Forum on Sustainable Development. The Rio +20 outcome also contained other measures for implementing sustainable development, including mandates for future programmes of work in development & financing. In 2013, the General Assembly set up a 30-member Open Working Group to develop a proposal on the SDGs. In January 2015, the General Assembly began the negotiation process on the post-2015 development agenda. The process culminated in the subsequent adoption of the 2030 Agenda for Sustainable Development, with 17 SDGs at its core, at the UN Sustainable Development Summit in September 2015. 2015 was a landmark year for multilateralism and international policy shaping, with the adoption of several major agreements.

Water Resources & Issues

Water Resources Natural (Rain Fall, River, Lake & underground water) & manmade (dams, constructed water bodies etc.) are most critical resource for the development.

The major issues for water resources cropped up in last few decades are as given below:

- Increasing demand for water due to population growth, urbanization, and industrialization,
- Rising awareness to have better quality of water,
- Increasing stress on water resources,
- Decrease in natural ground water recharge due to Change in land use pattern,
- Climate change & change in Rainfall pattern,
- Encroaching water bodies,
- Environment degradation, 8 Water Pollution.

These issues are threatening the water availability and hence need urgent attention. The bitter facts are majority of water resources are not safe because of natural & manmade contamination, globally 80% of the people living in rural areas have to use unsafe and unprotected water sources & 6 to 8 million people die annually from water related disease due to unsafe or contaminated water & almost

1.8 billion people worldwide will live in absolute water scarcity by 2025,

International Water Decades & its Implementation in India

First International Decade of Water 1981-1990 was to bring attention and support for clean water and sanitation worldwide. It resulted in impressive gains in providing Drinking Water & Sanitation to its population as compared to pre - independence (1950). India had better performance as compared to other countries. Second Decade (2005 -2015) title as Water for Life was to promote efforts to fulfil international commitments made on water & water-related issues, to have cooperation at all levels to achieve water-related goals of the Millennium Declaration, execution of the Johannesburg Plan of Implementation of the World Summit for Sustainable Development & Agenda 21, to focus on action-oriented activities and policies that ensure the long-term sustainable management of water resources, in terms of both quantity and quality and include measures to improve sanitation, to achieve the goals of the 'Water for Life' Decade that requires sustained commitment, cooperation and investment on the part of all stakeholders.

Current International Decade for Action title as Water for Sustainable Development 2018-2028 was launched on World Water Day, 22 March 2018 at the United Nations. The objectives are to promote efficient water usage at all levels, taking into account the water, food, energy, environment nexus, to have cooperation & partnership at all levels in order to help to achieve internationally agreed water-related goals and targets, to highlight the importance of the participation and full involvement of all relevant stakeholders (women, children, young, elderly, handicapped persons, indigenous peoples and local communities), implementation & promotion of related programs and projects & to have integrated management for sustainable development of water resources for the achievement of social, economic and environmental objectives. SDG 6 is exclusively carved out to achieve all above-mentioned objectives

Sustainable Development Goals

The Sustainable Development Goals (SDGs) or Global Goals are a collection of 17 interlinked global goals designed to be a "shared blueprint for peace and prosperity for people and the planet, now and into the future". The SDGs emphasize the interconnected environmental, social and economic aspects of sustainable

development, by putting sustainability at their centre. Though the goals are broad and interdependent, two years later (6 July 2017), the SDGs were made more "actionable" by a UN Resolution adopted by the General Assembly. The resolution identifies specific targets for each goal, along with indicators that are being used to measure progress toward each target. (1) The year by which the target is meant to be achieved is usually between 2020 and 2030. (2) For some of the targets, no end date is given.

Target SDG 6.3 Improve Water Quality, Wastewater Treatment & Safe Reuse

The objectives are to improve water quality by reducing pollution, eliminating dumping, and minimizing release of hazardous chemicals and materials, reducing the proportion of untreated wastewater, identifying & diverting the contaminated flows, creating barriers to eliminate access for waste dumping, keeping the catchment area free from human settlement, stormwater Treatment before releasing to water bodies & regular monitoring of water quality. The completion year is 2030. Current Issues in India are protection & preservation of Water resources, developing new water resources (though almost saturated) & rainwater collection, use & harvesting

Only 27% of Sewage is safely treated in India. (3) During summer most of the rivers in urban area carries the untreated sewage Major Wastewater Treatment Technology issues in India are C, N & P reduction, non-destructive removal of pollutant for recovery of solids, reduction in Energy Footprint, development of design parameters for MBBR, MBR & SBR, development of appropriate technologies to handle new manmade solids being added to sewage, user's friendly low-cost treatment technology & reuse & recycling of wastewater. In the last 5 decades we have forgotten Oxidation Pond, the most suitable natural technology for the Indian continent. Natural Energy wastewater Treatment and vertical gardens have the least energy footprint. Trickling Filter & Rotating biological contactor have low energy footprint but not getting the attention. Credit goes to dumping of high energy technologies in India.

