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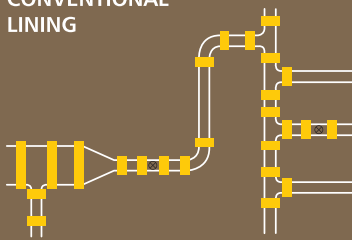
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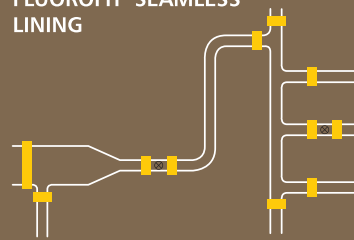
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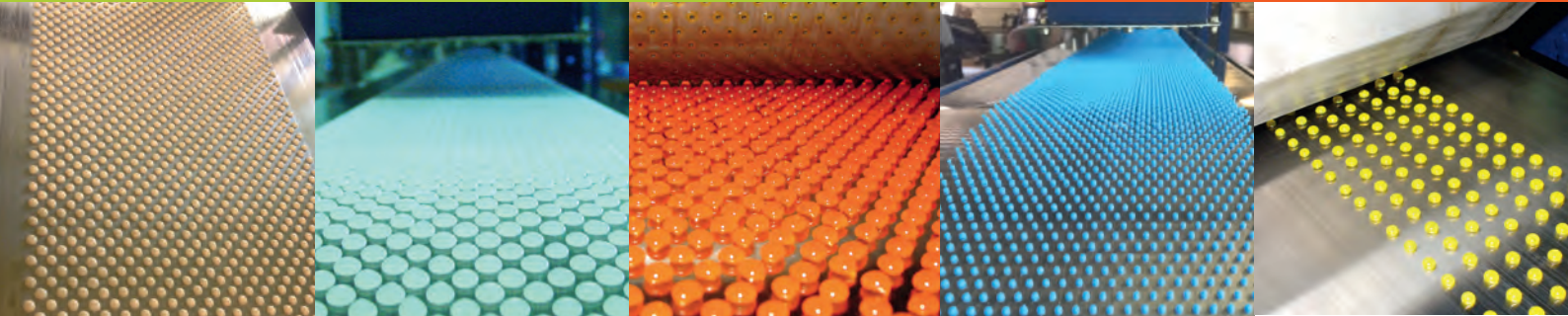
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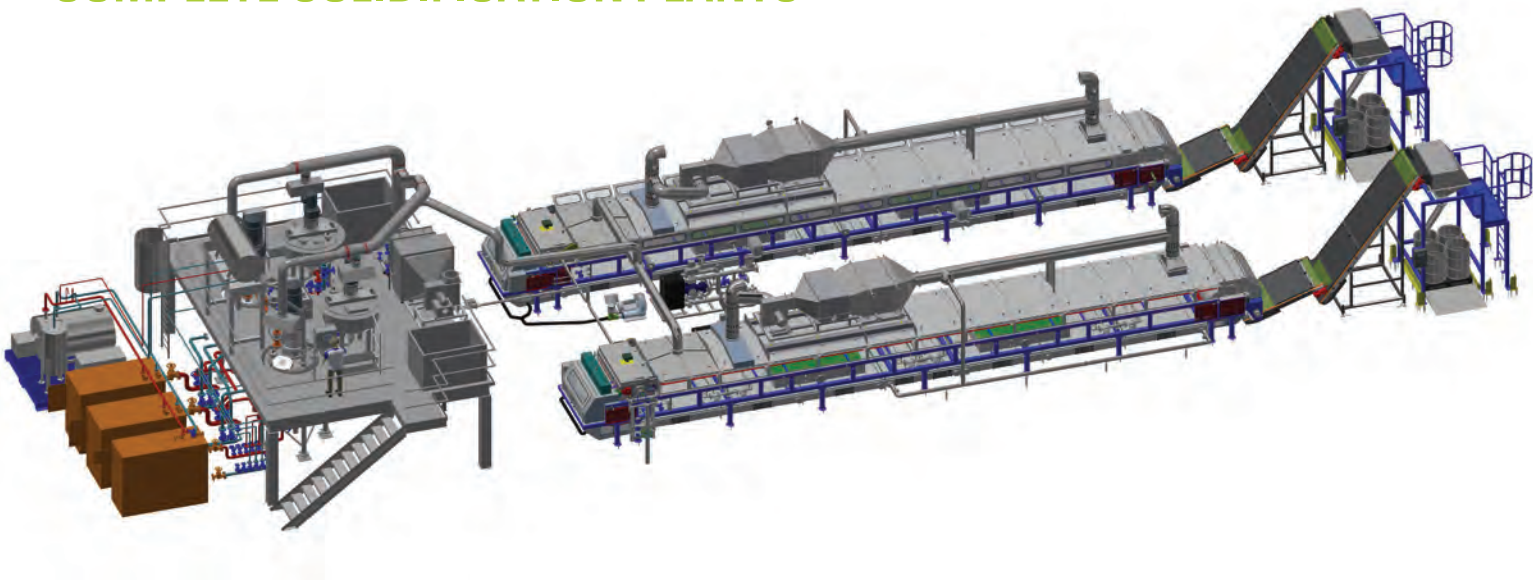
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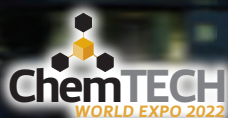
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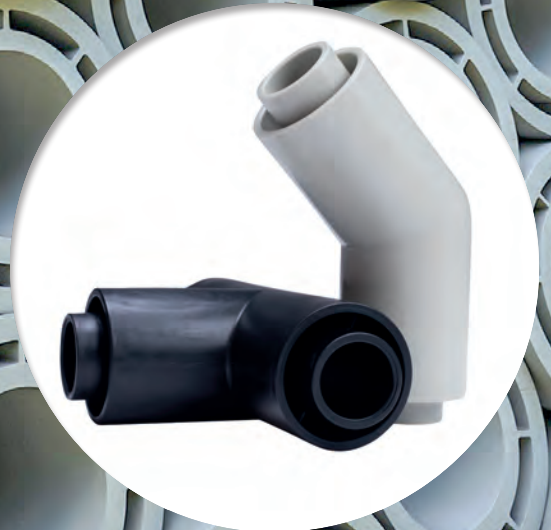
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Registered Office: 26, Maker Chambers VI, 2nd Floor, Nariman Point, Mumbai 400 021, INDIA.

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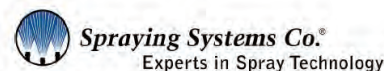
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Key to Navigating the Energy Transition is in the Data

AVEVA

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The process plant industry knows it needs to build and operate more efficient and sustainable plants. The good news is that the technology needed to solve the complex challenges of engineering modern, efficient and sustainable plants of the future is already here. Organisations are actively implementing digital twin strategies with intelligent engineering information at their core to transform plant performance across both brownfield and greenfield projects, as well as in their operational state.

The transition to greener more sustainable projects and operations has accelerated over the past year. And against this trend, digital transformation must keep pace. The digitalisation, efficiency and sustainability initiatives are in motion, but there remains a long way to go. Capital projects are still carbon-intensive, and operational programmes depend on digital insights



Steve Parvin, Head of Information Engineering, AVEVA

and large-scale cultural and strategic shifts before sustainability outcomes can be fully realised.

No matter whether you begin in the

operational or project phase of your plant, the answers to more sustainable practices are already available in the data. Creating a data-centric culture that collates and verifies engineering data into a single, trusted hub right from the initial phases of a project is cornerstone of a reliable digital twin. Research by Deloitte found that digital transformation provides an opportunity to gain safety, efficiency and significant financial benefits, including a 5-10pc reduction in build costs and a 10-20pc reduction in operational costs.

By connecting teams, engineering tools and data at every phase of the project, performance can be transformed and engineering efficiency increased by 30pc. With teams aligned around the data, siloes can be broken down, improving transparency, collaboration and decision-making. As performance and efficiency increases project costs and risks reduce—freeing up time for engineering, procurement, construction (EPC) contractors and owner-operators to spend more time on innovation to deliver better solutions to complex problems.

The industrial sector is now embracing technology and new ways of working to build the sustainable, digital and connected plants of the future. To get there, project and operations teams will depend on innovation, flexibility and collaboration to reform an industry ripe for change.

Cloud and interactive 3D visualisation, engineering and simulation solutions are enabling EPCs and owner-operators to become better prepared for what lies ahead. They integrate engineering tools and streamline processes to meet key business imperatives: engineering efficiency, sustainability, and budget capital project delivery, and the creation and maintenance of the trusted engineering data that forms the digital twin.

Unique Challenges, One Solution

Digital twins are useful in transforming both net-new and brownfield projects, and even operational plants, to deliver sustainable outcomes and optimise performance long into the future.

Net-New, Greenfield Projects: Whether for net-zero, carbon capture and storage, hydrogen production or for renewable power generation, connected engineering information can be used to build a digital twin for teams to efficiently innovate and design for sustainability, reduce emissions and waste, and hand the plant—and the digital twin—over seamlessly to operations.

Brownfield Revamp Projects: It is not just new developments where digital twin technology can deliver results. Existing plants can be transformed to become connected digital facilities as well—empowering capital project planning and execution, or to create operational

insights to improve performance. Going forward, this digital thread can be used to also modernise operations, extend plant lifetime, and ensure continued compliance with sustainability and safety regulations that emerge over time.

Why Intelligent Engineering Information Management Matters

Integrating quality engineering data within a capital project can deliver benefits immediately and long into the future. Once a data-centric approach is implemented in a capital project, owner-operators and EPCs can reuse the same data structure on future projects, allowing them to accelerate the process and continuously identify opportunities to improve both performance and design.

Putting trusted engineering information at the core of your project and plant digital twin can produce the following wins in the immediate, medium and long terms:

Immediate Wins: Connecting people, data and decision-making drives down costs, reduces waste and improves project efficiencies.

Medium-Term Wins: By developing a data-rich digital twin right from the conceptual phase of an engineering project, when it comes to handover, the owner operator can receive an accurate digital twin that will support operator training, eliminate startup risks, optimise

operations performance and provide an 'as-is' digital replica for future maintenance programmes.

Long-Term Wins: If developed from the initial concept and maintained throughout the operational phase, a digital thread is created that allows each asset to be tied back to the original concept, providing actionable performance insights and enabling sustainability key performance indicators to be tracked.

Tomorrow's plants will be smart, automated, efficient and well connected, regardless of whether built recently or many years in the past. Operations, maintenance and capital project stakeholders will be connected to a single, trusted hub of data—the digital twin—to break down siloes, enable collaboration and facilitate smarter decisions made faster.

The solutions to achieve this are already here. The process plant industry has an imperative, and an opportunity, to transform today and achieve a sustainable and high performing plant for tomorrow. ■

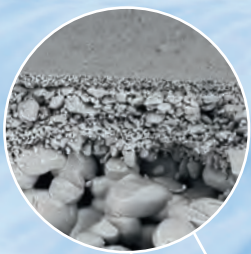
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54.22 Crore utilized on 'Enhancement of Competitiveness in Indian Capital Goods Sector Scheme



Mahendra Nath Pandey, Honorable Minister, Ministry of Heavy Industries & Public Enterprises, Govt. of India

New Delhi, India: Eight Centres of Excellence for Technology Development (CoE), nine Common Engineering Facility Centres including four SAMARTH Udyog centres for Industry have been established at research and academic institutes of eminence across the country. Ministry has embarked on an innovative path to engender Research & Development in manufacturing by establishing six Technology Platforms which shall be accelerators for making India self-reliant in Capital Goods Sector and Auto Sector with focus on developing mother technologies.

The total Funds utilized, under the Scheme on 'Enhancement of Competitiveness in Indian Capital Goods Sector' in the financial year 2020-21 is Rs.54.22 crore for the financial year 2020-21. So far, Rs. 37.692 crore has been released to Indian Institute of Technology - Kharagpur (IIT-KGP), West Bengal regarding funding for setting up of "Centre of Excellence (CoE) under the Scheme on Enhancement of

competitiveness in the Indian Capital Goods Sector.

The scheme on 'Enhancement of competitiveness in the Indian Capital Goods Sector' was notified in November, 2014 to encourage technology development and infrastructure creation. Under the Auto Sector, Ministry of Heavy Industries has two schemes, viz., Scheme named "Faster Adoption and Manufacturing of Electric Vehicles in India (FAME India) Scheme" is being implemented for promotion of electric vehicles in India. At present, Phase-II of FAME India Scheme is being implemented w.e.f. 01st April, 2019 for a period of 5 years with a total budgetary support of Rs.10,000 crores.(ii) The Production Linked Incentive (PLI) Scheme for manufacturing of Advance Chemistry Cell (ACC) in the country approved by the Government on 12th May 2021. The total outlay of the scheme is Rs. 18,100 crore for 5 years. The scheme envisages to establish a competitive ACC battery manufacturing set up in the country. Under the Scheme, a mechanism for availing incentives on manufacturing ACCs with higher specific energy density and cycles is provided.

Total 105 Exploration blocks awarded under Open Acreage Licensing Policy

New Delhi, India: The Minister of State for Petroleum and Natural Gas, Rameswar Teli in a written reply to a question in the Rajya Sabha informed that total 105 Exploration blocks admeasuring an area of 156,580 Square Kilometer have been awarded under Open Acreage Licensing Policy (OALP) in 5



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API Technical Report 655 | First Edition, April 2021



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Bid Rounds. Out of 105 Blocks, 89 Blocks are presently active for carrying out exploration activities.

Production of Crude Oil from NELP blocks started in 2004-2005. Cumulative production of Crude Oil from 2004-05 to 2020-21 is 4.9 million metric tonne (MMT). Commercial production of crude oil has not commenced from OALP blocks so far.

The Government notified the policy reforms in exploration and licensing policy for enhancing domestic exploration and production. The reforms provide that in respect of the large and marginal nomination fields, Oil and Natural Gas Corporation Limited (ONGC) and Oil India Limited (OIL) can choose field specific production enhancement models including farm out and Joint Ventures/ Technical Service Model. Monetisation of identified pipelines of GAIL through InViT mechanism for providing new sources of funds for infrastructure development is envisaged.

MoPNG launches Open Acreage Licensing Programme Bid Round-VI

New Delhi, India: The advent of the Hydrocarbon Exploration and Licensing Policy (HELP) promulgated in March 2016, brought about paradigm changes in the way exploratory blocks are auctioned in India. It led to transition from production sharing regime to revenue sharing regime. The Open Acreage Licensing Programme (OALP) offered the potential investors freedom to carve out blocks of their choice through submission of Expression of Interest (Eoi). The Eoi window is open round the year and the investors need



Hardeep Puri, Honorable Union Minister MoPNG, Govt. of India

to wait for periodic launch of bid rounds. After successful completion of 3 bidding rounds, the Government notified further policy reforms within ambit of HELP in February 2019. The focus was shifted from 'revenue' to 'production' maximization. There was also focus on greater transparency and streamlined procedures. Bid Rounds IV onwards are being carried out under the further reformed policy and revised model bid documents.

The Government launched OALP Bid Round-V on January 14, 2020 for 11 E&P Blocks for an area of 19,789 sq. km and completed on November 17, 2020, with the award of all the Blocks to winning bidders. In spite of COVID-19 pandemic, the bidding was successfully completed and blocks awarded. In the E&P Investor Meet held on 30th July 2021 at New Delhi, the Minister for Petroleum and Natural Gas had made the announcement that the OALP Bid Round VI is being launched soon and welcomed the domestic and international communities to participate in the robust Indian energy growth story.



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Accordingly, in continuation of its focus on aggressive acceleration of E&P activities, the Government has now launched the OALPBid Round-VI for International Competitive Bidding. The 21 blocks under OALP Round-VI are spread across 11 Sedimentary Basins and include fifteen on land blocks, four Shallow Water blocks and two Ultra Deep Water block. Category wise, there are 12 blocks in Category-I basins, 4 in Category II basins and 5 in category-III basins. It is expected that this Bid Round VI would generate immediate exploration work commitment of around USD 300-400 million. An area of 156,580 sq. km. has already been awarded under past bid rounds OALP Bid Rounds (I to V). This Bid Round-VI is expected to add further 35,346 sq. km, taking the total area for exploration to 191,926 sq. km. under the HELP regime.

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Mangala, India's Largest Onshore Oil Field Celebrates 12 Years of Prolific Production

New Delhi, India: Cairn Oil & Gas, India's largest private oil and gas exploration and production company, completes 12 years of operations from its Mangala oil field, situated in Rajasthan. Discovered in 2004, the field was the largest global discovery of the year and India's largest offshore discovery in 25 years. Since first oil was found here on August 29, 2009, Mangala field has produced more than 473 mmstb as on July 2021.



Cairn Oil & Gas today contributes ~25% to India's domestic crude oil production – majority coming from the company's Rajasthan block that is spread across 3,111 sq km. Production from Mangala, and its sister fields Bhagyam and Aishwariya, has contributed \$19 billion to the national and state exchequer as on FY'21. The cumulative production from the block has crossed 600 mmboe. Playing a key role in fulfilling the country's energy demands, the block will drive India's dream of achieving energy Aatmanirbharta.

Speaking on the occasion, Harish Choudhary, Revenue Minister, Government of Rajasthan, said, "Since the beginning of oil and gas exploration and production by Cairn, there has been visible socio-economic transformation in the landscape of western Rajasthan. The region now produces over 150,000 barrels of crude oil every day, with the district of Barmer registering a 650% increase in per capita income. I extend my heartiest congratulations to personnel at Cairn, as well as the residents of Rajasthan, on completing 12 years of prolific production. I wish them more success in the years to come."

Celebrating the occasion, Prachur Sah, Deputy CEO, Cairn Oil & Gas, said, "Since the discovery of first oil in 2009, the Mangala field has lived up to its name to truly become auspicious for the country's energy needs. We have followed a path of continuous innovation,

research, and adoption of new technology to maintain production levels. Moving ahead, Cairn Oil & Gas is committed to contributing 50% of India's

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An essential function of the coupling is the ability to compensate for displacements in the drive train. That is why double-cardanic couplings are often used. Apart from that radial assembly and disassembly without dismounting adjacent drive components is a vital demand from the part of process and petro chemistry. Torsional flexibility and dampening of vibrations is required to increase the service life of the overall pump drive. Another specification is conformity with industry standards (API, ATEX etc.) and company standards.

