

FUTURETM FUELS

Advancing Efficiency and Environment

FEBRUARY 2022 | PRIVATE CIRCULATION ONLY

DECARBONISING MINING MOVING TOWARDS ALTERNATIVE FUELS

INTERVIEW



**WE ARE NOT
CERTAIN WHICH
WILL BE THE
FUEL OF CHOICE
FOR TRANSITION**

Anil Devli
CEO
Indian National Shipowners' Association

Mining industry is one of the biggest producers of carbon dioxide. The constantly growing sector is currently responsible for 4 to 7 per cent of greenhouse gas (GHG) emissions globally. Of late, after the recent COP26 world climate summit at Glasgow, the mining sector is also facing pressure from governments, investors, and society to reduce emissions.





**VISHWA
SAMUDRA**
CHALLENGE IT. CHANGE IT.

STABILIZATION / FULL DEPTH RECYCLING TECHNOLOGY with stabilroad – AN APPROACH TO GREEN ENVIRONMENT



STABILIZATION / FULL DEPTH RECYCLING WITH STABILROAD

Fully Mechanized Full Depth Recycling on an average can achieve 1km per day can be complete in and the road can be made operational in 12hrs post completion of work.

Depending upon the existing base composition, need for new Aggregates can be completely avoided

Major saving in transport and environmental costs

Stabilised base can accept lower CBR and hence subbase compaction is seldom required

Mechanised controls and Minimal testing for acceptance criteria

Life cycle cost is reduced. Minimum maintenance costs

Union Budget is good step towards decarbonisation, but needs transformative action

Union Budget for 2022 has been presented in the Lok Sabha by Finance Minister Nirmala Sitharaman on February 1, 2022. The Budget has given push to climate action from energy to mobility. In this year's Budget the FM has announced sovereign green bonds under the government's overall market borrowings in 2022-23. The bonds will be issued for mobilising resources for green or climate-friendly infrastructure. The proceeds from the bonds will be deployed in public sector projects to reduce the carbon intensity of the economy.



In a major push towards decarbonisation, Budget also proposed to promote a shift to the use of public transport in urban areas. Special mobility zones with zero fossil fuel policy to be introduced. Considering space constraints in urban areas, a 'Battery Swapping Policy' will be brought in. Budget has encouraged the policy to use electric vehicles, as part of a larger plan to achieve the subcontinent's decarbonisation goals.

The Budget has made firm strides towards decarbonisation, but much will depend on how the priorities and funds committed in the budget will match the scale and cost of change needed for clean and low carbon pathways.

The National Hydrogen Energy Mission was announced in the Union Budget of India for the last fiscal 2021-22, which has heightened expectations from the climate and energy fraternity from this year's Budget. The expectations were high on the launch of incentives for hydrogen storage and fuel cell development. The India Hydrogen Alliance, a coalition of industry participants, made a six-point policy submission to the NITI Aayog and the Ministry of New and Renewable Energy for building a hydrogen economy.

India's potential in building capacity to become the cheapest green hydrogen producer in the world by 2050 is known to very few today, and to realise this, it is imperative to reduce the cost of green hydrogen production focussed on domestic electrolyser manufacture and cheaper renewable energy supply. Cost-efficient storage and delivery are necessary to generate a workable green hydrogen ecosystem.

Budget is certainly a good step forward towards decarbonisation, but needs committed strategy, milestones and upscaled funding to make ambitious clean air and climate action more real.