Target SDG 6.4 Increase Water-Use Efficiency and Ensure Freshwater Supplies

The objectives are to substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity

and substantially reduce the number of people suffering from water scarcity.

Scarcity Water efficiency is defined as

Water efficiency (WE) = Country's total gross domestic product (GDP) / Total freshwater withdrawals.

Fresh water scarcity or stress is measured as

Freshwater stress (FS)= Freshwater withdrawal (Agro, Industries & Domestic)/ Available freshwater resources

The indicator values for Stress are Low <10%, Low to Medium 10-20%, Medium to high 20-40%, High 40-80%, Extremely high >80%.

Recently added Parameter is Water Footprint of Product. It gives water consumption in the full supply chain & volume of polluted water.

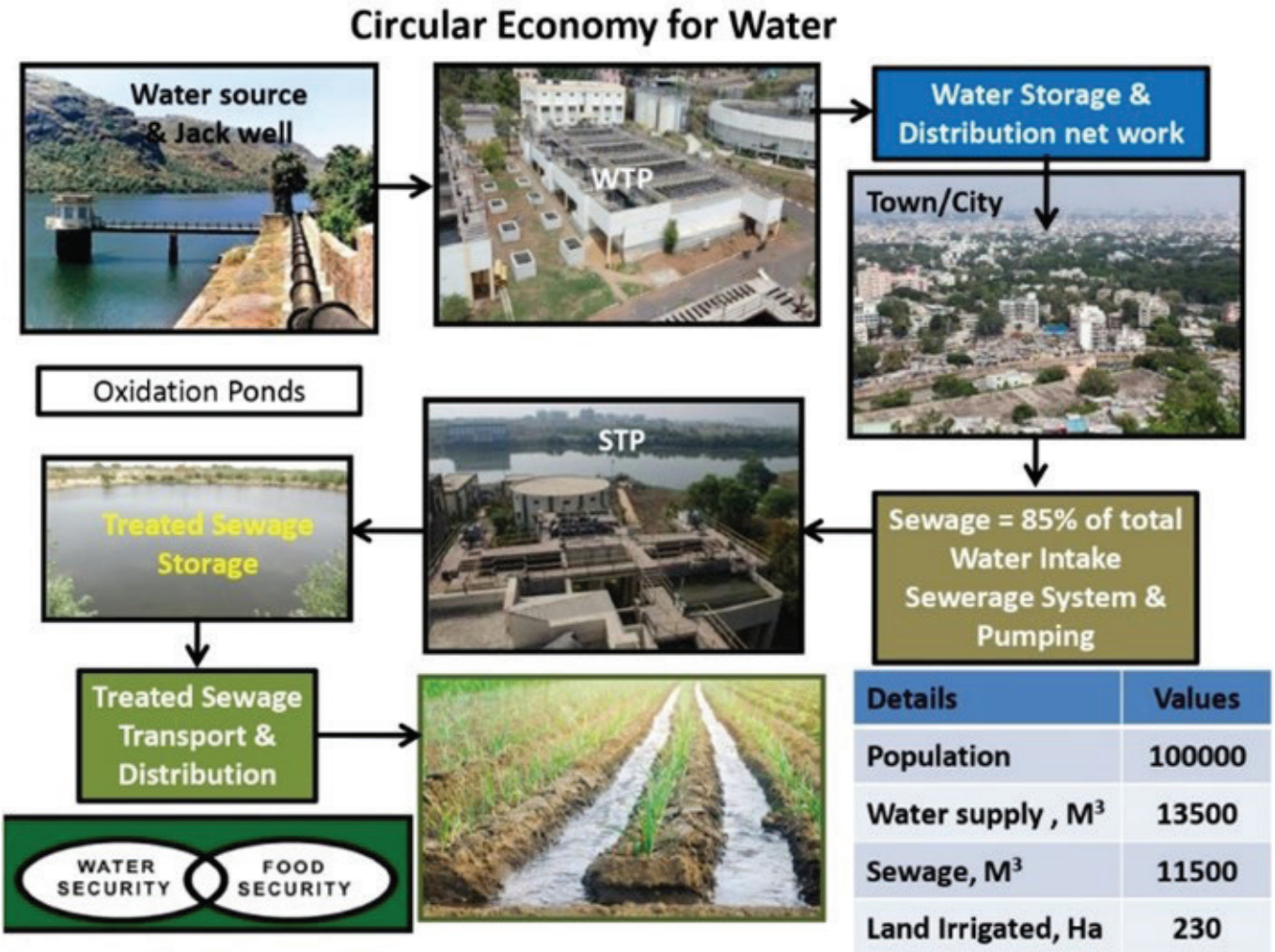

Figure 1. Circular Economy for Water

Water Footprint per unit of Product (WFP) = Amount of water used in the production processes of Product during their entire life cycle / Total Quantity of Product

It is measured as Green water Footprint (Direct use of Rainwater), Blue Water footprint (Use of stored water) & Grey Water Footprint (Fresh water required to dilute pollution to the level of Fresh water Bodies).

Target SDG 6.5 Implement Integrated Water Resources Management

The objective is to implement integrated water resources management at all levels, including through trans-boundary cooperation as appropriate. It is Proportion of trans-boundary basin area with an operational arrangement for water cooperation. This is assessment (scale 0–100) of the status of national development and implementation of Integrated Water Resource Management plans across the world. It involves trans-boundary water cooperation & resolving the conflict. The Nile Water dispute is at International level. However, in India there are interstate disputes for Ravi and Beas, Narmada, Krishna, Godavari and Periyar rivers. Even people from the same state oppose sharing the water with others. With increasing urbanization water reserve for agriculture will be diverted to Domestic usage. This will reduce availability of water for Agriculture. Therefore, Conflict between Domestic, Agriculture & Industries for Water Right cannot be ruled out. Application of Circular Economy for water is shown in Figure 2 will reduce stress on freshwater availability in India for irrigation & more water will be available for drinking.