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domestic crude oil production. For this, the Rajasthan block and Mangala particularly, will continue to play a driving role.”

Along with aiding India’s energy needs, the Rajasthan block has also contributed significantly to improving socio-economic conditions in the state. Since Cairn commenced operations, the district of Barmer has registered a 650% increase in per capita income – taking it above both the national and state averages. Initiatives across water, biodiversity, education, women, and child development, etc., have together generated rich social wealth that is visible in the changed landscape and livelihoods of western Rajasthan today.

26 Adoption of Energy Efficient and Environment Friendly Technologies for Modernization & Expansion of Steel Sector

New Delhi , India : The steel industry is adopting energy efficient and environment friendly technologies as part of technological up-gradation/modernisation/expansion of programme/projects. Some of these are:- Coke Dry Quenching (CDQ) - Power generation from the waste heat from CDQ, Sinter Plant Heat Recovery (Power generation from Sinter Cooler Waste Heat), Bell Less Top Equipment (BLT) in Blast Furnace, Top Pressure Recovery Turbine (TRT) in Blast Furnace, Pulverized Coal Injection (PCI) system in Blast Furnace, Hot stove waste heat recovery in Blast Furnace, Dry type Gas Cleaning Plant (GCP) in Blast Furnace, Cast House/ Stock House Dedusting system, Converter Gas Recovery in BOF, Energy Monitoring & Man



RCP Singh, Honourable Minister of Steel, Govt. of India

agement System, Secondary Fume Extraction System in Steel Melting Shop, Regenerative Burners in Re-heating Furnaces of Rolling Mills, Hot charging process of continuously cast products at higher temperature directly to Rolling Mills, Direct Rolling Process eliminating the need for Re-heating furnaces, Energy efficient technology for Hot Strip Mill: Flexible Thin Slab casting & Rolling, Near Net Shape casting: Bloom cum Beam Blank caster, Bloom cum Round caster etc, Adoption of Variable Voltage Variable Frequency (VVVF) Drives for high capacity electric motors.

The wastes being generated are effectively recycled back within the steel plants.

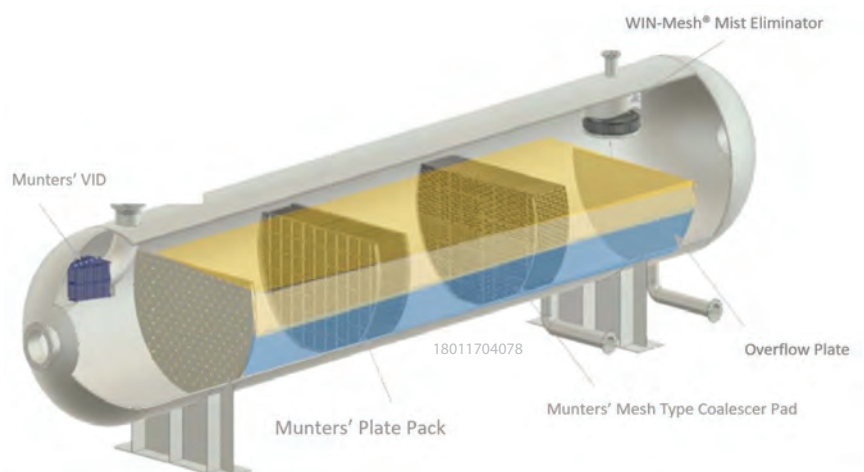
Some wastes such as Blast Furnace slag is granulated within the steel plant and sold to cement industry. Research & Development projects have also been undertaken for effective utilization of steel slag in road making, construction, agriculture etc.

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Skill Development Institute's Permanent Campus Dedicated to the Nation by Chief Minister of Odisha



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Naveen Patnaik, Hon'ble Chief Minister of Odisha Govt. of Odisha

New Delhi, India: The permanent campus of Skill Development Institute (SDI) at Bhubaneswar was dedicated to the nation by Hon'ble Chief Minister of Odisha, Naveen Patnaik, in the presence of Hon'ble Union Minister of Education and Skill and Entrepreneurship of Dharmendra Pradhan, Hon'ble Union Minister of Petroleum and Natural Gas and Housing and Urban Affairs Hardeep Singh Puri, Union Minister of State for Petroleum and Natural Gas Rameswar Teli, Member of Parliament from Bhubaneswar Smt Aparajita Sarangi and Member of Legislative Assembly, Jatni, Surendra Routray Ji. The occasion was also graced by Chairman-IndianOil, S M Vaidya Ji and Chairman, SDI & Director (HR), IndianOil, Ranjan Kumar Mohapatra.

IndianOil, under the aegis of the Ministry of Petroleum & Natural Gas, is steering SDI-Bhubaneswar as a 'Greenfield Mega Model Multi Skilling Institute' and has contributed Rs 255 Crore for setting up this Institute. IndianOil has planned a further investment of additional Rs 80 Crore. The permanent campus of SDI, located at Jatni Tahsil of Khurda district in Odisha, has been built over an area of 16 acres allotted by the Government of Odisha, and the foundation stone of this campus was laid by the Honourable President of India, Ramnath Kovind on 18th March 2018. The Institute envisages world-class industry-based skill training using state-of-the-art infrastructure and technology to create an industry-ready talent pool

Speaking on occasion, Chief Minister of Odisha, Naveen Patnaik, said, "I am happy to note that the SDI Bhubaneswar is going to start operating from their new permanent campus in Bhubaneswar. I hope this institute will excel and provide training and placement support to the youth of Odisha. I am also delighted to note that the construction of ICT-IOC's new permanent campus is going to begin on the land provided by the State Government of Odisha. The institute is known for its brilliant academic record and is expected to provide higher-order technical education and research facilities in chemical technologies and the allied sector. Odisha has seen phenomenal growth in the industrial sector in recent years"

Speaking during the occasion, Chairman IndianOil, Shrikant Madhav Vaidya commented, "Skill India Mission is leveraging India's rich demographic dividend. Driving that mission forward, the Energy PSUs of



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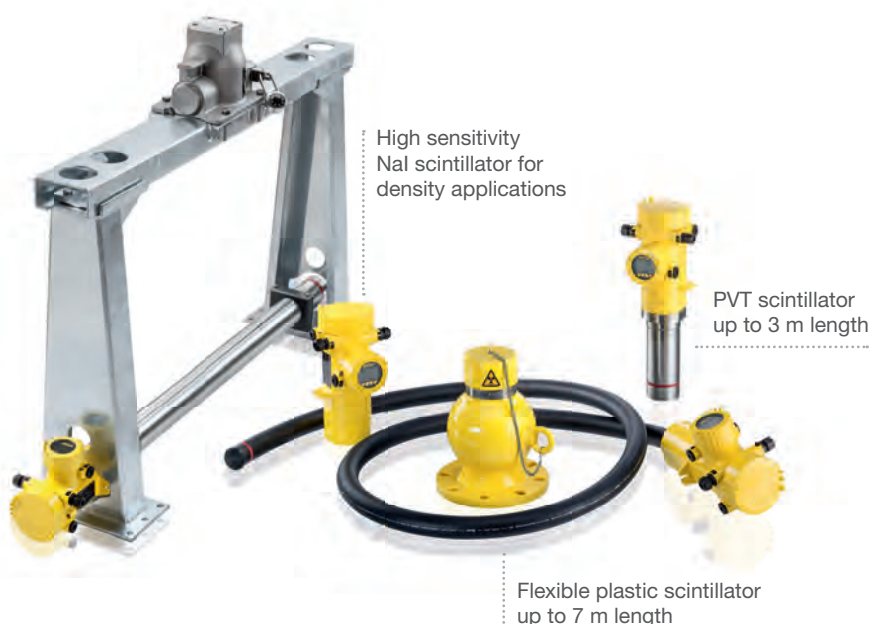
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India, under the guidance of the Petroleum Ministry, has undertaken major endeavours to strengthen the skilling infrastructure in the country. IndianOil is proud to have been given the opportunity to steer this Mega Model Skill Academy of International standard.

Bharat Petroleum Corporation Limited selects Salesforce to develop Single View of Customers



Arun Singh, Director (Marketing) & Director (Refineries)
Bharat Petroleum Corporation Limited

Bengaluru, India: Salesforce the global leader in CRM, announced that Bharat Petroleum Corporation Limited (BPCL) will be leveraging Salesforce to support its aggressive digital transformation strategy. BPCL has deployed Salesforce Sales Cloud and Service Cloud along with business analytics from Tableau CRM, to address an evolving business and consumer environment by digitizing the manufacturing and distribution supply chain to deliver a 'One BPCL' digital experience.

Bharat Petroleum is one of India's leading oil & gas companies, and a premier integrated energy company in India, with an intrinsic focus on customer centricity. BPCL has initiated "Project Anubhav" with an objective of delivering to its vast retail and commercial customer base of over 90 million individuals, a consistent superior and unified experience across multiple touchpoints. With Project Anubhav, BPCL is adopting key technologies like artificial intelligence (AI), internet of things (IOT) and implementing technology platforms that would cut across business units giving BPCLs teams a unified view of the customers, improve processes with increased automation and at the same time enhance employee safety. Deloitte India, a Salesforce partner, was also instrumental in the collaboration. Working with BPCL, they designed and oversaw the deployment of Salesforce and other processes in alignment with 'One BPCL' vision.

Arun Singh, Director (Marketing) and Director (Refineries), Bharat Petroleum Corporation Limited, said: "Continuous innovation has always been fundamental to BPCL. Digitalization opens up the possibility of collaborative innovation, allowing teams to connect better with their dealers and customers alike. Salesforce enables increased collaboration between our sales and service functions, providing a single view of our customers to deliver an unmatched and hyper-personalised experience."

Arundhati Bhattacharya, Chairperson & CEO, Salesforce India, said: "We are excited to be on this journey with the Bharat Petroleum Corporation of India. The oil and gas industry has progressed tremendously over the past few years to become a digitally mature

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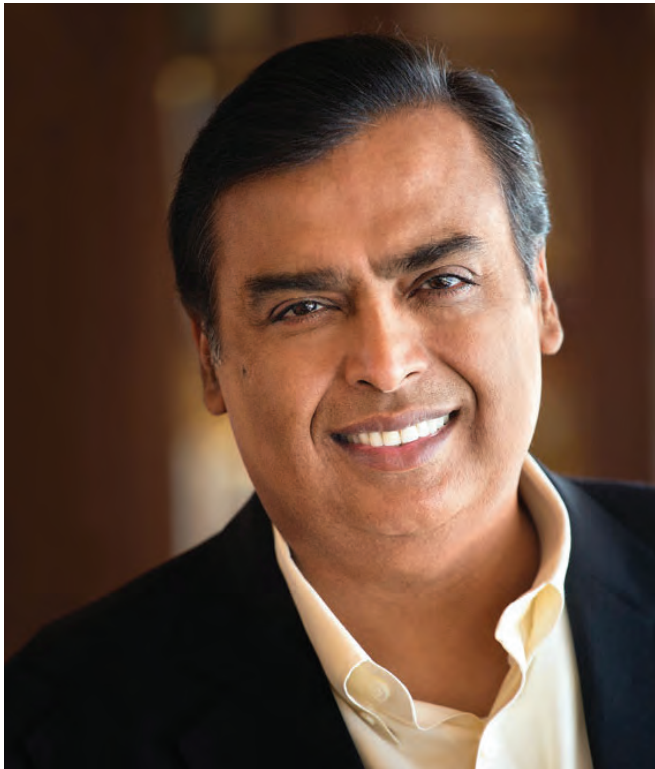


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industry. We look forward to building a strategic roadmap to help companies such as BPCL, drive a true 360 degree view of customers, enabling them to serve their customers in a truly differentiated way."

Reliance New Energy Solar Ltd to invest in Ambri Inc



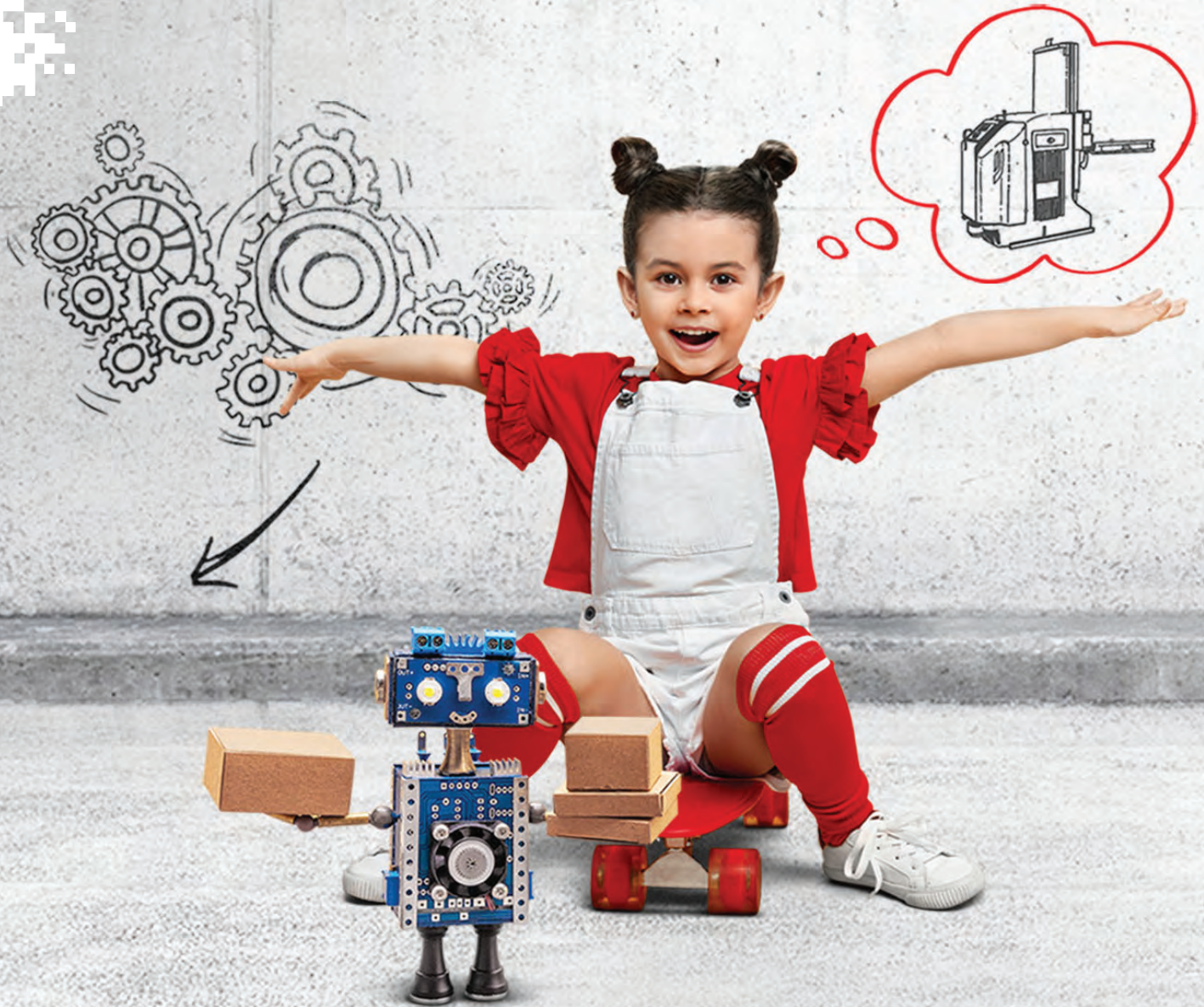
Mukesh Ambani, CMD, Reliance Industries Ltd

Mumbai, India: Reliance New Energy Solar Ltd a wholly owned subsidiary of Reliance Industries Ltd (RIL), along with strategic investors Paulson & Co. Inc. and Bill Gates, and a few other investors, has announced an investment of USD 144 million in Ambri Inc, an energy storage company based in Massachusetts, USA. The investment will help the company commercialise and grow its long-duration energy storage systems business globally. RNESSL will invest USD 50 million to acquire 42.3 million shares of preferred stock in Ambri.

Based on patented technology and designed to last between 4-24 hours, Ambri's long duration energy storage systems will break through the cost, longevity and safety barriers associated with lithium-ion batteries used in grid-scale stationary storage applications. They will enable a crucial energy storage solution capable of supporting the increasing amounts of renewable energy being integrated into electric power grids. RNESSL and Ambri are also in discussions for an exclusive collaboration to set up a largescale battery manufacturing facility in India, which could add scale and further bring down costs for Reliance's green energy initiative. Addressing shareholders in June this year, Reliance Industries chairman. Mukesh Ambani had announced plans to build a Giga Factory in Jamnagar for the storage of intermittent energy, as part of the Dhirubhai Ambani Green Energy Giga Complex project.

"We are exploring new and advanced electro-chemical technologies that can be used for such large-scale grid batteries to store the energy that we will create. We will collaborate with global leaders in battery technology to achieve the highest reliability for round-the-clock power availability through a combination of generation, storage, and grid connectivity," Ambani had announced. Ambri can cater to projects that require energy storage systems from 10 MWh to over 2 GWh. The company will manufacture calcium and antimony electrode-based cells and containerised systems that are more economical than lithium-ion batteries, capable of operating safely in any climatic condition without requiring supplemental air conditioning and meant to last for over 20 years with minimal

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degradation. Ambri systems are particularly suited for high-usage applications, such as shifting energy from daytime solar generation to evening and morning peak load times. The company is securing customers for large-scale projects with commercial operation in 2023 and beyond.