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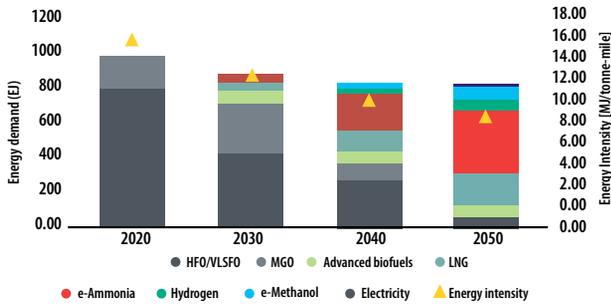
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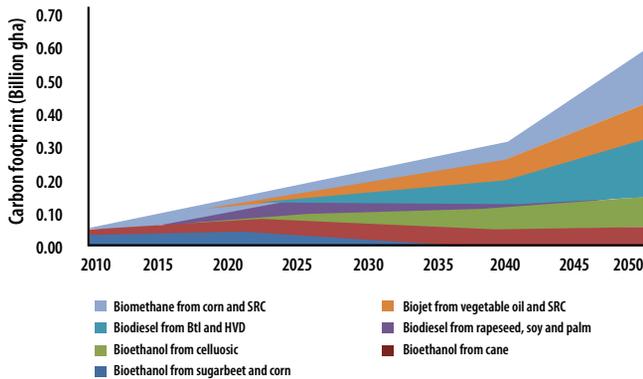
NUMBERS & GRAPHS

50C SCENARIO ENERGY PATHWAY, 2018-2050



Source: IRENA

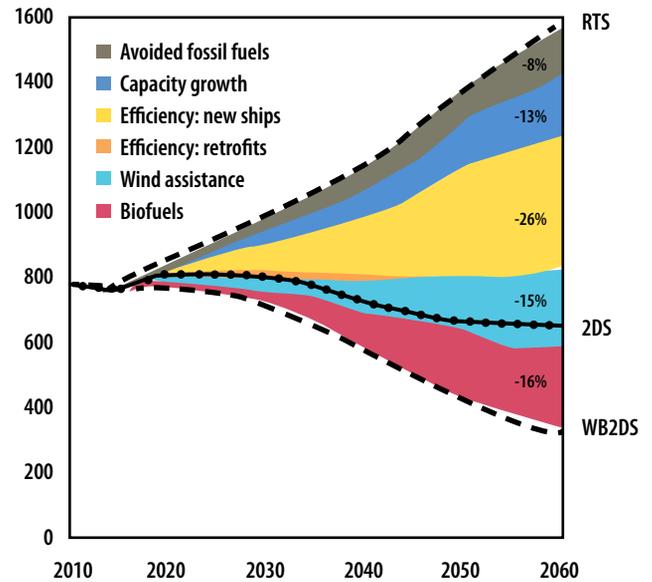
CARBON FOOTPRINTS ASSOCIATED WITH THE WORLD PRODUCTION OF VARIOUS BIOFUELS AND FEEDSTOCKS (2010-2050)



Source: <https://onlinelibrary.wiley.com/doi/full/10.1111/gcbb.12300>

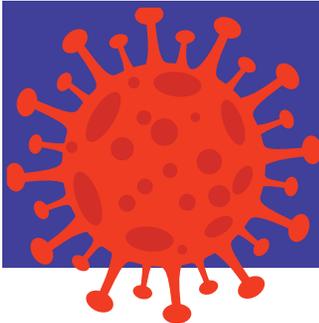
PROJECTED ANNUAL CO2 EMISSIONS FROM THE SHIPPING SECTOR (MILLION TONNES)

Annual shipping emissions (MtCO₂e)



Source: ResearchGate

IMPACT ANALYSIS OF COVID - 19



Materials

The Materials sector will see MIXED impact due to COVID-19 outbreak and is expected to register at Par growth rate compared to the global GDP growth



IMPACT

Market Impact

This market will have **NEUTRAL IMPACT** due to the spread of COVID-19



Pandemic Impact on Market

DIRECT

Global Fuel Additives Market 2020-2024

Market growth will **ACCELERATE** at a CAGR of almost

7%



Incremental growth

\$ 4.08 bn



Growth for 2020

5.24%



Market growth in 2020 likely to **INCREASE** compared to 2019

Expected time by when the impact on market will normalize

👍 Q3-2021 (Best case)
👎 Q1-2022 (Worst case)