Target SDG 6.6 Protect and Restore Water Related Ecosystems

It was decided to protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers, and lakes by 2020. However, it is going to take longer. Media & Non-Government Organizations can play a role in awareness programs. Encroachment on water bodies due to rapid urbanization & rapid changes in water basin due to change in Land use pattern are major issues in India. River Clean-up programs like Clean Ganga Project, Namami Chandrabhaga shall not be confined to water bodies but must include the catchment area. The significant results are not yet seen. Each state has to take up

Monitoring and Evaluation Indicators

SDG 6 has 12 indicators for monitoring and evaluation and are given below:

Goal	Indicator	Indicator Title	Lead Agencies
Drinking Water	6.1.1	Proportion of population using safely managed drinking water services.	WHO/UNICEF
Sanitation & Hygiene	6.2.1	Proportion of population using safely managed sanitation services.	WHO/UNICEF
	6.2.2	Proportion of Population having hand washing facilities with soap and water at home.	WHO/UNICEF
Water Quality & Wastewater	6.3.1	Proportion of wastewater safely treated.	WHO/Habitat
		Reducing the proportion of untreated wastewater and substantially increasing recycling and safe reuse	
Water Quality & Wastewater	6.3.2	Proportion of water bodies with good ambient water quality.	UNEP
		By 2030 improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials.	
Efficiency & withdrawal	6.4.1	Change in water-use efficiency over time	FAQ
		Water efficiency (WE) is measured as a country's total gross domestic product (GDP) divided by total freshwater withdrawals.	
	6.4.2	Level of water stress: freshwater withdrawal as a proportion of available freshwater resources.	FAQ
IWRM	6.5.1	Degree of integrated water resources management implementation (0–100).	UNEP
	6.5.2	Proportion of trans-boundary basin area with an operational arrangement for water cooperation.	UNECE/UNEP
Ecosystem	6.6.1	Change in the extent of water-related ecosystems over time.	UNEP
Cooperation	6.A.1	Amount of water- and sanitation-related official development assistance of a government coordinated spending plan.	OECO, WHO, UNEP
Participation	6.B.1	Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management.	WHO, UNEP

the project to clean the major and minor rivers flowing through their territory. Public involvement is a must for these programs.

What can we do for SDG 6?