Indianoil Deploys State of the Art Technology to Foil Pipeline Pilferage

New Delhi, India: The 15,000 KM plus country-wide IndianOil's pipeline network serves as underground energy highways of India that are assets of crucial national importance. These pipelines carry highly inflammable petroleum products at high pressure. Any pilferage attempt on these pipelines can cause serious accidents that threaten lives and damage property besides interrupting energy supplies. Any pilferage

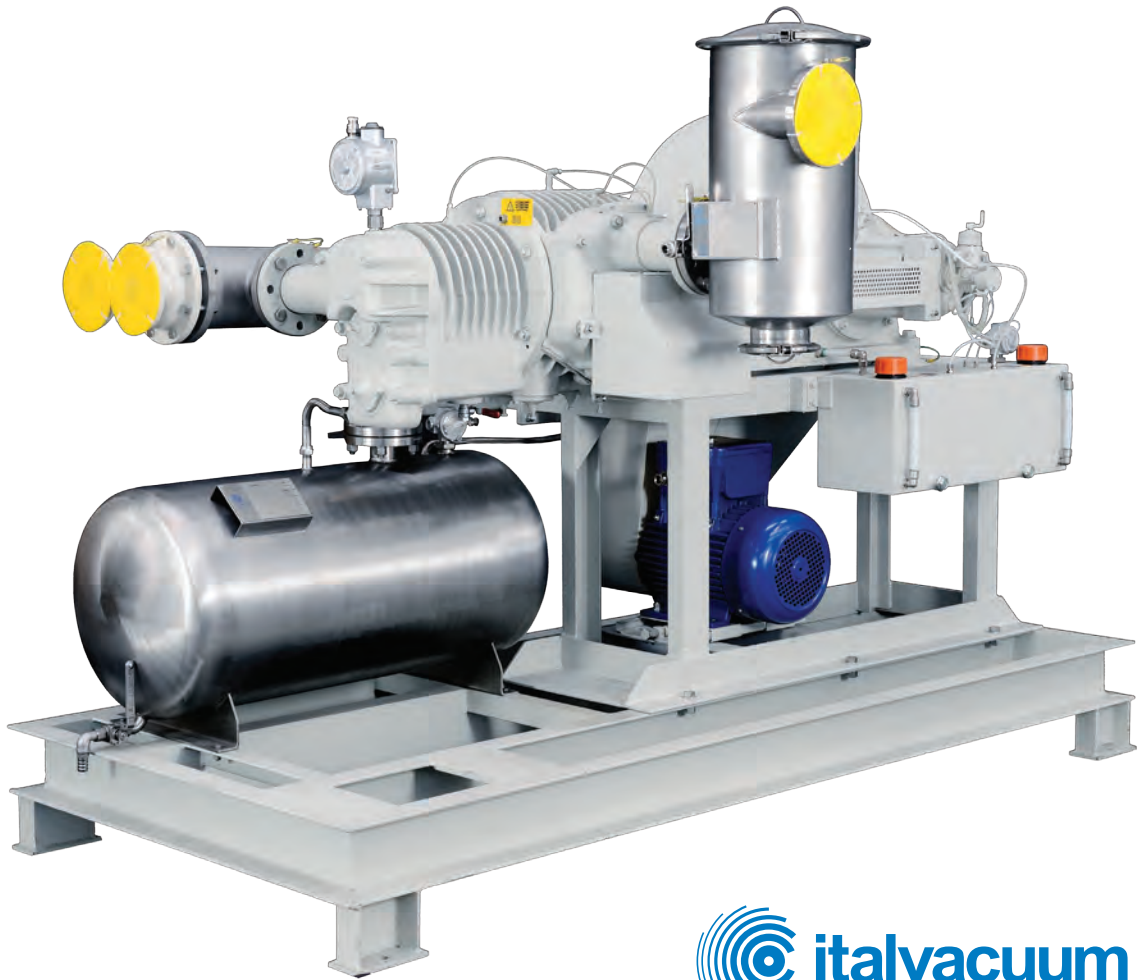
attempt on these pipelines is a grave offence under Sections 15 and 16 of The Petroleum and Mineral Pipelines (Acquisition of Right of Way) Act 1961. Such criminal acts are non-bailable offences, and intruders are punishable with rigorous imprisonment for ten years or more.

IndianOil has deployed a robust round-the-clock monitoring system to track pipeline pilferage or any other such disruptive attempts on its pipeline network. The Corporation closely monitors the pipeline flow, pressure parameters, and trends through an Instrumentation and Supervisory Control and Data Acquisition (SCADA) system. In addition to this, a Leak Detection System (LDS) ensures 24X7 analysis to identify tentative vulnerable points.

Moreover, a comprehensive system of physical inspection of the entire network on foot by line patrolmen and DGR guards



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are also in place. To further enhance the effectiveness of this constant vigil, the movement of line patrolmen and DGR guards are monitored through Global Positioning System (GPS) enabled devices. The existing Right of Way (ROW) of the pipelines is also mapped through Geo-Fencing. Such GPS-tracked physical inspections also help spot and identify abnormalities like loose soil, the smell of leaked petroleum products or suspicious vehicle tyre marks in the vicinity of the pipelines. IndianOil teams, along with local Police, also undertake periodic joint-patrolling of vulnerable locations to track any unauthorised activities.

The surveillance system is further strengthened by garnering local support in enhancing the efficacy of the overall process. IndianOil urges all citizens residing in the vicinity of these pipelines to be vigilant and report any suspicious activity to IndianOil and local police authorities. Frequent awareness drives are organised for the villagers settled near the pipelines. IndianOil authorities at the Pipeline Stations also undertake regular meetings with local village Sarpanches along the pipeline routes. Such sensitisation endeavours are often combined with welfare drives like free medical check-up camps and community development programs to engage locals better. Reward schemes for informants have also been put in place to incentivise local monitoring. The identity of the citizens informing such illegal intrusion will be kept confidential. Any unlawful action or attempt to damage these national assets will have severe consequences for these miscreants.

Adani Enterprises Incorporates Wholly-Owned Subsidiary Adani Petrochemicals

Ahmedabad, India: Adani Enterprises has incorporated a wholly-owned subsidiary, namely Adani Petrochemicals (APL). The authorised and paid-up share capital is Rs one lakh. APL is yet to commence its business operations. The company has set up the subsidiary to carry on business of setting up of refineries, petrochemicals complexes, specialty chemicals units, hydrogen and related chemicals plants and other such similar unit.

Meghmani Finechem Limited gets listed on NSE and BSE



Maulik Patel, CMD, Meghmani Finechem

Ahmedabad, India: Meghmani Finechem Limited made a stellar debut on stock exchanges on 18th August, as the stock got



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listed at ₹ 406.45 on NSE, a 194 % premium to its opening price of ₹ 138.25 (Closing price of its parent company, Meghmani Organics Ltd, on 17th May, 2021). On BSE, the script got listed at ₹ 405.65, up 194%.

The shareholders of Meghmani Organics Ltd (Face value ₹ Rs. 1 per share) were allotted shares of MFL (Face value of ₹ 10 per share) in the ratio of 1000:94. Considering the face value of both the companies at same price, ratio comes to 94 shares of MFL against 100 shares of MOL. In addition to the listing, the company has delivered a strong operating and financial performance in Q1FY22 amidst the second wave of the pandemic. The key performance highlights are: Q1FY22 operational highlights were Capacity utilization across all the division is highest ever On YoY, ECU realisation for Caustic Soda improved by 12% and CMS sales realisation improved by 40%, H2O2 sales realisation improved by 36% QoQ, Achieved 75% capacity utilisation of Hydrogen Peroxide in the 2nd year of operations.

Commenting on the results, Maulik Patel, Chairman and Managing Director said, "The listing of MFL as a separate entity is a key milestone in our journey towards sustainable and long term value creation. We at MFL have a singular focus of creating a world-class chemicals company with strong focus on sustainability.

Our highly capable management team and our motivated workforce are ensuring that we continue our strong growth trajectory. This is also evident from the fact that we delivered on of our best operational and financial performance in Q1FY22, despite an extremely

challenging environment on account of 2nd wave of Covid. Our revenue and profitability both grew 2.1x compared to Q1 of last year. We have been able to maintain our balance sheet strength and our growth have primarily been financed through strong internal cash flows. We hope to maintain similar momentum in the coming quarter and are confident of delivering superior stakeholder value. "

GHCL announces Q1 FY22 Results



R S Jalan, MD, GHCL

Ahmedabad, India: GHCL, India's leading Chemical & Textile Company, announced its financial results for Q1 FY22. "We have commenced the new fiscal year on an encouraging note with substantial gains across all our business segments. This was possible despite severe disruptions witnessed in Q1 due to localized restrictions and lockdowns on account of the second wave of the pandemic. I am glad that our teams have positively responded to this crisis and ensured business continuity. I would like to



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extend my gratitude to our entire workforce for their relentless contribution and would like to assure them that the Company will do what is required to protect and support them." said R S Jalan, Managing Director, GHCL.

Our Inorganic chemicals business demonstrated healthy volume growth with positive realizations supported by consistent demand in the key end user categories. We believe this positive trend will continue going forward as demand has been stabilizing and we are also looking to expand our portfolio to add some products to leverage our scale and expertise.

Q1 FY22 VS Q4 FY21, Revenue for Quarter stood at Rs. 854 Crores as compared to Rs. 821 crores in the Q4 FY21 (4% growth) and Rs. 440 crores in the same quarter last year (94% growth).

EBITDA for the Quarter stood at Rs. 189 Crores as compared to Rs. 195 crores in the Q4 FY21 and Rs 84 crores in same quarter last year.

Net Profit for the quarter stood at Rs. 101 Crores as against Rs. 104 crores in the Q4 FY21 and Rs. 17 crores in same quarter last fiscal.

Methanol Market to Hit USD 39.18 Billion Forecast 2028

Pune, India: The global methanol market size is set to gain traction from the urgent need to lower environmental pollution caused by the surging usage of heavy fuels, such as diesel and gasoline. Pollution further leads to global warming and climate change. Statista mentioned that the earth's surface

temperature was 0.98 Celsius degrees warmer in 2020 than the 20th Century average.

As per the report, the market stood at USD 27.95 billion in 2020. It is projected to grow from USD 28.74 billion in 2021 to USD 39.18 billion in 2028 at a CAGR of 4.5% during the forecast period. This information is published by Fortune Business Insights™

Yokogawa Signs Investment and Collaboration Agreements with Fluence Analytics



Tokyo, Japan: Yokogawa Electric Corporation announced that it has agreed to invest in Fluence Analytics, Inc., a US-based startup that provides combined hardware and software analytics solutions to polymer manufacturers. Additionally, the companies agreed to a global strategic business partnership for sales and deployment of new high-end models of the automatic continuous online monitoring of polymerization (ACOMP) system from Fluence Analytics. Under the terms of the collaboration agreement, Yokogawa Electric will commence customer trials with existing ACOMP models by the end of 2021, and will have exclusive or coexclusive sales rights for the new models that will be launched in the future.

ACOMP is currently the only system on the market with the online capability to

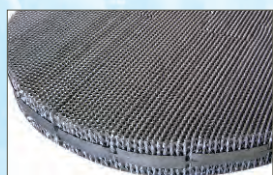
Separator and Mass Transfer Internals for Oil & Gas Industry



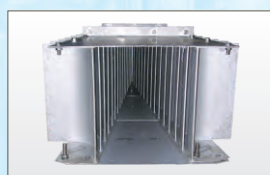
Axial Cyclones



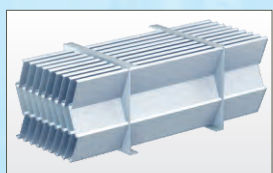
Multi-Cyclones



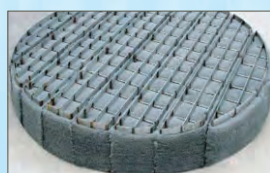
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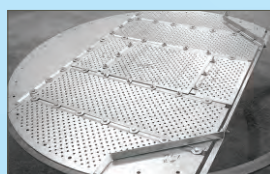
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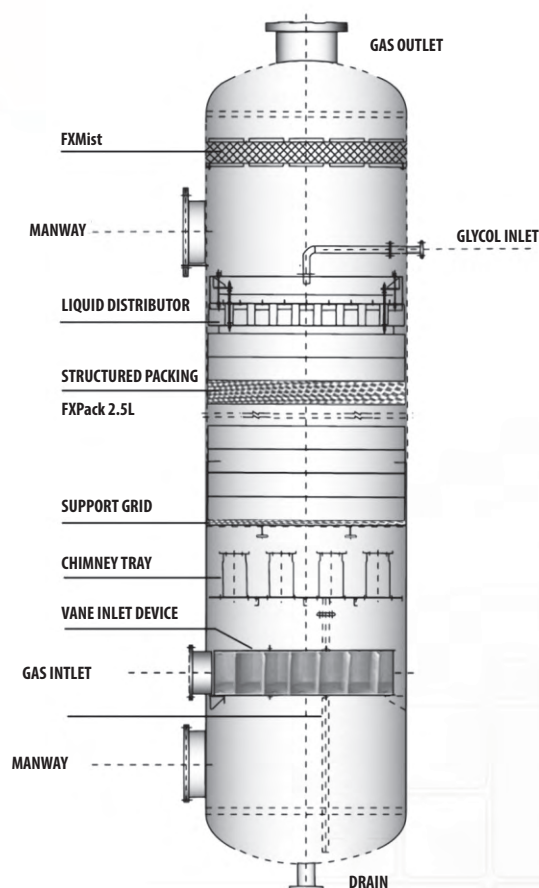
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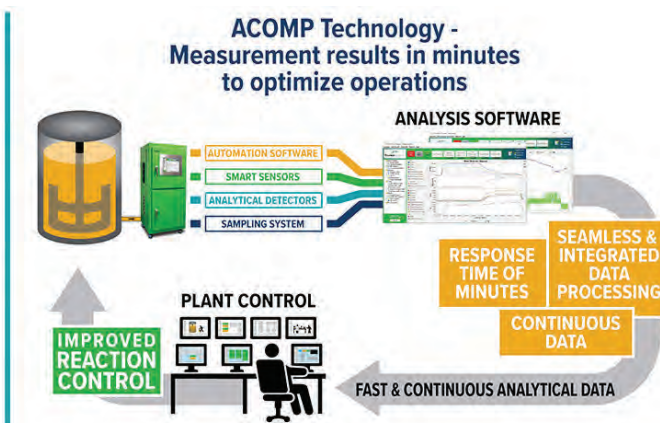
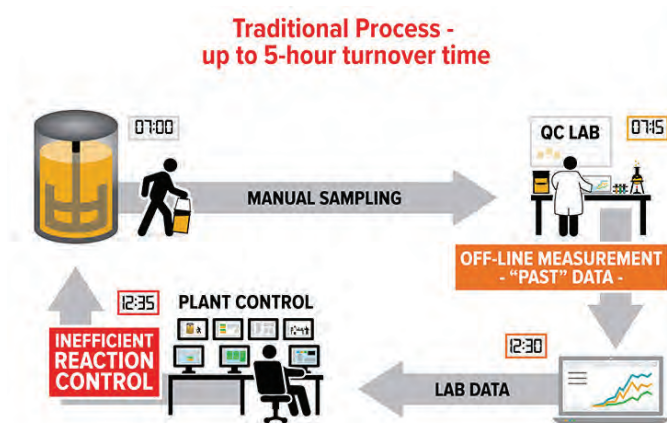
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continuously extract and analyze important aspects (viscosity, molecular weight, monomer concentration, solute concentration, etc.) of polymerization processes that produce plastics, rubber, paint, and other products. As evidenced by customers, 2 this realtime monitoring of polymerization processes enables optimizations to be performed that enhance safety, quality, and yield as well as operational efficiency. Significant cost savings have also been observed. Kenji Hasegawa, a Yokogawa Electric vice president and head of the Yokogawa Products Headquarters, commented, "We have been supporting the petrochemical industry through the provision of measurement and control solutions. By cooperating with Fluence Analytics, we will be able to offer additional value in polymerization processes. We look forward to providing our customers with these new systems, which, in addition to benefiting health, safety, and the environment, will enable the reduction of cycle time, eliminate the production of off-spec products, and produce an estimated US\$1.5 million in cost savings per year based on average reactor size." "Our team is very excited to add Yokogawa Electric as a strategic partner and investor. Yokogawa's global leadership in measurement and

process control technologies will be a major asset, enabling us to scale up operations, augment field engineering efforts, and expand our installed base throughout the world," said Alex Reed, CEO of Fluence Analytics. "We look forward to working with Yokogawa as we continue optimizing polymerization processes and improving product quality, consistency, and yields for polymer manufacturers."

The company will also handle engineering and all other system integration tasks and provide after-sales field services for its customers in the chemical industry. As a general practice, in the manufacturing operation, the chemical industry relies on the analysis of polymerization reactions*1 at specific intervals to control the polymerization process. Typically, samples are manually extracted from the reactor and transported to a laboratory for analysis, an offline process that can take up to 5 hours to complete for a single datapoint. The time required for the analysis limits the ability to optimally control the reaction timing and maintain stable product quality. The safety of the technicians responsible for the manual extraction and transport of samples is also a concern.

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BASF India Limited announces Q1 2021-2022 results



Narayan Krishnamohan, MD, BASF India

Mumbai, India: BASF India Limited registered sales of Rs. 30,129.2 million for the first quarter ended June 30, 2021, as compared to Rs. 17,864.9 million in the corresponding quarter of the previous year, representing an increase of 69%. The Company reported profit before tax (before exceptional items) of Rs. 2,484.4 million as compared to loss before tax (before exceptional items) of Rs. 406.9 million in the prior-year quarter. "We saw a strong start to FY 21-22 and the Company recorded growth in revenues and margins compared to the corresponding quarter of previous year, which was impacted by the COVID-19 induced lockdown. The intense second wave of the pandemic led to lockdowns in several states impacting industrial activity and businesses, especially related to the automotive sector.

However, the Company managed to outperform the preceding quarter in most business segments aided by enhanced

customer engagement and initiatives that enhanced supply chain resilience," said Narayan Krishnamohan, Managing Director, BASF India Limited. "Ongoing focus on margin improvement and cost management delivered substantially increased profits," he added. Digital outreach for products from the Agricultural Solutions segment helped increase their visibility and demand.

The Industrial solutions and Materials segments delivered strong growth in revenues and results with increase in volumes and prices realizations. The intense second wave of the pandemic had a significant impact on the health of the people, businesses, and economy. During this time, the Company offered innovative chemistry in the form of molecular sieves to enhance the generation of medical grade oxygen in the country. Additionally, the Company donated life-saving medical equipment like oxygen cylinders and oxygen concentrators to augment the medical infrastructure in the vicinity of our facilities. The financial results of the Company for the quarter ended June 30, 2020 have been restated to include results of erstwhile BPPIPL (BASF Performance Polyamides India Private Limited), which was merged with the Company effective February 1, 2020.