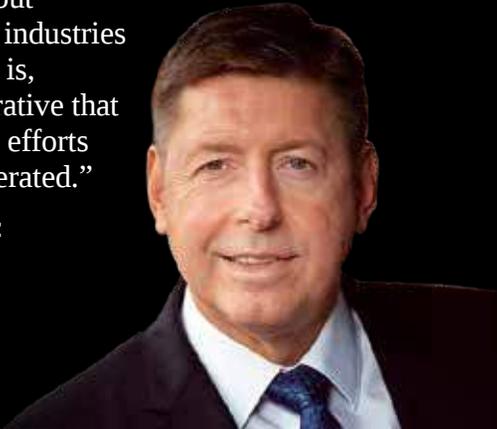


Market estimates to be revisited and updated in Q3-2020, based on the revaluation of the impact as the pandemic spread plateaus. The update will be available free of cost to all customers.

QUOTES

“The mining and cement industries contribute over 10% of the world’s CO₂ emissions but demand in both industries remains high. It is, therefore, imperative that decarbonisation efforts should be accelerated.”

- **Thomas Schulz**
CEO, FL Smidth



“We are progressing toward the introduction of LNG-fuelled vessels, the most effective measure to reduce GHG emissions at the present moment, and plan to expand the fleet to 90 vessels by 2030.”

- **Takeshi Hashimoto**
President & CEO, MOL



“There is a tremendous role that ethanol can play in helping to get to the netzero carbon emissions by 2050 goal.”

- **Geoff Cooper**
Renewable Fuels Association (RFA)
President and CEO



“We expect to invest more in low carbon businesses – and less in oil and gas – over time. The goal is to invest wisely, into businesses where we can add value, develop at scale, and deliver competitive returns.”

- **Bernard Looney**
CEO, BP



“We also need a “drop dead” date for the building of new fossil-fuel-powered vessels. Industries only function with clear and enforceable deadlines.”

- **Vincent Clerc**
CEO - Ocean & Logistics
A.P. Moller – Maersk



MARINE

ICS, IRENA collaboration to advance global green fuel transition



ICS has signed a Partnership Agreement with the International Renewable Energy Agency (IRENA) to support the decarbonisation of the shipping sector and its role in the transition towards a global energy sector based on renewables. The partnership will provide a framework over the next two years for ICS and IRENA to assist with the decarbonisation of the shipping sector and the use of renewable technologies on this key sector of the global economy.

It will also enable the industry to work closer with IRENA on issues related to the increasing role of renewable energy in decarbonising shipping. More specifically, the organisations will establish a regular exchange of information regarding energy supply and demand relevant to the shipping sector and exchange of data on scenarios of 'future fuels', for both, nation states and the shipping industry. This partnership agreement draws particular focus on the need to ensure an equitable energy transition for developing economies,

and the important role of capacity building as well as recognising the energy needs of shipping itself. Shifting to alternative fuels such as hydrogen, ammonia, biofuels and electrification from renewable sources could cut 80% of emissions from maritime transport by 2050 as presented by IRENA.

Getting to Zero Coalition calls for a CO2 price of \$200 per tonne

The Getting to Zero Coalition, a group of leading maritime companies and environmental NGOs dedicated to reducing carbon emissions from shipping, has released a new report calling for carbon pricing of about \$200 per tonne of CO2. To make green future fuels more cost-competitive with conventional HFO and VLSFO, the coalition says that a combination of fees and subsidies will be required. The fee structure envisioned in the study would generate a giant pool of revenue, peaking in the mid-2030s at about \$80-180 billion per year worldwide – creating ample resources for subsidizing higher-cost green fuels.

The study calls for a mix of policy measures, enacted at the global and regional levels, to make green fuels more competitive. Recent reviews by LR and UMAS suggest that zero-emissions fuels will be twice as expensive as conventional options through the 2030s, creating an "urgent need for policy to close the competitiveness gap."