Successful reduction of water footprint by 96 to 98 % in residential complexes by adopting the following measures:

a. Increase in Green Water Footprint by direct use of rainwater during rainy season

b. Decrease in Blue Water Footprint by using water saving appliances, conservation of water, reuse & multiuse of water & awards for less consumption of water.

c. Reduction in Grey Water Footprint by Sewage Treatment & reuse for WC Flush, Carwash & irrigation.

d. Application of Three Tier system which is developed and successfully implemented by the author is shown in Figure -3. It saves 40 to 50% fresh water.

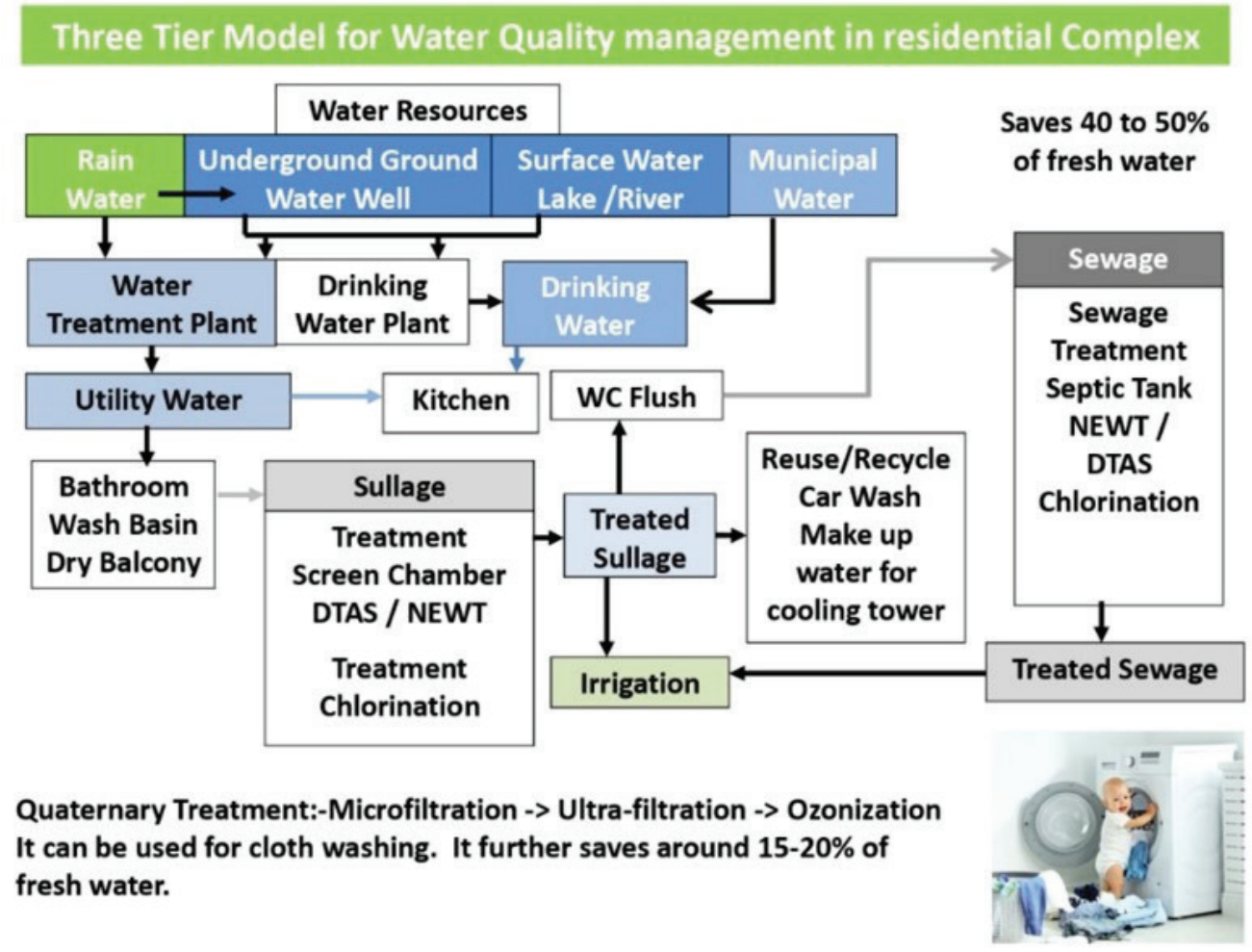

Figure 2. Three Tier model for Water Quality Management in residential complexes

- Reduction in water losses by a. reducing evaporation and percolation at water source, b. control of leakages in pipeline from sources to water distribution system, c. sludge and backwash water recovery and WTP. Total losses vary from 15 to + 30%. This needs a leak detection and control system. Challenges ahead for technology providers & Entrepreneurs are Reduction of Losses (Source to Tap) from +25% to Least, Leak Detection & Repairs need the team of plumbers for Leak prevention & Control in the shortest possible time.
- Patented Natural Energy Wastewater Treatment process does not require energy and chemicals. It is user friendly, sturdy, resistant to flow and strength variation. It has Low Capital and Operation and Maintenance Cost. It does not have any off smell and snakes and rodents are not found in it. Most importantly it adds to green cover and helps for carbon sequestration.