Marathon Petroleum Corporation Confirms Successful Test Run for US Refinery

Ohio, USA: In late 2020, Marathon Petroleum Corporation (Marathon) began the production of renewable diesel at their Dickinson refinery

in North Dakota, US. Marathon now reports successful completion of the refinery's test run of the grassroots renewable diesel unit.

The new HydroFlex™ unit produces 100% renewable diesel from soy and corn oil with a capacity of 10,000 barrels-per-day. The Topsoe's HydroFlex™ technology enables our client to convert low-carbon renewable feedstocks into cleaner fuel alternatives.

"This is a great accomplishment for the Marathon and Topsoe Team. We are also excited about the conversion of the Martinez refinery to renewable fuels production with an even larger capacity. We are pleased to be working with Topsoe to expand our production of renewable diesel," says Jeff Sexton, Refining Technology Director, Marathon Petroleum Corporation. "We want to thank Marathon for excellent collaboration during entire project execution of the Dickinson ND facility. Marathon is moving forward with a number of additional renewable fuels projects, and we're proud to contribute to this important endeavor," says Henrik Rasmussen, Managing Director, The Americas, Haldor Topsoe.

With HydroFlex™, customers can convert low value feedstocks to renewable fuels that qualify for the California Low Carbon Fuel Standard (LCFS) credit. The innovative HydroFlex™ process layout offers lower capital expenditure (CAPEX), but also a lower energy consumption during operation, resulting in a lower Carbon Index (CI). Topsoe's HydroFlex™ can be deployed in both grassroots units and revamps for co-processing or stand-alone applications.

SABIC First to Launch Circular Polycarbonate Produced from Post-Consumer Mixed Plastic

Sittard, Netherlands: SABIC, a global leader in the chemical industry announced the launch of its certified circular polycarbonate (PC) resin and blends made from the upcycling of post-consumer mixed plastic - a first in the industry. This solution, based on advanced recycling, demonstrates SABIC's ongoing commitment to drive towards a circular economy for plastics, by increasing the availability of more sustainable products. According to an internal SABIC LCA study[1], the certified circular polycarbonate offers a potential carbon footprint reduction up to 23% in comparison to its incumbent. "In another significant contribution towards the development of a circular economy for plastics, we are proud to have developed a new solution that can help our customers to meet their sustainability targets and generate value by increasing the amount of recycled post-consumer mixed plastic they process," said Abdullah S. Al-Otaibi, ETP & Market Solution General Manager at SABIC. SABIC is continuously broadening its sustainability offerings, and in ETP (engineering thermoplastics) specifically, new solutions in our polycarbonate portfolio to help support our customers' increasing needs for circular content and CO2 footprint reduction," added Al-Otaibi.

Part of SABIC's TRUCIRCLE™ portfolio of circular solutions, the certified circular polycarbonate is produced through the advanced recycling of post-consumer mixed plastic that could otherwise be destined for incineration or landfill. Through a process called pyrolysis, difficult-to-recycle used plastic is broken down into a liquid called

pyrolysis oil. This is then used as a feedstock to create certified circular building blocks for high-performance plastics with the same properties as the virgin material – in this case, polycarbonate.

Polycarbonate – more specifically LEXAN™ resin – forms part of SABIC's extensive ETP portfolio including PC blends such as CYCOLOY™ and XENOY™ resins. Customers across industries – such as E&E, Automotive, Healthcare, B&C and Consumer Goods – may use the certified circular polycarbonate under identical process conditions to those used for its incumbent. The polycarbonate is certified by an independent third party under the International Sustainability and Carbon Certification (ISCC PLUS) scheme using a standardized mass balance approach, which provides a method of asserting the recycled material content along predefined and transparent rules. In addition, the widely recognized ISCC PLUS accreditation provides traceability along SABIC's physical-linked supply chain, from the feedstock to the final product, requiring a chain of custody based on the mass balance system.

Launched in 2019, SABIC's TRUCIRCLE portfolio is a considerable milestone on the journey towards closing the loop and creating a circular economy for plastics and intends to provide manufacturers with access to more sustainable materials. The TRUCIRCLE portfolio spans design for recyclability, mechanically recycled products, certified circular products from feedstock recycling of used plastics, certified renewables products from bio-based feedstock and closed loop initiatives to recycle plastic back into high quality applications and helps prevent valuable used plastics from becoming waste. ■

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L&T Hydrocarbon Engineering Wins Large Offshore Contract from ONGC



Subramanian Sarma, Whole-time Director & Sr. Executive Vice President (Energy) Larsen & Toubro

The contract has been awarded through international competitive bidding on a Lump Sum Turnkey (LSTK) basis. Subramanian Sarma, Whole-time Director Et Sr. EVP (Energy), Larsen & Toubro Limited and CEO & MD, LTHE said, "We have been delivering several large and mega projects for ONGC over the past decade.

Our world-class fabrication facilities at Hazira (West Coast) and Kattupalli (East Coast) enable us to maximize the local content, entirely supporting the Government's AatmaNirbhar Bharat Policy.

L&T Bags Order for Titanium Clad Oxidation Reactor from Technip Energies

The Heavy Engineering arm of Larsen & Toubro (L&T) has won an order for oxidation reactor from Technip Energies-India against global competition. This order for the technologically critical titanium clad reactor is for a public sector petrochemical project for purified terephthalic acid plant.

The scope of supply involves design, material procurement, fabrication, inspection and testing of reactor meeting the licensors stringent quality requirements. This is an important step in indigenisation of high technology equipment and a major contribution towards the government of India's Aatmanirbhar Bharat initiative.

Lai-Heavy Engineering developed the technology for titanium clad equipment fabrication in-house conforming to global standards of quality. This critical reactor is built to precision tolerances considering the exposure to severe corrosive atmosphere and dynamic loading during service.

This order marks the opening of multiple avenues for L&T Heavy Engineering for critical titanium clad reactors in both domestic and global markets.

L&T Completes HPCL's Mumbai Refinery Expansion Project

The project, which started amid the peak second wave of COVID-19 pandemic on 15 April 2021, was completed on 16 June 2021. HPCL is now into final stage of making the plant operational. The MRU team completed concurrent shutdown of four plants – atmospheric pipe still, naphtha stabilising unit, continuous catalyst regenerator and fluid catalytic cracking unit at the Mumbai Refinery.

The task for L&T was cut out with the replacement, modification and dismantling of over 180 critical equipment, 1,30,000 fabrication of pipe spools and other components. This is one of the most complex and biggest revamps till date, that too in a refinery that was in operation.

Even before starting the work, L&T had planned pre-shutdown work when the refinery was in operation. To de-risk, the MRU team had to modify some of the critical heat exchangers and pump foundations in live plant to complete the project without delay.

The HPCL project started during the second wave of COVID-19 at Mumbai which was the worst affected with labourers fleeing the city. In a move to overcome the issue, the MRU team planned the shutdown with several automation and digitalisation initiatives, besides engaging with labour forces at the

labour camp assuring them medical and financial support.

This helped the MRU team minimise labour shortage to 30 percent compared to 70 percent experienced by other contractors. The availability of oxygen was another challenge as it was diverted for medical purposes.

This challenge was mitigated by proactive use of alternative means of cutting like diamond wire rope cutting and plasma cutting.

CIL to Infuse 14,000 Cr in First-Mile Connectivity Projects

Coal India (CIL) will be infusing Rs 14,000 crore till FY25 in first-mile connectivity infrastructure in two phases. CIL has taken steps to upgrade the mechanized coal transportation and loading system under 'First Mile Connectivity' projects. In Phase-I, 35 projects had been tendered out of which four projects of 30 million tpa have been commissioned. The total capacity involved in this is 414.5 million tpa.

In Phase-II, 14 projects with a total capacity 100 million tpa will be taken up which will require an investment of Rs 3,500 crore. Meanwhile, CIL plans to clear 18 mining projects having a capacity of 144 million tonne to be approved in FY22. Out of this, two mining projects had been approved by CIL and its subsidiaries in Q1/

FY22, with a rated capacity of 36 million tpa and sanctioned capital of Rs 3,389.95 crore.

Tata Steel BSL sets up World's First UV Oxidation Plant to treat Cyanide in Wastewater

A cutting-edge ultraviolet (UV) oxidation technology to treat cyanide in its coke oven wastewater has been adopted in Tata Steel BSL as a step towards achieving environmental excellence.

It has established the world's first UV oxidation plant in the steel industry, with support from research and development (R&D) team of its parent company Tata Steel, at its Narendrapur plant in Dhenkanal district of Odisha with capacity to treat 80 cu mtr of waste water per hour for the purpose. This technology for commercialisation has been jointly developed by R&D team of Tata Steel and Environment and Coke Oven teams of Tata Steel BSL.

Tata Steel R&D team has protected the technology through patent on the key formula and novelty of the process. The conventional method of treating cyanide in coke oven wastewater, one of the most toxic and potentially deadly pollutants, is called solid sludge separation technology which may lead towards cyanide toxicity by secondary means of toxic sludge decomposition. However, the new technology will address this issue.

The company has got the equipment like different UV reactors, UV control panels customised before commissioning the plant in consultation with suppliers and the R&D team of Tata Steel.

With sustainability at the core of its operational process, Tata Steel BSL has made many other technological interventions ensuring no untreated water is discharged from the plant. It has set up six effluent treatment plants (ETPs) and three gas cleaning plants (GCPs) for treatment of waste water from different units like two coke ovens, cold rolling mill, blast furnace, steel melting shop, etc. Similarly, it has also established five sewage treatment plants (STPs) having total treatment capacity of 4,900 cu mtr of water per day in the plant and its housing colony.

It has established scientifically designed high-density polyethylene (HDPE) lined rainwater harvesting pond of capacity 50,000 cu mtr, first-of-its-kind in Tata Steel Group for utilisation of surface run-off available in the coke oven and raw material handling system area. To stay ahead of the curve, the company has conducted a thorough water audit by the leading industry body of the country, the Confederation Indian Industry (CII), and implemented its recommendations saving around 9,000 cu mtr of water per day.

To ensure the water quality always remains as per parameters set by the regulatory bodies, the company has established

a full-fledged environment laboratory for daily monitoring of quality of the discharged water which is well below the stipulated limit of the statutory authorities.

Ion Exchange India Bags Contract worth 357 Cr from IOCL

Ion Exchange (India) has secured a contract worth Rs 357.465 crore from the Indian Oil Corporation (IOCL). The engineering, procurement, construction and commissioning (EPCC) contract is for design, installation of effluent treatment plant on turnkey basis for its Para Xylene (PX) and Purified Terephthalic Acid (PTA) complex project at Paradeep, Odisha.

PTA is a major raw material used to manufacture polyester fibers, PET bottles and polyester film used in packaging applications. The project is to be constructed and commissioned within 26 months from the date of letter of acceptance (LoA).

RIL to set up Recycled Polyester Staple Fiber Facility in Andhra Pradesh

Reliance Industries (RIL) is doubling its PET recycling capacity by setting up a recycled polyester staple fiber (PSF) manufacturing facility in Andhra Pradesh. The move is part of RIL's commitment to lead the industry on circular economy, enhance its sustainability quotient and

bolster the entire polyester and polymer value chain. As a part of this endeavour, Srichakra Ecotex India will build and operate exclusively for RIL the new recycled PSF – RecronGreen Gold and PET flakes wash-line in Andhra Pradesh.

RIL's initiative to more than double its recycling capacity to five billion post-consumer PET bottles will ensure India maintains over 90 percent recycling rate. RIL is focusing on sustaining India's post-consumer PET recycling rate which is currently the highest in the world. RIL will empower entrepreneurs to divert post-consumer used packaging from landfills, setup recycling facilities and create wealth from waste throughout the country.

RIL is driving various initiatives such as Fashion for Earth in partnership with Lakmé Fashion Week and the United Nations in India, Hub Excellence Programme and Circular Design Challenge to inculcate circularity and sustainability concepts in polymer, textile and fashion industries. RIL has underwritten the entire production from Srichakra's facility to provide support for development of the business. The alliance will propel Srichakra's commitment to reduce plastic pollution and facilitate both organisations to advance the circular economy for plastic waste in India.

RIL's industry expertise, technical knowledge and business assurances will allow Srichakra to research, innovate and

develop high-quality and sustainable products for RIL's GreenGold portfolio. RIL currently recycles PET bottles at its Barabanki, Hoshiarpur and Nagothane plants. The post-consumer PET bottles are used as a raw material for manufacturing recycled polyester fiber.

At present, RIL converts over two billion post-consumer PET bottles into fibers annually. With addition of Srichakra capacity RIL will be instrumental in converting about five billion used PET bottles into value-added fibers.

Technip Energies Awarded a Contract by Indian Oil Corporation to Upgrade Barauni Refinery

Technip Energies has been awarded a significant Engineering, Procurement, Construction and Commissioning (EPCC) contract by Indian Oil Corporation Limited (IOCL) for its BR9 Expansion Project in Barauni, Bihar, in the Eastern part of India. This EPCC contract covers the installation of a new Once-through Hydrocracker Unit (OHCU) of 1 million metric tonnes per annum (MMTPA) capacity, a Fuel Gas Treatment Unit (FGTU) and the associated facilities. The OHCU, in combination with downstream refinery units, will enable production of BS VI Grade fuels – similar to Euro VI Grade fuels – and petrochemicals.

Bhaskar Patel, Senior Vice President India Business Unit at Technip Energies commented: "We are very pleased to



Bhaskar Patel, Sr. VP, India Business Unit
Technip Energies

have been awarded this contract by Indian Oil Corporation Limited. This award demonstrates our long-term commitment in India and substantially consolidates our positioning in High Operating Pressure projects. It also strengthens our position as a leading provider of key projects to the major players in India's domestic energy sector." IOCL's Barauni refinery, built in 1964, is the second refinery to be built in India. The BR9 Expansion project shall enhance refinery capacity from 6 MMTPA to 9 MMTPA and will add petrochemicals such as Polypropylene into Barauni refinery's product portfolio. ■

Geopolitical shifts, Climate change, Diversification of energy mix, Digitalization are the game changers that are compelling the refiners world over to realign their future plans. In the **August edition of Chemical Engineering World, the Cover Story** focuses on **Refining & Petrochemicals sector**, bringing insights of the Indian refining sector.

It projects the views of leaders, their priorities to drive the growth during a time when the entire energy sector is going through major transformations.

Odisha, a Paragon of Being the Refining Hub of East India

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***Bhupendra Singh Poonia** was transferred and posted as Managing Director of IPICOL and has spearheading a lot of projects that aims to strengthen the industrial reforms and capabilities of Orissa to gain recognition nationwide. Chemical Engineering World is glad to cover his views about his current role and future plans.*



Bhupendra Singh Poonia (IAS)

Managing Director, IPICOL
Govt. of Odisha



Early congratulations, for taking up your new role. IPICOL was categorised as “Top Performers” amongst 20 State Investment Promotion Agencies with an overall score of 98%, in a State IPA rating report last year, how do you react to this & take this forward?

Over the last few years, Odisha has undertaken several efforts in the area of Investment Promotion and Facilitation, development of Single Window System, Industry Care mechanism, Central Inspection System, GIS based platform for selection of industrial land to name a few. We have a dedicated team handling the investment promotion activities and follow a set process. We have been taking incremental steps and aim to continue and build upon our efforts to help improve the mechanisms. To stay ahead of the curve, our team has been regularly updating the mechanisms, based on user feedback and global and national best practices. We are learning from our experiences and improving our systems and mechanisms. The state has taken significant steps in minimizing regulatory compliances for the industries. We provide highest importance to the feedback from our investors and stakeholders. We aim to translate this success of Investment Promotion at the district level and are taking necessary steps in this direction. I am sure our efforts will translate in enhancing the positive image for the state and make Odisha, an investment destination of choice.

Tell us about the ‘Vision 2030 of Odisha’ and initiatives & action plan of IPICOL to realize this. How does “Industry care” initiative fit into the larger picture of Vision 2030?

Vision 2030 is related to development of downstream & ancillary unit in metal sector. And may not be relevant to chemicals sector.

Tell us about the progress of Paradip Refinery project in Odisha and what kind of investments are being planned into the state. What is the role that the state will play in the global petrochemicals industry?

IOCL's Paradip refinery acts as the anchor tenant for the Paradip PCPIR. To create value chain in petrochemicals, IOCL Paradip Refinery has setup a 680 KTPA Polypropylene unit, which has been operational since 2019. The feedstock for PP unit is recovered Propylene from cracked LPG which is generated from FCC - INDMAX unit. The product finds wide use in making furniture, Injection Moulding products. Also, a Mono Ethylene Glycol (MEG) plant is being set up which will help in the manufacture of items like polyester fibre, textiles. An integrated PX/PTA plant which will act as feedstock for PET Chips, packaging film, yarn and textile industries is also in the pipeline. Besides, IOCL also plans to setup a dual feed naphtha cracker unit which will help in production of various derivatives of petroleum including chemicals, agro chemicals, specialty chemicals etc.

Odisha is developing dedicated parks such as plastics park at Paradip and Textiles Park at Bhadrak. IOCL will supply the feedstock and is the anchor tenant for these parks. To further develop downstream units in Plastic Park and fast-track development of plastics sector in Paradip, a MoU has been signed with IOCL for Special Strategic Incentives Scheme of INR 2000/MT for supplying Polypropylene granules to downstream industries in Plastics Park.

Walk us through the progress of various infrastructure projects to support the growth of this industry. (LNG terminals, Paradip port, Pipeline network for petrochemicals & LNG transportation)

Paradip has witnessed various infrastructure development projects to cater to the growing industries in the region. A railway line is being constructed from Haridaspur to Paradip which will connect with the Chennai-Kolkata main line. This will significantly boost the rail connectivity for cargo transportation to Paradip. A multipurpose container terminal to handle clean cargo has been operational at Paradip from 2018. The port aims to have connectivity with premium shipping lines of the world. Paradip also has a dedicated pipeline corridor to cater to the import and export requirements of industries in the region.