Maersk to launch decarbonisation hub

Maersk Tankers has announced it is to establish a knowledge hub focusing on decarbonisation. The hub will seek to gather intelligence and create solutions to help shipowners and cargo customers cut emissions, the company said. Maersk Tankers says the decarbonisation hub will bring experts, shipowners, cargo customers and other stakeholders together to develop a suite of solutions that will reduce emissions from cargo customers' supply chains and shipowners' operations. It will gather and share external and internal intelligence on regulations and developments in tanker shipping's decarbonisation, and provide emission transparency on the transportation of cargoes. 'There is an immediate need for shipping to change its emissions trajectory,' said Christian M. Ingerslev, CEO at Maersk Tankers. 'The decarbonisation hub is part of our commitment to create a more sustainable path for shipping through sector-wide collaboration.'

The hub will be headed by Frederik Pind, Head of Decarbonisation at Maersk Tankers, and will be staffed by a specialist, cross-disciplinary team who will work with external and internal stakeholders to support the establishment of commercial and regulatory means to cut emissions. The team is anchored in the Commercial department at Maersk Tankers. The decarbonisation hub, which will liaise with external stakeholders including global associations working to decarbonise shipping,

REFINERIES

Higher crude demand supports India-bound Suezmax rates



Suezmax rates from the Mideast Gulf to the west coast of India have been rising on account of higher demand from Indian state-controlled refineries. Indian state-controlled refiners continued to operate at higher capacities this month in anticipation of an increase in fuel demand in 2022. "Indian charterers have been quite active over the past few weeks and the trend is continuing," a Delhi-based shipping broker said. There has been an increase in imports of Middle Eastern crudes, while market participants also said that there has been a rise in shipments from the US. Freight rates for 130,000t shipments from the Mideast Gulf to the west coast of India have risen to WS77.5 from WS65, when concerns of the Covid-19 Omicron variant loomed over markets. Similarly the Ice front-month February Brent contract has jumped to \$79/bl from \$69.86/bl. Gains in Ice Brent crude futures remained curbed to an extent, following continued concerns about the Omicron variant.

Cummins and Sinopec ally to produce green hydrogen



Cummins Inc. and China Petrochemical Corporation, owned by the Sinopec Group, announced the formation of 50:50 joint venture through Cummins Enze Hydrogen Technology Co., Ltd to develop green hydrogen. The joint venture will accelerate the affordability and availability of the fuel through increased technological innovation, research and development, as well as manufacturing capacity.

Cummins Enze, a subsidiary of the US-based company located in the city of Foshan, will initially invest \$47 million to locate a manufacturing plant to produce proton exchange membrane (PEM) electrolyzers. The plant will initially have a manufacturing capacity of 500 megawatts of electrolyzers per year upon completion in 2023, which will be gradually increased over the next five years to reach one gigawatt of manufacturing capacity per year.

Cummins Enze will also provide a variety of hydrogen generation system solutions to meet diversified application requirements.

MINING

USGS estimates US mines produced \$90.4 bn in non-fuel mineral commodities in 2021

US mines produced approximately \$90.4 billion in mineral commodities in 2021 – a \$9.7 billion increase over the 2020 revised total of \$80.7 billion – according to the US Geological Survey USGS.

This information comes from the 27th annual Mineral Commodity Summaries report from the USGS National Minerals Information Centre. The report is a comprehensive source of 2021 mineral data for the world and includes information on the domestic industry structure, government programs, tariffs, world production and five-year salient statistics for nonfuel mineral commodities that are important to the US economy and national security. It also identifies events, trends and issues in the domestic and international minerals industries that impact production and consumption. This report covers more than 90 nonfuel mineral commodities monitored by the USGS.

Industries that use nonfuel mineral materials—such as steel, aerospace and electronics—created an estimated \$3.32 trillion in value-added products in 2021, which represents an 8% increase from that in 2020. – Steven M. Fortier, USGS National Minerals Information Center director.

Increases in consumption of nonfuel mineral commodities were attributed to the restarting of markets in 2021 following closures due to the global COVID 19 pandemic in the prior year.