Conclusion

The implementation of SDG is possible only if the Common man to the Policy makers and implementer work together. Only 8 years are left to achieve the 17 Goals. Some of the states have the excellent task however in totality Indian have to put more efforts to achieve the desired goals.

Implementation of SDG 6 will ensure sustainable Water Management in India. It will effectively influence the long-term capital infrastructure in India – physical, human, natural and social – and therefore the realisation of these goals is imperative for Foreign Direct Investment and enhancing the 'ease of doing business' in the long term. There is a need to revamping India's water and sanitation policies with an integrated approach and reaching out to all sectors for their active involvement.

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Ion exchangers make sweetness perfect

Whether the sugar for our sweets comes from the beet, corn, or sugar cane, it is created in a field under the sun. Some plants can present particular traits that are not always desirable in food ingredients. These include a distinctive or bitter flavour, discoloration, certain salts, minerals and a caramel aroma. That's where chemistry comes in to make a sweet treat even sweeter. To make candy taste the way we love it, numerous ingredients must be carefully processed. ion exchange resins, for example, ensure that sugars taste purely sweet and are of the best quality.

What are ion exchange resins?

Synthetic ion exchange resins usually take the form of functionalized, cross-linked polyacrylates or polystyrenes. The monomers acrylonitrile and styrene, from which the polymers are primarily formed, constitute the majority of the mass, and thus have a major impact on the carbon footprint of the resin. These monomers account for more than 50% of the dry mass of many resins.

These cross-linked polymers remove various substances from liquids due to functional groups that make up each resin bead. This is very useful, for example, to soften water and to purify groundwater, as well as processing biomass for pharmaceuticals. Food ingredients such as dextrose and fructose syrup, sugar syrup and gelatine are purified with ion exchange resins. Why is that? Because often times, naturally grown products may not be of a high enough quality for further processing.