A 5 MTPA LNG import and regasification terminal is coming up at Dhamra. IOCL and GAIL have signed long term supply

agreements to off-take gas from this terminal. GAIL plans to supply the gas to its customers in eastern India and along the Jagdishpur-Haldia gas grid that the company is currently

Tell us about the other key projects coming up in the state

Odisha has garnered interest from several leading players across the focus sectors of chemicals, petrochemicals, textiles, food processing etc. A petrochemical project is being planned at Subarnarekha. IOCL is planning to setup dual feed naphtha cracker, besides MEG and PX-PTA plants at Paradip. Also, IOCL is the anchor tenant for the Technical Textiles Park at Bhadrak. A 300 KTPA polyester plant with dedicated feedstock of Polyester Staple Fibre, Drawn Texturized Yarn and Fully Drawn Yarn will act as the anchor project for the textile park. Besides, a plastic park is under development near the IOCL refinery at Paradip. The Polypropylene unit of IOCL will supply PP as feedstock to the Plastic Park. Several projects in the other sectors such as food processing, metals sector are in the pipeline and have received approvals from the State Level Single Window Clearance Authority.

In the current times, how do you plan to attract investments in the state? Which are the key industries that look very promising for the investors?

Odisha is fast emerging as the manufacturing hub of East India owing to

its proactive and progressive governance. Even during the difficult Covid-19 pandemic time, the investor sentiment towards Odisha has been extremely encouraging and the state has been able to attract new investment of over one lakh crores across multiple sectors.

We are focussing on attracting investments in the focus sectors of the state which include food processing including sea-food, chemical, plastics & petrochemicals, electronics manufacturing, ancillary & downstream industries in metal, textiles & apparels and tourism. While the focus even post-covid remains in these sectors, Odisha is now looking to accelerate the industrial development in the food processing and metal downstream sectors.

The state already has a dedicated Biotech Park close to Bhubaneswar, which is being setup by Bharat Biotech and the state plans to expand it to cater to the upcoming industries in the sector. Further, with the recent signing of MoU between IOCL and IDCO, dedicated feedstock availability at Plastics Park will enable more investments in technical textiles like PPEs. Sector-specific parks such as Technical Textiles Park, Plastics Park, Electronics Manufacturing Cluster, Aluminum Downstream Park, Seafood Park etc. are being developed to cater to industries in these sectors. ■

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Flexibility: 'The Mantra' for Technology Selection

Dr. SSV Ramakumar, has a 28 years of experience as a R&D professional working in India's foremost Petroleum R&D organization. In talks with CEW, he shares the overview and challenges of India gearing to become a global refining hub.



Dr. SSV Ramakumar

Director (R&D), IndianOil

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Demand variation, fluctuation & destruction as the factors for slack in throughputs across the refineries. The challenges for refiners to keep the GRMs intact is formidable if not surmountable. The Indian refining industry aspires to be the global refining hub and now learning the hard way how to manage this kind of demand fluctuations & demand destruction.

While this may not be the last pandemic but it has taught the lesson to the industry to be geared up for any such future occurrences. The refineries must be technologically robust and offer agile in terms of scale & products. Dr. SSV

Ramakumar underscored 'Flexibility' as 'The Mantra' for selection of technology for operating as well as Greenfield refineries.

Globally, refineries contribute around 6% of GHG emissions & reduction of carbon footprint is one of the major challenges that this industry needs to address. Dr Ramakumar expressed "I am very inclined towards converting the captured CO₂ to produce value added products & bring it back in the system to establish carbon circularity rather than capturing & storage of CO₂. Then only bottom lines will improve & the industry will be resilient to future fluctuations." ■

Building Sustainable Resilience of EPC industry & Future Readiness for Growth



S K Barua

Managing Director, Numaligarh Refinery Limited

Video Link: <https://youtu.be/7F9Q0oiUCZw>

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Theme: Building Resilience of EPC Industry

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S K Barua the Managing Director, NRL presented the Keynote Address during inauguration of EPC World . IE 2021 conference

'Building Sustainable Resilience of EPC industry & Future Readiness for Growth' Talking about the expansion plans of NRL to set up target capacity of 9 MMTPA and multiple projects in progress, he shared insights into overall industry growth & the expectations of project owners from the EPC players.

There is good amount of projects coming up in the Indian refining sector and for the EPCs & stakeholder industries , it is time to showcase the capabilities , competitiveness ability to maintain quality & on time delivery pf projects. He pointed out that committed culture, honest opinion, transparency, complete support during the times of difficulty would go a long way to create win- win situation for the project owners & EPC contractors for smooth & speedy implementation of projects. ■

BCPL, an Anchor for Future Growth of the Industry

Reep Hazarika the MD of BCPL comes with an experience of 30 years in the oil refining and Petrochemical industry. He shares an overview of current polymer market and its growth and future targets.



Reep Hazarika
Managing Director, BCPL

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Key challenges & how do you plan to stay competitive in the volatile market

BCPL is the newest player in the polymer market and its contribution is nearly 3% of the total national polymer production. BCPL is situated in the NE region of India and due to the strategic geographical location; it offers a lot of challenges for businesses and at the same time provides abundance opportunities for growth of the industry. The key challenges that BCPL has been witnessing are with

respect to the volatility in the feedstock prices and the availability of feed stock viz. naphtha and rich natural gas.

The low per capita consumption of polymer in NE region gives immense for the polymer market in the region. BCPL, being the only polymer plant in the entire NE region, can be the anchor for future growth of the industry. The low cost supply of BCPL polymer within the NE will facilitate setting up of downstream polymer units and thereby increase the polymer consumption in the entire

NE region. Also, BCPL's proximity to international borders opens up ASEAN and BBN market access helping exports to earn valuable foreign exchange. Increased polymer consumption in the region will be win-win situation both for the region as well as for BCPL.

Since inception, BCPL has been playing a pivotal role for the economic development of the region not only by providing employment opportunities but also creating entrepreneurs. The macroeconomic trends are also showing substantial increase in polymer consumption in the NE region and there is an increasing trend in the number of downstream units set up in this region. To remain in competitive, BCPL's prime focus has been on quality products to meet customer satisfaction and effective & efficient supply of materials to its customers.

Your immediate priorities to ensure sustainable growth

Plastics industry is one of the fastest growing industries in India. It has expanded at approximately 8% CAGR over the last five years and is expected to grow at around 7.5% in the medium term owing to increased polymer demand backed by high population growth and increasing disposable income.

To remain in competitive in the present scenario, BCPL is focusing on organic growth by tapping natural gas as feed

stock which is available in the NE region. In near term prospective, BCPL is planning to achieve additional 40% capacity expansion for which BCPL is in active discussions with the stakeholders for the additional feedstock requirements. As a long term strategy, BCPL is planning to double its capacity and also add new high-value products to its product mix to ensure sustainable growth. While focusing on growth, BCPL is also considering various Clean Technology Scenarios (CTS) to curb air and water pollution and at the same time reducing CO₂ emission.

Initiatives taken / implemented to reduce the carbon footprint

As a responsible corporate citizen, BCPL has always been very sensitive to the impact on environment and has taken appreciable steps in all respects in the areas of air pollution, water pollution, noise pollution, soil pollution and waste management. Pollution control and other environment protection norms are being fully complied and there has been an endeavor to maintain high levels of environmental standards along with operational efficiency. BCPL has taken holistic approach of reducing generation of waste as a part of its responsibility towards environment and to manage its waste in the best possible way. Utmost care is given for segregation of different wastes, their storage, treatment and disposal as per the latest environment practices. Co-processing of high calorific

Sr No	Products	Capacity MTPA	Expected year of completion
1	LLDPE/HDPE	220000	Existing
2	Poly Propylene	60000	Existing
3	First stage Hydrogenated Pyro Gasoline	47500	Existing
4	CBFS	10000	Existing
5	Fully Hydrogenated Pyro Gasoline	52000	2024

value waste as fuel in cement industries has been carried out successfully. E-waste, battery waste are being dispatched to authorized recyclers. Liquid hazardous wastes like used oil, waste oil etc. are being sent to recyclers. Oily sludge is treated through Bio-remediation. BCPL is ISO 14001:2015 compliant and is fully committed to operational excellence to improve environmental performance. BCPL's goal is to increase the renewable energy portfolio and invest in pollution control equipment to assure carbon abatement and offsetting. At all of our production facilities, dedicated staff works tirelessly to develop and implement energy conservation, resource optimization and renewable energy projects.

Existing products & new product mix with quantities

Presently, BCPL is implementing two value addition projects namely Butene-1 and 2nd Stage Hydrogenation of Pyrolysis Gasoline (HPG) plant at Dibrugarh at a cost of Rs 386 crore. The HPG (2nd stage) plant shall be a 52 KTPA plant and

Butene-1 plant shall be a 10 KPTA plant producing Butene-1.

Existing products and future scenario of BCPL products and byproducts after completion of the two projects as above are provided in tabular form above. ■

Existing Products & New Product Mix With Quantities

Prabh Das has been an instrumental leader working in HMEL since 2008 and has served in the Indian Administrative Services for 25 years. In talks with CEW, he shares his experience of administration and management across major application segments.



Prabh Das

Managing Director and Chief Executive Officer, HMEL

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H MEL operates a state-of-the-art crude oil refinery of 11.3 Million MT/annum capacity at Bathinda in Punjab and a Polypropylene Unit of Gas Phase Technology, licensed from Lummus Novolen (McDermott) Tech, GmbH with a nameplate capacity of 467 KTA.

1.2 Million MT/annum of Polyethylene (PE) and 0.5 Million MT/annum of Polypropylene (PP) to cater all major application segments, in the same premises.

The details of each unit & its technology as mentioned below.

HMEL is setting up 2 world class Dual Feed Cracker Unit for production of

Unit Name	Licensors	Technology	Capacity (KTA)
Dual Feed Cracker	McDermott, USA	Lummus	1200
Swing Unit (LLDPE/ HOPE)	Univation Technologies, USA	UNIPOL™ PE	2 X 400
Dedicated HDPE Unit	Chevron Phillips Chemical, USA	MarTECH™	450
PP Unit-1 (Existing)	NOVOLEN (McDermott)	Lummus Novolen Tech, GmbH	467
PP Unit 2	Lyondell Basell, Italy	Spheripol- II	500

New Super - Austenitic Alloy: Sanicro® 35



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A decade back, Sandvik embarked on a research project to develop a new stainless-steel alloy that combined corrosion properties with a high mechanical strength.

Sanicro® 35 bridges the properties gap between super austenitic steel grades and more expensive nickel alloys. Sanicro® 35 is available in Heat Exchanger Tubes,

alternative to conventional high nickel alloys and super austenitic alloys to support more cost effective and efficient operations.

The composition of the alloy was very carefully chosen. A number of trials and testsp were conducted to arrive at the most optimum range of alloying elements.

The composition of the alloy is:

C	Mn	P	S	Si	Cr	Ni	Mo	Cu	N	Fe
0.030	1.2	0.030	0.020	0.5	27	35	6.5	0.4	0.3	Remainder

Hydraulic and Instrumentation Tubing and regular tube and pipe form. The material provides a new, high-performance

This balanced chemistry helps Sanicro® 35 to achieve a very high structural stability.

Sanicro® 35 has a rare combination of tensile and elongation properties. The yield and tensile properties are almost in the range of duplex steel with elongation properties in the range of austenitic stainless steel as can be seen from the graph below –



Sanicro® 35 has an excellent yield strength of 425 MPa and with an elongation of min 35%. This is an interesting combination which will give an advantage to the designer to look for some weight reduction possibilities by reducing the wall thickness of the tube without compromising the pressure rating etc.

To prove the alloy's capabilities, particularly its potential for deployment in conditions such as seawater or environments which contain chlorides, it was necessary to test Sanicro® 35's corrosion resistance and mechanical properties and compare them with existing stainless steels and nickel-based alloys.

Polished samples of Sanicro® 35 were used for critical pitting testing (CPT), using a test solution of 3M MgCl₂.

Previous tests had proven that the CPT for Sanicro® 35 was 110°C. This was found to be some 45°C higher than the CPT identified in comparisons with 6Mo alloys such as 254 SMO, and suggested Sanicro® 35 would be suitable for use in water with a high chloride content and seawater.

Critical crevice temperatures (CCT) were determined on Sanicro® 35 along with alloy 625 (with a PRE of 49) and alloy C-276 (with a PRE of 72). The coupons were tested using two methods: in the first method (ASTM G48 method D), the test lasted 72 hours and a torque of 0.28 Nm was applied; and, in the second method (ASTM G48 Method F), a torque of 1.58 Nm was applied, and the test was for 24 hours.

In both test methods, Sanicro® 35 provided a CCT that was significantly higher than alloy 625, despite both materials having a similar PRE – in ASTM G48 method D, Sanicro® 35 displayed a CCT of 52.5, while in ASTM G48 method F, the CCT was 45. The CCT values for alloy 625 were observed as 45 and 25 respectively. The CCT values for Sanicro® 35 were similar to alloy C-276, which had a higher PRE. Based on these tests, it is possible to consider that Sanicro® 35 offers more resistance than alloy 625.

ASTM G48 6% FeCl₃

GROUND SAMPLES (P120)



Crevice corrosion resistance higher than Alloy 625 and at least on par with C276

Tests for general corrosion resistance to HCl in concentrations up to 5% were undertaken in line with the standard ISO 18069.

When tested in HCl, Sanicro[®] 35 displayed no corrosion at boiling point in 1% HCl, which is an improvement on 6Mo alloys and alloy 904L which cannot be used at boiling point. Sanicro[®] 35 is therefore suitable for use in the manufacture of refinery heat exchangers which can often experience dew point-corrosion from condensing HCl. At low concentrations Sanicro[®] 35 displayed comparable corrosion resistance to alloy 625 and the super austenitic stainless steel UNS S32654.

In the hydraulic and instrumentation (H&I) tubing sector, the new material bridges the gap between stainless steel and expensive nickel alloys, helping to streamline inventories, reducing the amount of capital

tied up in product portfolios, and providing a safe alternative to existing materials.

When it comes to high performance heat exchangers (HX), Sanicro[®] 35 offers a high operational temperature limitation and a cost-effective choice over nickel alloys. These benefits can support lower lifecycle costs, eliminate unscheduled downtime, combat general and pitting corrosion, and avoid crevice corrosion.

Its versatile material properties mean it offers clever risk reduction, providing customers with a smart and cost-efficient choice for dealing with corrosion. By bridging the gap between stainless and nickel alloys, Sanicro[®] 35 is able to deliver an optimized price-performance ratio and the ability to balance out heat exchanger performance fluctuations.

Sanicro[®] 35 has the ability to generate confidence in material selection and

reduces traditional over-conservatism through the delivery of performance capabilities appropriate to the demands of the job. In a cost-conscious environment, Sanicro® 35 can be considered an all-round tube solution to many H&I and HX challenges.

Approved as UNS N08935 as per ASTM B 163.

It's compliant with NACE MR0175/ISO 15156-3:20151, for type 4a and type 4c materials.

It's compliant with ANSI/NACE MR0103/ISO 17495-1:20162 for highly alloyed austenitic stainless steels and nickel alloys.

ASME Code Case 2982 Boiler and Pressure Vessel Code, Section VIII, Division I and II. ■

Introducing a new member of the Sanicro® 35 family -
<https://youtu.be/Q-Jel3ihqyc>

Disclaimer: This article was initially published in the February 2021 issue of *Stainless Steel World Americas*.

For more information

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Plastics Waste Disposal – Challenges & Opportunities



Jayant D Divey

Polyolefins Technology Consultant
Mumbai

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Jayant D Divey is a Senior Process & Technology Professional & Consultant working in the Polyolefins & Petrochemicals industry. In this contribution to CEW he has laid down the basics behind the much needed latest initiative of the Govt of India, that announced single use plastics items being phased out of production, imports, use, storage and sale etc.



We are living in “Age of Plastics” wherein our daily existence depends on plastics products in all spheres of life. With ever growing consumption of polymers or plastics, the problems arising out of disposal of plastics waste are also assuming alarming proportion. Thus

far whatever waste is not recycled to plastics processing, finds way to either land-fill or combustion or simply leakage to environment contributing to air and soil pollution. After maximizing recycle, Pyrolysis of plastics waste is promising to become not only economically viable but also necessary mode of disposal to move towards circular plastics economy.

It is not exaggeration to state that we live in “Age of Plastics” or “Age of Polymers”. Our daily existence depends on plastics products. We cannot live without plastics. Polymers or Plastics are primarily of two types, namely thermoplastics and thermosets. Some popular examples of thermoplastics are polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polystyrene (PS), polyethylene terephthalate (PET), polycarbonate (PC) etc. Popular examples of thermosets are

polyesters, polyurethane (PUR), phenolic resins, phenol formaldehyde resins, silicones etc. (Refer Table No 1 for detail list). PE and PP are probably the most versatile plastics accounting for nearly 60 % of all plastics combined. Global plastics production in 2019 is estimated to be approximately 360 Million Metric Tonnes per Year (Million MTPY) with approximately 200 Million MTPY being the share of PE and PP together.

Table No 1 : Examples of Thermoplastics & Thermosets Polymers

Thermoplastics		Thermosets	
Family of plastics that can be melted when heated and hardened when cooled. These characteristics which lend the material its name are reversible that is these can be reheated, reshaped and cooled repeatedly.		Family of plastics that undergo a chemical change when heated. These plastics cannot be remelted and reformed once they are heated and formed hence the name.	
Polyethylene	PE	Polyurethane	PUR
Polypropylene	PP	Polyesters	
Polyvinyl Chloride	PVC	Epoxy Resins	
Polyethylene Terephthalate	PET	Vinyl Esters	
Polystyrene	PS	Silicone	
Expanded Polystyrene	EPS	Phenol Formaldehyde Resin	
Acrylonitrile Butadiene Styrene	ABS	Urea Formaldehyde Resin	
Styrene Acrylo Nitrile	SAN	Phenolic Resins	
Polyamides	PA	Acrylic Resins	
Polycarbonate	PC		
Polymethyl Methacrylate	PMMA		
Thermoplastic Elastomers	TPE		
Polyaryl Sulfone	PSU		
Polyether Ether ketone	PEEK		
Polyoxymethylene	POM		
Polybutyl Terephthalate	PBT		
Ethylene Vinyl Alcohol Copolymer	EVOH		
Fluoropolymers			

Plastics – Applications & Disposal: The vast applications of all plastics can be broadly classified under the following categories:

- Packaging
- Building and Construction
- Automotive
- Electrical and Electronics
- Agriculture & related Agro Industries
- Households & Leisure Items
- Others

The use of plastics products can also be specified by their pattern of use for example:

- Use and throw or single use
- Use, retain, reuse before discarding or multiple uses
- Use over life span from few days to few months to few years before discarding

The disposal of plastics after use depends on type of applications and patterns of use.

Plastics recycle or use of recycled plastics is integral part of plastics processing industry.

The recycle of plastics starts from collection after its discard. Collection is followed by sorting, sizing and treating before recycle to plastics processing.

How much Plastics Waste is Recycled?

The quantification of plastics waste before and after disposal is difficult by its very nature. But some global estimates, which are more guestimates, based on estimates in developed nations suggest the following break-up:

- Land Fill = 40%
- Collected for Recycle = 14%
- Combustion (with or without power recovery) = 14%
- Leakage to Environment = 32%
- Total = 100%

In Indian context, based on the observations and experience, the above break-up can be empirically revised as following:

- Land Fill = 40%
- Collected for Recycle = 15%
- Combustion = 5%
- Leakage to Environment = 40%
- Total = 100%

There are some items in plastics waste which are easier to collect for recycle than many others. When not recycled, wherever possible the waste is diverted for land-fill. Insignificant proportion is incinerated simply because there are practically negligible incinerating facilities for plastics waste in India. The actual amount could be much less than 5 % which is a nominal value. A large amount of plastics waste is simply discarded in the

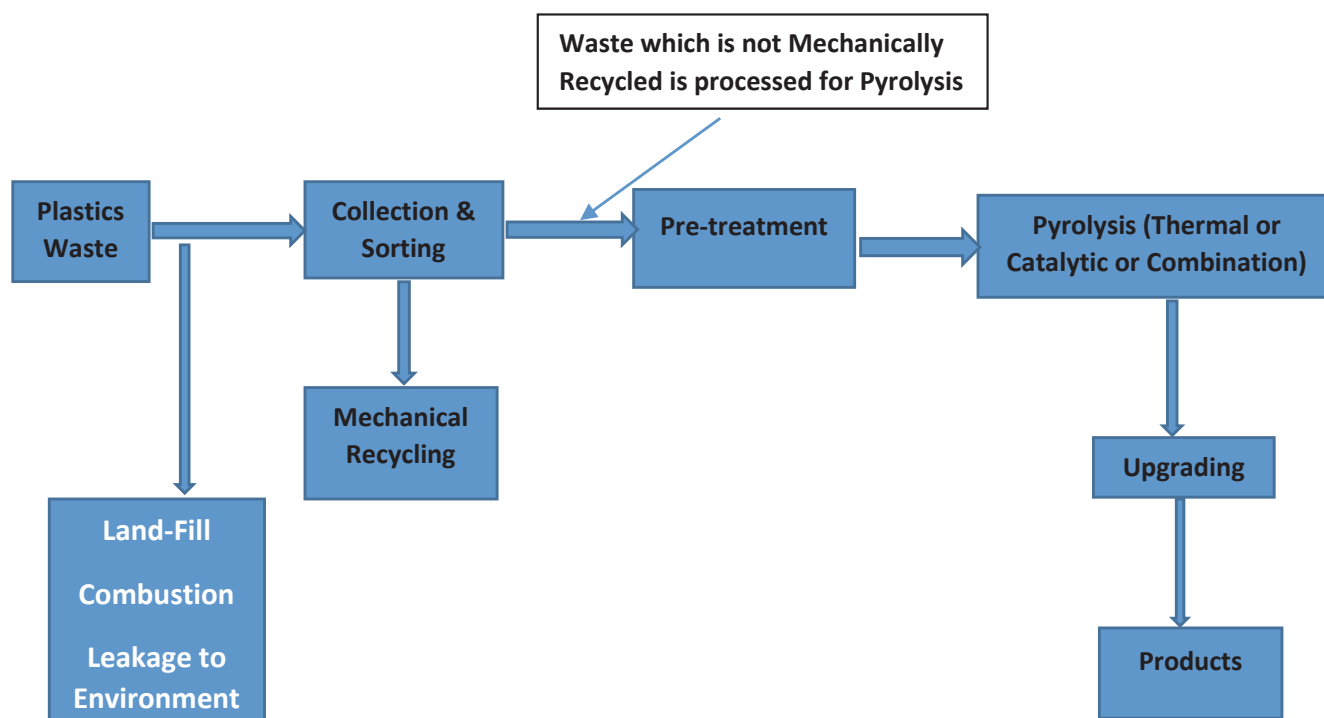


Figure 1: Life Cycle of Plastics Waste

environment which can be easily observed while travelling anywhere in India. Thus by corollary, if mechanical recycle of waste is to be increased, then it has to be correspondingly reduced from the land-fill and leakage to environment. Advanced countries have significantly improved upon this aspect in last two decades. Developing nations like India stand a great opportunity for improvement in this area.

recycled is processed for either land-fill or energy recovery by combustion (or simply burnt) or pyrolysis. Large amount of plastics waste which is not collected at all, leaks to environment.

The prevailing trend and expected or desired future strategy or pattern for plastics waste disposal is summarized below.

Life Cycle of Plastics Waste: The simplified life cycle of plastics waste is depicted in Figure 1. After collection, sorting and initial treatment, the plastics waste is mechanically recycled for plastics processing or to plastics converters. Plastics waste which is not mechanically

Prevailing Trend	Expected or Desired Future Strategy
Mechanical Recycle	Maximize
Land-Fill	To continue with target to minimize and eventually eliminate
Combustion or Energy Recovery	To Continue with target to minimize if not eliminated
Pyrolysis	Maximize Post Mechanical Recycling
Leakage to Environment	Target to minimize in favour of any of the above

In the ideal world, there should not exist any options for Land-Fill or Combustion and zero Leakage to Environment that is no soil or air pollution.

Pyrolysis

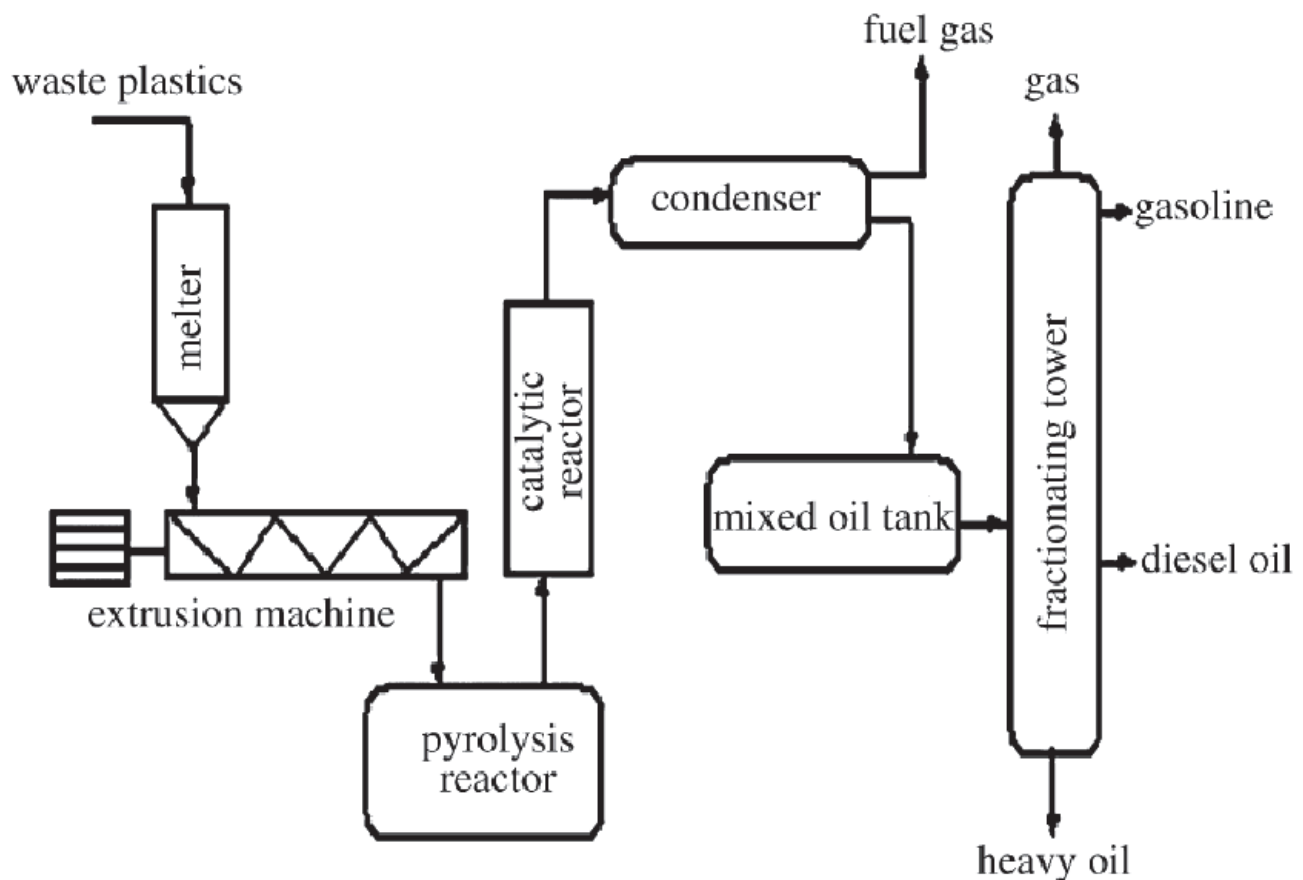
Plastics or polymers by nature are very large molecules having very high average molecular weight and are combustible in general sense. Pyrolysis is a thermal process of cracking heavy or very high molecules by heating at elevated temperature in absence of air or oxygen. The typical heating temperature range employed for pyrolysis of plastics or polymers is 500 C to 800 C (minimum 450 C to maximum 900 C). The higher the temperature, higher is the product yield and higher the temperature, higher is the content of gaseous products from pyrolysis. Catalytic pyrolysis is using catalysts to enhance the selectivity of products, reduce the temperature and optimize the retention time of pyrolysis. Selectivity of products is intended to

produce lower boiling range liquid mixture and / or also produce gaseous products which can be upgraded for superior downstream applications. The

typical products emerging from pyrolysis can be classified as follows for example.

Globally several corporations, universities and research institutes have been engaged in conducting research on pyrolysis for last few years. The pyrolysis can either be thermal or catalytic or combination of both. The objective has been to optimize pyrolysis conditions in order to maximize the yield of useful products or improve the selectivity of valuable products. Generally the gaseous products are aimed to be mixture of lower alkanes to be suitable for using as fuel or feedstock for gas crackers. Alternately, the higher objective is to produce mixture of olefins like ethylene and propylene which can be separated for use as monomers. Liquid products are aimed to be suitable for blending with gasoline or diesel or kerosene or as feed stocks for crackers. Solid residue is assumed to be suitable for use as carbon black feedstock or blending with bitumen or simply as coke. This is

Sr. No	Product Category	Examples	Examples of Source Plastics
1	Oil Refinery Feed-stocks Chemicals Fuel Oils like Diesel or Kerosene Lubricants	Mixture of Higher Paraffins Mixture of Olefins Mixture Middle to Higher Paraffins Waxes	PE / PP
2	Monomers	Styrene Styrene Oligomers MMA	PS / PMMA
3	Fuels Chemicals	Aromatics, Methane Benzoic Acid, Vinyl Terephthalate, Ammonia,	PET / PUR



A typical simplified process schematic of pyrolysis is depicted in Figure No 2.

the basis of circular plastics economy or ideal guiding concept of circular plastics economy where the plastics waste is converted to monomers.

Indian Scenario: Plastics production or consumption in India is estimated to be about 16 to 18 Million TPA (as of 2020) against estimated global production of approximately 360 Million MTPY (as of 2019). The share of PE and PP is about 10 Million MTPY.

The same is expected to grow to about 30 Million MTPA by 2025.

The quantitative break-up would look like as below:

Thus there is great scope to increase recycle by reducing the combination of Land-Fill, Combustion and Environmental Leakage and processing part of selected waste for pyrolysis to recover useful

Mode of Disposal	%	2020 (Million MTPY)	2025 (Million MTPY)
Land-Fill	40	6.4	12.0
Combustion	5	0.8	1.5
Recycle	15	2.4	4.5
Leakage to Environment	40	6.4	12.0
Total	100	16	30

products as a step moving towards circular plastics economy.

Imagine recycle increasing to 20 % or 25 % and share of pyrolysis becoming 10 to 20 %. This would mean 3 to 6 Million MTPY plastic waste is processed for pyrolysis enabling recovery of 2 to 4 Million MTPY of useful products contributing to circular economy.

Government of India has recently announced the intention of discontinuing single use plastics items effective July 1, 2022 which is important step towards restraining disposal of plastics waste. It will be imperative in coming decade to gradually move towards circular economy arising out of plastics waste. ■

Suggested Reading

1. *Plastics – The facts 2020, an analysis of European plastics production, demand and waste data, Publication of Plastics Europe, 2020*

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'Releasing Natural Power of Stone to Enhance the Modern Living'

***Vinay Pratap Singh** with more than 20 years of experience in Building/Constructions & Industrial Industry has handled diverse portfolios stretched across key stakeholders and projects. In an exclusive interview with Chemical Engineering World, he talks about global industrial insulation market and other key industrial updates.*



Vinay Pratap Singh

Business Unit Director

ROXUL ROCKWOOL Technical Insulation India Pvt Ltd

According to 'Markets & Markets' the global industrial insulation market is projected to reach USD 3 billion by 2025 from USD 2.4 billion in 2020. What are the key drivers for the growth of these solutions across oil & gas and downstream petrochemical & chemical manufacturing industries?

Rising fuel prices have pushed industry

players to be more focussed on energy efficiency to cut the input costs. Moreover, governments across the world are keen on reducing greenhouse gas emissions. This quest for energy efficient and sustainable solutions will push the world to adopt insulation systems in huge way. We believe this will be the best time for the insulation industry to claim their rightful place under the sun.

High quality thermal insulations products like ours will be the most relevant and effective tool in the hands of industries to be able to make a tremendous impact on the energy scenario as they help cut down heat losses and minimize the carbon footprint.

In your view how is the demand of insulation solutions likely to pan out as many projects have either been delayed or deferred? Which segments will drive the growth in the foreseeable future in India & globally?

The year 2020 will undoubtedly be remembered most for the global pandemic, the first in more than 100 years. Its impact on our world has been profound, changing the way we interact, how we work and live, and forcing us to adapt to new and often inconvenient alternatives. The huge destruction due to COVID-19 around the world which hampered world economy and various industries, big projects getting delayed because of Logistical constraints, manpower shortages, government restrictions has really cast a long shadow on the future growth but there are many positive news happening and we can surely see light at the end of the tunnel. Huge vaccination drives have started by the India Government, which would help to mitigate the cases and normalize the market soon.

According to certain sources The Oil and Gas industry is expected to attract US\$ 25 billion investment in exploration and production by 2022, this is good news in these stormy days.

Moreover, Indian government has taken initiatives to promote energy efficiency and sustainable development in industries. Under the Make in India project government aims to increase the manufacturing sector's growth. These development push by the government are expected to play a key role in steering insulation material demand in the coming years.

What is the market size for these products in India & market share of Roxul Rockwool?

As per industry sources, By the year 2025, the Indian construction sector is expected to be the third largest market globally, fueled by favorable government policies as well as increased government spending and foreign direct investments.

The construction output is expected to grow on an average by ~6.5% every year till 2025, underlining the increased activity in the sector.

With an anticipated focus on investments pertaining to green and sustainable materials, the next five years is expected to witness an emphasis on sustainable and environmentally friendly building materials having better thermal efficiency with reduced carbon footprint. ROXUL ROCKWOOL Technical Insulation India Private Limited is a subsidiary of ROCKWOOL International group, we are amongst the leader in High thermal insulation industry. As far as worldwide

installed capacity is concerned, we are the largest.

Tell us about the demand supply gap & market structure for these solutions in India? To what extent is Indian market dependent on imports for these solutions?

The oil & gas industry has unique requirements, when it comes to insulation products.

Low thermal conductivity, Durability, chemical stability, fireproof and water repellence are some of the most desired properties and there are very few Insulation players who can fulfil these requirements in letter and spirit.

The industry needs to adopt international standards to be able to provide the best quality products to the Oil and gas India has quality manufacturers to provide expected insulation requirement to the O&G sector. However, stringent standard and guidelines will ensure quality product for betterment of the sector in future."

Typically, what are the kind of losses that producers incur due to poor insulation & how can these be prevented in Oil & Gas, Refineries, natural gas & LNG distribution companies and chemical manufacturing? Can you share some data related to Indian market?

Industries such as oil & gas and downstream petrochemical plants have

specific insulation requirement depending on the equipment, size, operating temperature etc. Poorly insulated equipment can lead to poor thermal efficiency, corrosion under insulation and lack of fire safety.

Recently we have heard news on industrial accidents of gas leak and fires where factories were not having the necessary fire safety measures in place. The non-combustible insulation such as ours helps in such scenario where they do not become fuel for the fire and aggravate the situation.

ROCKWOOL Stone wool products are made By melting rock (Stone)" and can resist very high temperatures while fulfilling their primary task of stopping heat losses in equipment's.

Walk us through the manufacturing set up & latest innovations offered by Roxul Rockwool for various industrial applications

Roxul Rockwool Insulation India Pvt Ltd, is part of the world renowned ROCKWOOL international group.

The world class stonewool insulation manufacturing plant was set up in Dahej SEZ, Gujarat in the year 2010. This plant has State of the art installed capacity of 30000 MT Stone wool insulation. capacity of 30000MT stone wool insulation.

Being the pioneers in this field, the responsibility of bringing innovation in this market falls to a great extent on

our shoulders and we believe we have managed the market expectations by launching products like ProRox Pipe section stone wool insulation with WR-Tech Water Repellence Technology, which is the first of its kind and remains the best-in-class solution to keep your plant dry.