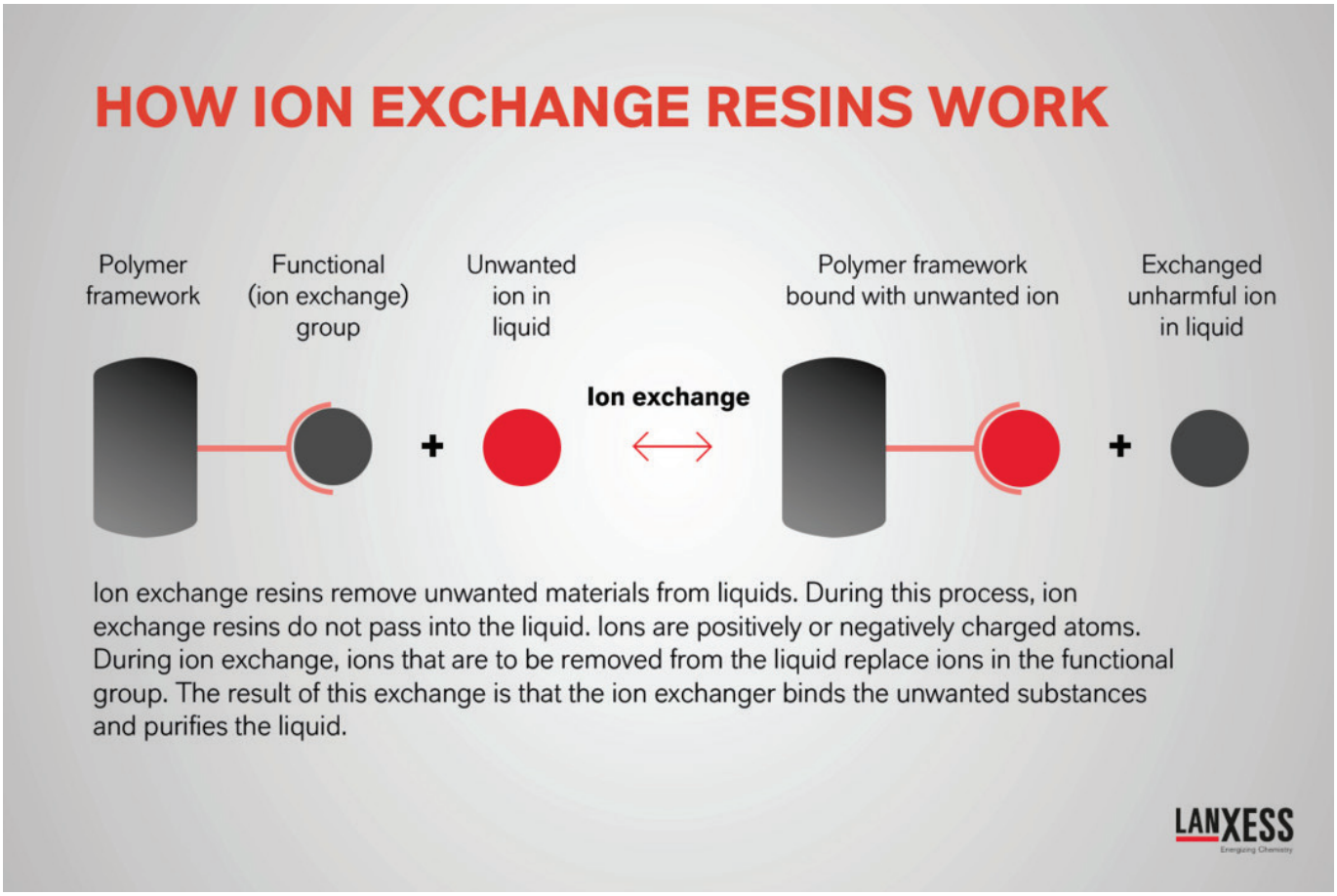
Ion Exchange Beads

Ion exchange resins like Lewatit® are small beads less than one millimetre in diameter. They consist of a polymer backbone and a so-called functional group. These

functional groups, which are incorporated into the polymer network in a second production step during the manufacturing of ion exchange resins, are responsible for the exchange of ions.

Ions are negatively or positively charged atoms or molecules. During ion exchange, the ions of the ion exchange resin change places with the ions that are to be removed from the liquid environment . What remains is the purified liquid - without the ion exchange resins. Incidentally, these can be used several times. In this way, Lewatit® ion exchange resins have been in use for a few years. Food companies can use these polymer beads repeatedly to produce pure dextrose, fructose, or granulated sugar, among other things. Ion exchange resins are very versatile.

To ensure that food ingredients meet the highest standards, ion exchange resins like Lewatit® have powerful beads to remove unwanted colorants, odours, and



flavours from the raw sugar solution via an adsorption process. This process makes it possible to produce top-quality sugar and increase the yield from the raw mass.

Ion exchange removes ions from the raw sugar solution, for example in the form of Na+ and Cl- (common salt). It also plays a role in splitting the beet or cane sugar into glucose and fructose. The splitting is a catalytic process in which H+ ions (positively charged hydrogen ions) play a decisive role. It is the ion exchangers that provide the H+ ions.

Ion exchangers make sweetness perfect

Ingredients such as glucose, granulated sugar, and fructose, as well as gelatine and citric acid are commonly found in most of sweets we consume. Sugar-free varieties are sweetened with maltitol syrup. Vegetarian fruit gums do without gelatine and contain starch instead. These ingredients are purified with ion exchange resins. The effect is that manufacturers obtain a purer ingredient. That is free from salts, colour, taste, and inherent odour. We at home also appreciate a baking assortment with different sweeteners such as brown or white sugar. This way we can implement many of our own creations.

Another use case: Chocolate and cocoa, indulgence without bitterness

Cocoa beans can be naturally very bitter and without sweetness, this gift of nature would not be much of a treat. Credit ion exchange resins for adding in a consistent sweetness and improved quality to cocoa. From whole milk to dark to hot chocolate, how much sweetness tastes best is a personal preference.

Conclusion

We cannot survive without carbohydrates and proteins, which give us energy for our bodies and minds. For those who like it less sweet, there are alternatives, like protein bars. Again, it's all about specific ingredients, which go through a purification process before being used as an ingredient in the power snack. This includes ingredients such as vitamins, proteins and amino acids, sweeteners such as isomaltooligosaccharides, sucralose or maltitol and emulsifiers such as soy lecithin. The Lewatit® beads form an indispensable component in their added value. ■

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