The WR technology helps durable performance over the critical CUI temperature range. These products have the lowest possible water absorption, even after cyclic heating and prolonged aging.

We also have a flagship programme known as "Procheck", where an EIRF certified audit engineer visits the clients process plant and audits the insulation effectiveness and based on the audit report suggests the proper insulation system that can lead to energy savings.

What are the major challenges for insulation manufacturers & suppliers in India vis-à-vis overseas while dealing with the customers? How have you addressed these challenges.

Robust growth of petroleum, chemicals and petrochemicals sector along with infrastructure expansion should generate steady growing demand for thermal insulation and fire protection products like high temperature fibres, refractory and microporous insulation products"

The regulatory standards & guidelines have a big role to play here, they need to be upgraded and standardized with international standards like ASTM & EN .

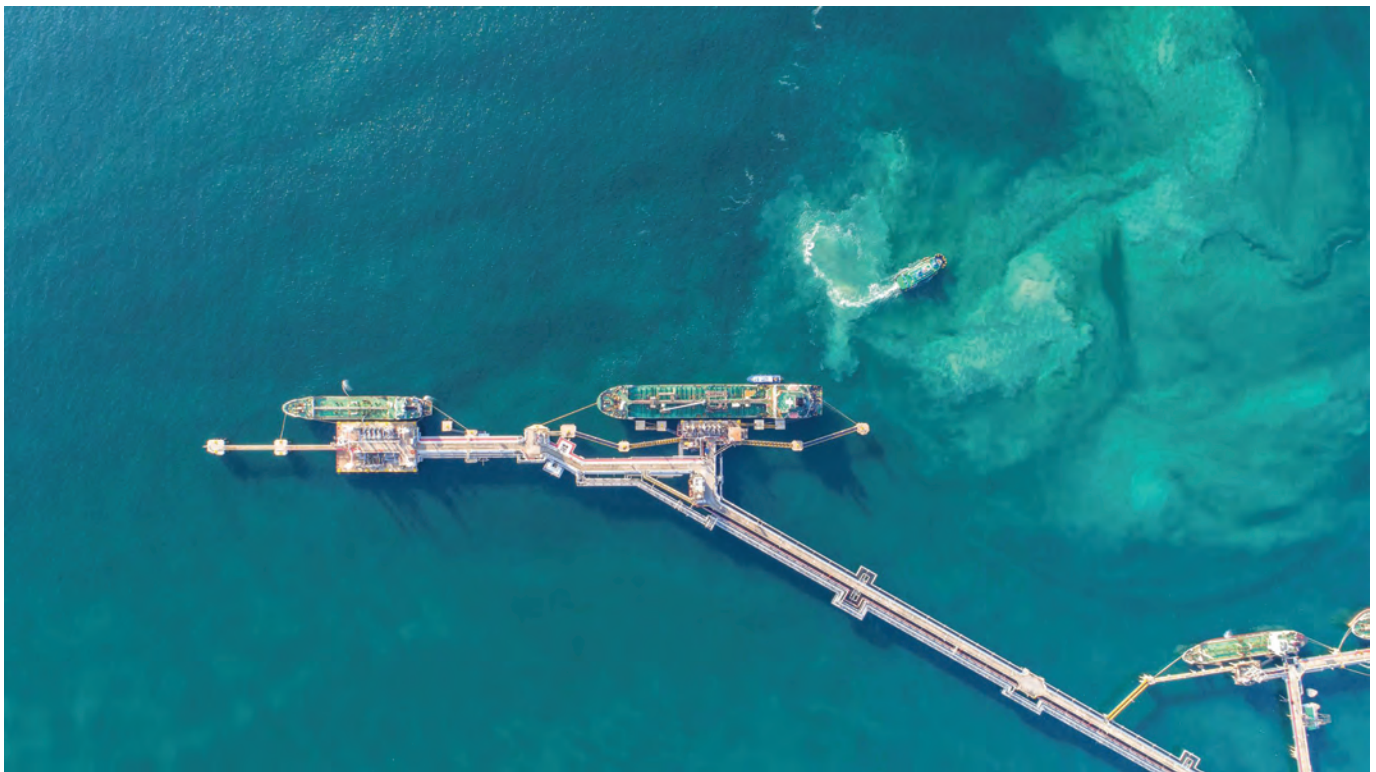
This will be a win win situation specially for the end user clients as they will be assured of the best quality products for the money they Also to uplift the industry overall.

How do you plan to stay competitive? Tell us about future plans of organization.

We continued investing our resources in new product innovation, more efficient and sustainable technologies; accelerated our usage of digital platforms to meet customer needs; and made new and ambitious long-term commitments regarding sustainability goals.

With the pandemic surely leaving its mark throughout the year ahead, we anticipate that governments will continue prioritizing keeping construction sites open, owing to the multiple economic, climate, and health benefits of especially building and industry sector. Together with the strong market focus on non-combustible, recyclable building materials, the existing policy emphasis on greening the economic recovery should positively influence market developments, especially in the medium- to longer-terms. Our future plan is to accelerate the growth with strong commitment to our purpose "Releasing natural power of Stone to enhance the modern living. ■

Post-COVID-19 Recovery of LNG Market: What's Next?



GECF LNG recovery IMG

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The global economy is cautiously walking away from the shadow of the unprecedented challenge of the COVID-19 pandemic.

The GECF is observing a reset of the world energy outlook for the longer term and is finding it imperative to take part in the imminent and accelerated energy transition towards a less carbon-intensive energy mix, which envisions a cleaner, environmentally more friendly future.

LNG might be the last great opportunity in the oil and gas industry. LNG trade has

been historically showing remarkable development over the past two decades with over 3.5 times growth, ramping up from 103 million tonnes (mt) in 2000 to 356 mt by the end of 2020 [1] [2]. The GECF Members were following the trend, having exported 130 mt in 2010 to 190 mt by 2019, according to the GECF Annual Statistical Bulletin 2020.

COVID-19 impact on LNG trade was severe, especially in the Q2 and Q3 2020, due to massive lockdowns and multiple various disruptions across the globe.

However, by year-end, LNG trade grew to its record number, mostly driven by Asia's steady demand and underlying global economic recovery. Expanded exports from Australia and the U.S. contributed to the supply side of the equation, with the latter's 33% growth in LNG exports compared to 2019. In essence, LNG trade has proven resilient, increasingly diverse, and global.

Though the overall LNG market was much more robust compared with the oil market through the course of the pandemic, there were significantly increased volatility in traded volumes and extreme turbulence in spot prices. Late 2020 and early 2021 recorded six-year highs in spot prices in Atlantic and Asia Pacific basins, replacing the record lows of early 2020 in a blink of an eye.

The structure of the LNG trade was evolving over the past few decades and 2020 just amplified that transformation. There is a clear and consistent trend towards gaining higher flexibility, agility, current and forward-looking liquidity of the LNG markets

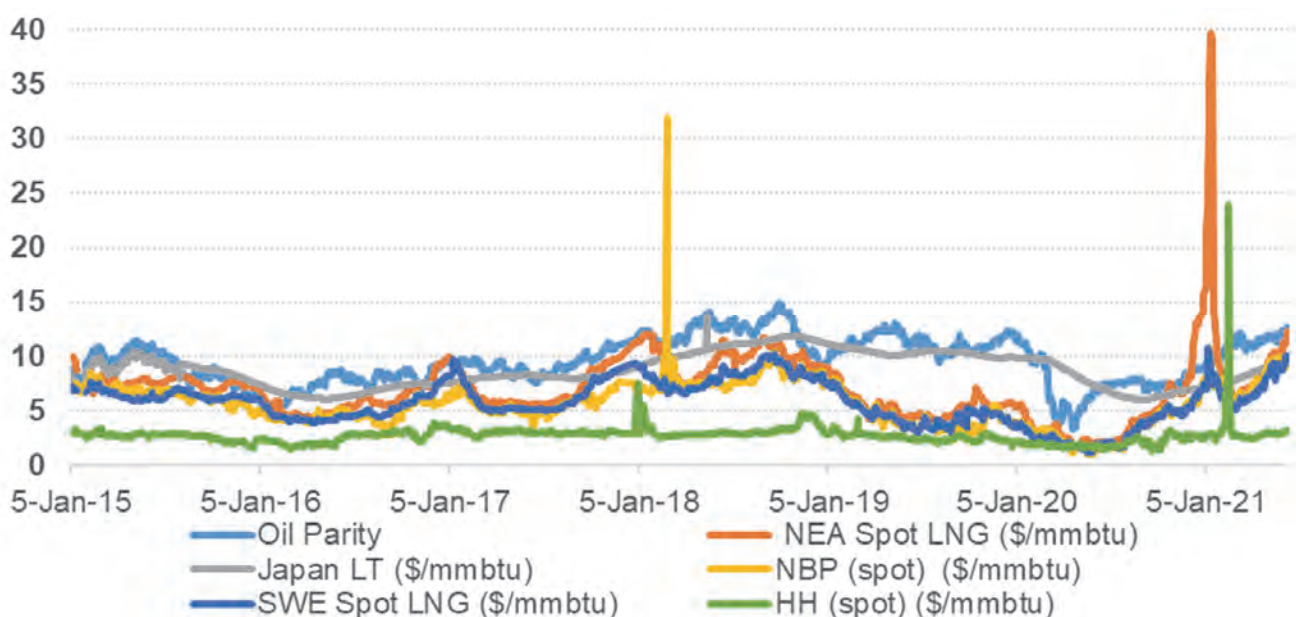
Natural gas price turbulence of 2020-2021

Though historically, crude oil and natural gas are inherently volatile commodities, 2020 was an extremely volatile year for global crude oil and spot natural gas prices.

Although being at initially low levels on average through 2019, the natural gas spot market witnessed plummeting prices,

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Figure 1. Natural gas prices, 2015 - 2021



Source: GECF Secretariat, based on data from Refinitiv, Argus, OANDA

resulting from downfallen demand in the first half of 2020 due to economic, social, and humanitarian impacts of COVID-19 as well as warmer than expected 2019-2020 winter in the northern hemisphere.

Shortly after that world saw a 'magic' turnaround. Natural gas spot prices have increased 18-fold from lows seen just six months ago. Natural gas benchmarks demonstrated substantial gains with the start of the heating season in the third quarter of 2020. On top of post-COVID-19 recovery, a general rebound in prices was explained by market fundamentals as well as temporary dynamics, primarily driven by the supply side: colder than expected winter, LNG supply disruptions, and limited shipping capacity.

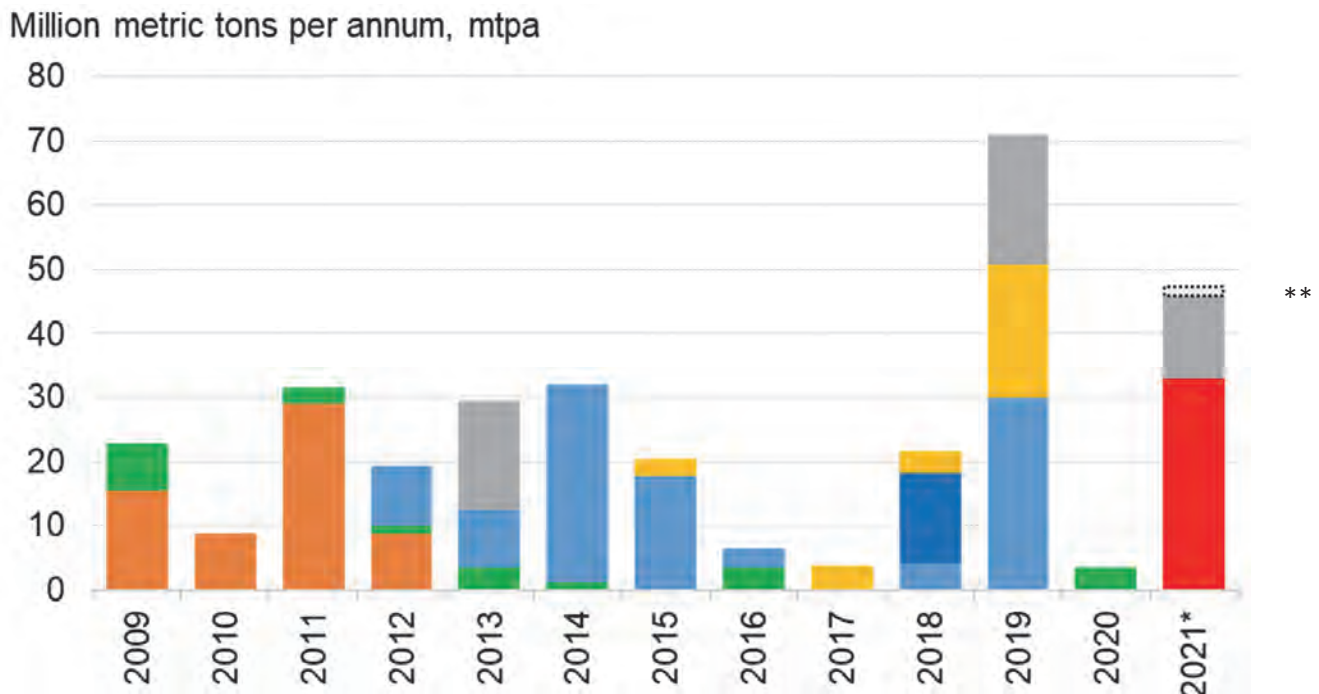
Natural gas spot price volatility has affected a broad array of industry stakeholders. It impacted the short-term targets of the suppliers and portfolio players to optimise their trading strategies in 2020. LNG suppliers and buyers were reconsidering old and signing new long-term agreements at lower levels of oil indexation, between 10 and 11% record low levels, compared to the earlier 14% slope contracts. The oil and gas majors have been seriously challenged by severe losses in earnings, negative cash flows leading to massive asset write-downs amid high leverage of 30% across the industry. The world's top energy companies have

slashed the value of their oil and gas assets by around US\$80 billion by the end of 2020 [4].

Higher flexibility and liquidity of the LNG markets on a roll

The emergence of U.S. natural gas and LNG on the global marketplace, on the supply side, and Japan's post-Fukushima reliance on LNG on the demand side were leading to the transformation of LNG market mechanics and enhanced commoditisation of LNG. Further liberalisation of the power and gas markets together with market regulations providing for third-party access to the existing gas and LNG infrastructure have been contributing to this trend as well. LNG trade pattern now is backing the growing commoditisation, liquidity, and flexibility trend with (i) higher share of spot and short-term LNG trades in overall trading, (ii) the rise of the LNG portfolio players and increase of flexibility in destination clause contracts, (iii) growth in gas-on-gas indexation pricing, (iv) smaller-scale volumes of the contracts and (v) increased forward-looking liquidity, etc.

LNG was traditionally delivered under long-term arrangements between buyers and sellers, and was only marginally traded on a spot or short-term basis. But since the last few decades, spot and short-term LNG trading has grown steadily, accounting for only 25% in 2012 out of

Figure 2. LNG liquefaction approved FIDs, 2009 – 2021

Source: GECF Secretariat, based on data from GECF Global Gas Model, GIIGNL, BloombergNEF; * - FIDs taken as of August 2021, ** - Fast LNG FID of 1.4mt taken in March 2021.

total LNG traded, but since growing to record 40% in 2020 [5] [1]. In a more tight LNG market, especially for the rising Asian LNG demand, the 'sellers' market will keep the LNG spot prices relatively high. At the same time, LNG longer-term contracts might accommodate buyers with lower prices and secure sellers by protecting their investment plans in upstream and LNG infrastructure development. Though some LNG legacy buyers in Asia, such as Japan, might focus on increased flexibility and reluctance to commit longer-term due to energy transition uncertainties, there are buyers from China and developing

Asia, such as, Pakistan and Bangladesh, who will continue to look at term contracts [6].

From the perspective of LNG suppliers, the GECF Member Countries maintain adherence to the main principles of the 2019 Malabo Declaration, adopted at the 5th GECF Summit of Heads of State and Government. The underlying Declaration fully supports the fundamental role of long-term gas contracts as well as the gas pricing based on oil/oil products indexation, to ensure stable investments in the development of natural gas resources

[7]. Such principle provides a solid base for the LNG buyers to gain long-term visibility of their cash flows and on LNG supplies protection against price volatility. Qatar's long-term contracts represented around 60% of the exports as of 2019 [8]. Algeria, Russia, and other GECF Member Countries have also favoured and will continue to rely on long-term contracts with pricing indexed to oil.

LNG investment resilience in the loop

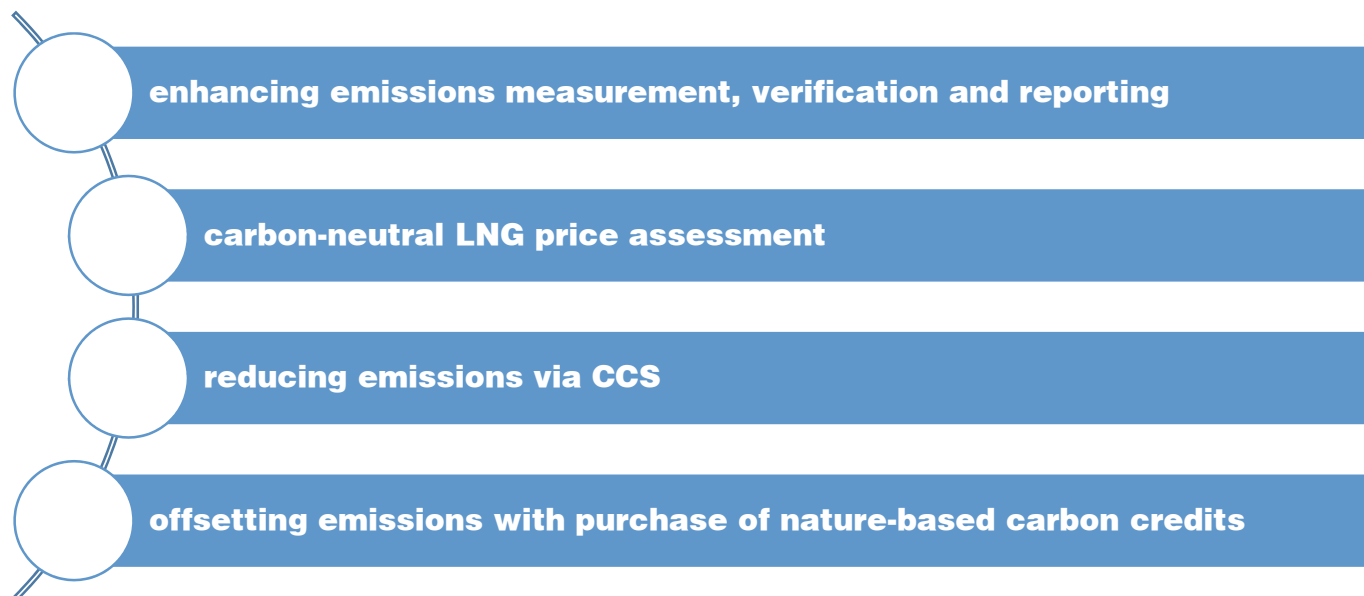
LNG liquefaction investment decreased by more than a third in 2020 but is anticipated to go up by more than two-thirds in 2021 to over US\$23 billion [9]. Qatar, Russia, and the U.S. are leading the trend, whilst Mozambique's LNG future remains uncertain due to security issues. Qatar's project, with a final investment decision (FID) of US\$29 billion taken in February 2021 on North East Field expansion, which will add 33 mt per annum to the currently existing 77 mtpa, is a game-changer.

Existing and new LNG projects will be facing two major issues: one relating, obviously, to the profitability with project stakeholders realising the agreeable profit margins, and second, being of increased concern, the acceptability issue due to more environmentally stringent 'greener' boundary conditions implying on the newly evolving standards for LNG properties.

'Greener' LNG to capture the minds of the industry stakeholders

LNG buyers are increasingly considering LNG's low-carbon properties on top of price competitiveness. The market witnessed a spike in carbon-neutral LNG deals in late 2020 and early 2021 as increasing pressure came from governments's changing policies and tighter regulations. Furthermore, the corporate sector's shareholders and investors are increasingly becoming more conscious about LNG's carbon footprint. Asian buyers' interest in 'green' LNG continued to ramp up last year, crystallising a new sustainable trend of future LNG trading.

When carbon emissions couldn't be avoided, they can be either (i) reduced or/and (ii) offset with the purchase of nature-based carbon credits and verified carbon standard certificates. Both carbon emissions reduction strategies should imply more rigorous emissions measuring, verification, and reporting with enhanced and clear guidelines together with emissions transparency along the LNG value chain (Figure 3.). Carbon-neutral LNG price assessment activity (Figure 3) is also underway. S&P Global Platts, in mid-June 2021, announced the launch of the world's first daily carbon-neutral LNG price assessment (CNL). It tracks the cost of carbon credits purchased and

Figure 3. Carbon-neutral LNG trends

retired to offset the carbon emissions for an LNG cargo on the world's most active trade route - from Australia to JKTC (Japan, Korea, Taiwan, China) [10]. The LNG industry is anticipated to further address the implementation of improved greenhouse gas (GHG) emissions quantification and reporting methodologies. A carbon-neutral LNG price assessment tool might be applicable to the broader universe of LNG trades. The industry will also continue walking along the 'lower emissions' pathway, optimising the reduction of GHG emissions, related to the production and consumption of LNG.

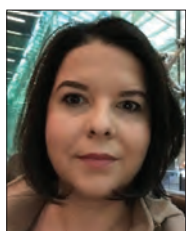
The GECF Member Countries are aligned with the mentioned trend. From the emergence of LNG carbon-neutral deals in mid-2019, JERA delivered the first carbon-neutral LNG into India sourced from a

liquefaction facility in Das Island by UAE's ADNOC LNG, where JERA only partially offset emissions from the regas terminal downstream. In March 2020, Taiwan's CPC received from Shell its first carbon-neutral LNG at the Yung-An LNG, sourced at Russia's Sakhalin 2 LNG facility, and in November 2020 its second carbon-neutral LNG – sourced from Nigeria. The mentioned Shell cargoes offset all emissions from extraction to regasification. Russia's Gazprom also delivered its first carbon-neutral LNG cargo - sourced from the Novatek-led 16.5mn t/yr Yamal LNG project - to Shell at the UK's 4mn t/yr Dragon in March 2021.

The transformation of the LNG contractual structure vis-à-vis the growing share of spot and short-term trading, multilateral trading schemes, gas-on-gas indexation is

leading to increased volatility in the LNG market. Such volatility is an impediment to the development of the gas infrastructure. Also, it creates a need for new patterns for financing the LNG industry as overall investment risks to be distributed in a manner to secure required financing for the upcoming LNG infrastructure projects. Hence, move to a more open and liquid LNG market will lead the key LNG stakeholders and players to search for optimal and lucrative trading strategies. A spot gas-on-gas indexation with destination-free contracts up to the traditionally established long-term oil-indexed destination-bound trades – all that represents a range of possibilities. The latter is historically known for reinforcing market resilience and mitigating risks of increased volume and price volatility and supply disruption risks as well as allowing to secure long-term investment into LNG infrastructure. 'Green' LNG with a reduced carbon footprint is rapidly gaining momentum and will be vital for LNG industry development in the decades to come to match the environmental sustainability of the energy transition. ■

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Biofuel: Importance towards Agriculture and Society

This earth, air, soil and water, we haven't inherited from our ancestors but this is the debt we have taken on account from our next generation. It's our responsibility to pass on this heritage to our future generations in the same way we received.

-Mahatma Gandhi

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These words of Gandhiji, are coming to my mind today on this occasion of the World Biofuel Day, who made the evolutionary approach of the human race making aware of the reality. After Gandhiji, the fourth generation has now ridden on the chariot of development of India. In this post-independence migration, we are experiencing great transition and radical change. But, while enjoying these fruits of development, we are unknowingly sowing the seeds of destruction for future generations, already resulted in global warming. It would be inevitable now to put into practicing the idea of handing over the heritage received from the Mother Earth

to the coming generations at least in the same intact form.

Every year on the 10th of August, World Biofuel Day is celebrated. On the same day in 1893, Rudolf Diesel had begun model testing of engines running on liquid fuels, groundnut oil, instead of steam-power. Later, after the Second World War, due to an increased private vehicles usage and the availability of fossil fuels, Biofuel production efforts were lagged behind. After the fuel crisis in the seventies of this century, Brazil and America re-started efforts and initiated ethanol production using the basis of sugarcane and maize crops. Their success made other nations,

to take steps towards bringing this thought forward in practice. Pollution by fossil fuels and global warming are the main reasons which have made the proposition of production of alternative fuel predominant in 21st century. The Royal Society of London, in one of its research amendments published in 2020, has said that the rise in Greenhouse gas emission, the root cause for the global warming, is due to the high outflow from the vehicle emission. In 2018, due to usage of vehicle fuels, in the world, 96.3% of the share was from fossil fuels. Out of the total greenhouse gas emissions in the world, 15% and 23% of the emissions are due to the usage of vehicles, alone.

The dependency on fossil fuel is inexorable and its consequences are graver. Due to the ignition of fuels, the percentage of air pollutants such as carbon dioxide, ozone, sulfate, formaldehyde and benzene is increased in the air. Asthma, pneumonia, pleurisy, sore-throat, burning of the eyes, digestive disorders, brain disorders, cancer, inefficient functioning of organs resulting in fatal diseases can be the result due to this pollution.

On one hand, fossil fuels are causing pollution, and, on the other hand, burning of Biomass, such as crop residue and squandered crops, are promoting the rise in pollution. A survey says, burning of one ton straw results in loss of the nutritional

components such as 5.5 kg of Nitrogen, 2.3 kg of Phosphorus, 25 kg of Potassium and more than 1 kg of Sulphur which improve the fertilizing power of the agro fields. Instead of burning the crop residue can be used for production of Advance biofuel such as 2nd generation biofuel.

Agriculture and allied production directly get harmed by pollution and we can see the research amendments from all over the world. Professor Piona Marshall, Department of Environment and Development, University of Sussex, England, says, "due to increased global temperature, there is increase in amount of ozone in the form of trioxygen, found highly at the places having high temperatures and vehicular pollution. Pollution creating industries are shifted and relocated outside the cities, usually near agricultural areas. This has direct effect on the crop production."

In 2030, there is possible rise in the crop residue like straw by 1.5% than in 2010. "In 2010, this stubble was about 55.6 Crore tons and in 2030, will rise to 86.8 Crore tons," the International Council on Clean Transportation (ICCT) has said in a research exercise, "The Future of Biofuel in India", published in December 2019. According to their findings, by 2030, India will have 7.1 Crore tons of agricultural crop residue like straw will be available for Biofuel production. By keeping the

required percentage of straw to maintain soil organic health and utilization the surplus for biofuel and other related applications will maintain the soil fertility.

The alternative sources can also be corroborated for the production of biofuels from planting of energy crops on non-cultivated land, using animal dung, wasted cooking oil, solid waste within the municipal limits.

Production biofuels by utilizing above listed carbon sources is better solution than burning of crop residues in the field. Accordingly, MoPNG has guided the Oil marketing companies to set up Twelve 2nd generation bioethanol projects. In phase one five projects are being set up in Punjab, Haryana, Orissa, Karnataka and Assam. Here, using around 5 lakh tons of agricultural stubble, 11 Crore tons of 2nd generation bioethanol will be produced and used for blending in gasoline. Another scheme of MoPNG called SATAT, under which 5000 CBG plants are going to be set up across India and this will replace existing CNG consumption in transport. The CBG will be procured by Oil marketing companies at the rate of INR 46/kg. Also, MNRE, GoI is providing a grant up to INR 10 Crore to attract investors and entrepreneurs to set up CBG projects in India. Bioethanol from agricultural crop residue and CBG from pressmud, crop residue and animal wastes are considered

as the advance biofuels. By product from the process of production CBG is better organic manure and will boost the organic farming.

Most of the nations in the world are inescapably dependent for fuel. With the help of these unconventional, bio-based energy production alternatives, these nations can be empowered. Biofuels, being studied around the world, are more effective in preventing the environmental damage than the fossil fuels. They also result in rural employment generation and increase in farmers' income. A research published last year by the Royal Society of London says, the plantation should be done in additional fields as the 2nd generation ethanol has more potential to prevent environmental damage than the 1st Gen ethanol. Therefore, the usage of Biofuel, an effective means of sustainable development is now a necessity. ■



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Energy Independence through Hydrogen: Setting Short Term Targets

Sustainable Development' is a term very widely used during the 21st century. Many interpretations of its meanings

have been given by scholars, educators, governments, policy experts, climate activists, stakeholders and so far, all of them have a different perspective on the meaning of sustainable development. Some consider sustainability as a process where there is least harm to the environment, while some define it as having zero environmental impact. Climate activists find chopping of even a few trees for any reason completely absurd, and at the same time, policy experts feel that achieving a larger environmental objective justifies felling a small portion of a forest, as has been the case in a Mumbai metro rail development project.

Similarly, the term 'energy independence' is generating a lot of conflicting opinions and thought processes in India. Does energy independence for a nation mean not having to depend on any other country for its energy needs? Or does it mean having the ability to generate renewable

energy to power all its requirements? Would a country like Venezuela be termed energy independent because it has one of the largest oil reserves in the world capable of satisfying all its energy needs? Or would it mean not relying upon Carbon based energy sources like coal, oil, & natural gas?

The terms 'energy independence' and 'sustainability' must be seen together. Countries must strive to meet their energy requirements with the least amount of environmental impact. "The energy sector alone is responsible for almost three-quarters of all global GHG emissions and holds the key to averting the worst effects of climate change, perhaps the greatest challenge humankind has faced," notes the International Energy Agency in its recent report. The roadmap to achieving a zero emissions society hinges substantially on renewable power generation capacity.

However, nations around the world are not evenly placed to generate renewable energy to satisfy all their energy demand. At the same time, several countries like

India have the potential to satisfy all their energy demand using renewable power and still have more energy left over. This imbalance requires an energy vector which can be easily transported across countries to fulfil energy demand, like the oil & gas industry today. This is where hydrogen becomes a part of the global effort to become an emissions free society and reduce our carbon footprint.

Hydrogen can be produced using renewable sources like solar, wind, geothermal, tidal, etc. through a process called electrolysis where water is split into its components, oxygen and hydrogen, and this hydrogen can be transported across any distance either in its gaseous or liquid forms, or as a compound with other elements, ammonia or methanol. As an energy vector, Green Hydrogen, i.e. hydrogen produced using renewable energy, is completely carbon neutral and the process does not release any carbon dioxide into the environment, except during the production of the components involved in hydrogen generation and distribution.

India has one of the largest potentials to produce renewable energy and by using it to generate hydrogen, India can become one of the world leaders in exporting hydrogen. Countries such as Germany, South Korea, Japan, etc. where the renewable energy generation capacity

is not sufficient to satisfy their domestic needs will require importing clean energy for meeting their requirements.

Green Hydrogen is also key to India's domestic energy supplies and its most substantial use would be in the hard to decarbonize sectors like steel, fertilizers, hydrogenation, aviation, shipping, long distance trucks and buses, chemical feedstock and much more. The Prime Minister of India proclaimed from the ramparts of the Red Fort to make India a global hub for Green Hydrogen and further said that green hydrogen would give India a quantum jump in its efforts to counter climate change.

The beginning of such massive green hydrogen programs requires huge investments and research & developments. Creation of a market where hydrogen can be utilized is also a major challenge for a country like India. Therefore, the government must make short term goals to first introduce an energy vector like hydrogen to the Indian society and thereafter transition from hydrogen produced through non-renewable means to green hydrogen.

One of the first steps in ushering in a hydrogen ecosystem across India would be to combine hydrogen in existing energy systems to build a market for hydrogen usage.

Hydrogen mixed with natural gas: In New Delhi, Indian Oil and Delhi Transport Corp. tested a mixture of 18 percent hydrogen with CNG for running public buses. If this model is extended to blending hydrogen with CNG, then the overall import of the gas will be drastically reduced. Further if hydrogen is also blended with cooking gas, we can further reduce our import dependence. Blending not only hydrogen but other alternative fuels such as ethanol with petrol will also lead to an energy independent India.

Another short-term target could be to convert existing diesel buses/trucks to operate on green methanol, i.e. methanol produced using green hydrogen and carbon capture leading to a carbon-neutral fuel. Converting existing bus fleets to run on methanol and developing a limited methanol infrastructure will be cost efficient and more suitable for India than discarding existing fleets and running new fleets on electricity or pure hydrogen.

Hydrogen can be effectively used for energy storage solutions. However, in the short term the electrolyser technology is costly and not as efficient as batteries for storage purposes. For the short term the government must mandate a policy for energy storage where both battery and green hydrogen must be used. This will provide the necessary boost for research

& development for hydrogen infrastructure and build a market for its utilization.

Railway electrification is also an area where short term targets for developing a hydrogen infrastructure will play a major role in advancing the ambitious energy independent India plan. Railways can use hydrogen powered locomotives on routes which are currently not electrified. This would save the Indian Railways huge CAPEX for electrification of the routes and provide a roadmap for creating hubs for hydrogen along these routes. The hydrogen produced can be used for powering the industrial units near the hydrogen hubs and drive forward the acceptability of a gas-based ecosystem.

Short term targets are particularly important in bringing about a complete transition in the energy infrastructure in India. The challenges posed by short term targets will guide the long-term strategy of the government and build public consensus in accepting new technologies and alternate fuels. The existing fossil fuel-based economy is a convenient option for the public, it may not be the right option, or the sustainable option, however, it is convenient and all systems and infrastructure for the use of fossil fuels is already in place. Bringing about an energy transition is also about asking the public to give up their convenience for a cleaner, more sustainable fuel and assist in making

India energy independent.

Public perception is required to be changed to enable this energy transition and for this to happen the public must directly experience the new technologies. Using green hydrogen in industries such as fertilizers, steel, refining, etc. will certainly create a market for the gas, however, the public would remain deprived of experiencing the benefits of green tech and its environmental impact. Therefore, the government must use clean hydrogen technologies where a maximum number of people are able to see and experience for themselves the benefits of new age alternative fuels such as city buses, ferries, railways, municipal vehicles, etc. Imagine a ton of green steel being carried across town on a diesel truck emitting thick black fumes. Will the people on the road appreciate the carbon-neutral steel technology or its environmental benefits while covering their noses to block the black smoke from the truck?. ■



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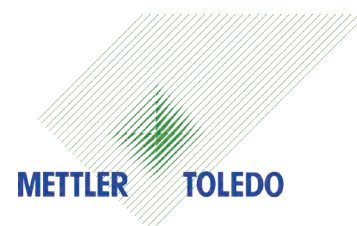
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A GPro 500 with an extractive cell adaption was duly installed to a new extraction system. Since its commissioning, the Spoleto plant has been very impressed with the GPro 500's measurement accuracy, rapid measurement and problem-free operation. The site manager said, "I'm delighted with the analyzer. It was surprisingly easy to install and since turning it on six months ago we've had no downtime from it whatsoever. I wish we'd known about it years ago." At

Italmatch, confidence in the accuracy of production vessel O₂ levels has been well and truly restored.

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Gas Scrubber

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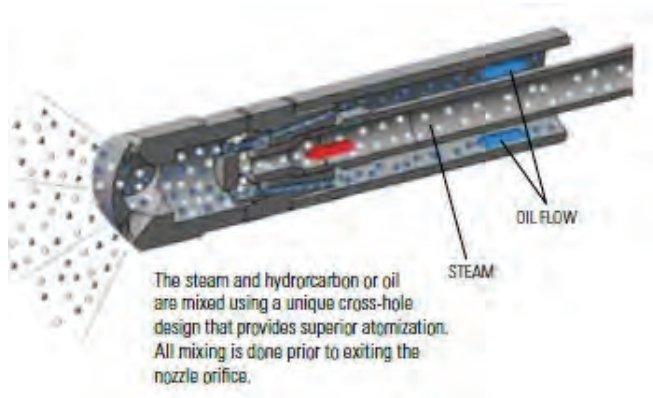
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