The 90.4 billion dollars worth of nonfuel mineral commodities produced by US mines in 2021 included other industrial minerals and natural aggregates, as well as ferrous and nonferrous metals. The estimated value of US production of all industrial minerals in 2021 was \$56.6 billion, which is 63% of the total value of US mine production value. Crushed stone was the leading nonfuel mineral commodity domestically produced in 2021, accounting for 21% of the total value of US mine production.

US metal mine production in 2021 was estimated to be valued at \$33.8 billion, or 23% higher than that in 2020. The principal contributors to the total value of metal mine production in 2021 were copper (35%), gold (31%), iron ore (13%), and zinc (7%).

There were 14 mineral commodities produced in the US valued at more than \$1 billion each. These commodities were, in order of value, crushed stone, copper, cement, gold, construction sand and gravel, iron ore, salt, lime, industrial sand and gravel, zinc, soda ash, phosphate rock, palladium and molybdenum. In 2021, the top 10 producing states were, in descending order of rank, Arizona, Nevada, Texas, California, Minnesota, Alaska, Utah, Florida, Missouri and Michigan.

In 2021, the USGS published a draft proposed revision of the critical minerals list (86

FR 62199) as an update to the original list published in 2018 (83 FR 23295). Critical minerals are discussed in a new critical minerals update added to the front section of the Mineral Commodity Summaries 2022. The minerals in this new section are those from the original list published in 2018. USGS anticipates the publication of the finalized revision of the critical minerals list by the end of February 2022, following the close of a 60-day public comment period on 10 January 2022.

Germany lays a path to quitting coal

In a coal heartland of Germany stands a monument to the source of its economic might: a giant mine more than a half-mile deep that once produced the largest amount of coal in the world. Built at the beginning of the Industrial Revolution, the Zollverein mine cemented Germany's place as a coal behemoth. And its legendary Shaft XII was hailed as a feat of technology due to its high level of automation.

By 1986, however, it had become more expensive to extract coal in Germany than to import it from places like Russia and the United States. The mine was decommissioned, and the facility was eventually turned into a cultural centre. Now Zollverein stands as a sprawling museum complex for coal's history and is a dedicated UNESCO World Heritage site. The iconic image of Shaft XII's pithead is scattered throughout the city of Essen as an unofficial trademark of the Ruhr region.

HEAVY OILS

Drop fossil fuel clients, over 450 scientists urge ad agencies

More than 450 scientists from across the world but mostly from the US, have together called on the executives of major advertising and public relations firms to drop their fossil fuel clients to help stop spread of disinformation around climate change. Stating that climate actions are hugely and negatively impacted by such publicity, the scientists, possibly coming together in such large numbers for the first time, said: "As scientists who study and communicate the realities of climate change, we are consistently faced with a major and needless challenge: overcoming advertising and PR efforts by fossil fuel companies that seek to obfuscate or downplay our data and the risks posed by the climate crisis." "In fact, these misinformation campaigns represent one of the biggest barriers to the government action that science shows is necessary to mitigate the ongoing climate emergency," they said.

India's oil production continues to slip down

India's production of crude oil, which is refined to produce petrol and diesel, continued to decline in December 2021, with lower output from state-owned ONGC leading to a near 2 per cent drop, official data

showed. Oil production in December 2021 was 2.51 million tonnes, down from 2.55 million tonnes a year earlier and a target of 2.6 million tonnes. The output was, however, higher than 2.43 million tonnes production in November 2021. State-owned Oil and Natural Gas Corporation (ONGC) – India's biggest producer, produced 3 per cent less crude oil at 1.65 million tonnes in December due to delays in mobilising equipment at western offshore fields. Oil India Ltd (OIL) produced 5.4 per cent more crude oil at 2,54,360 tonnes. India is 85 per cent reliant on imports to meet its crude oil needs as domestic output is insufficient to meet the demand.

Gas utilities push RNG and hydrogen to expand fossil fuel infrastructure

Electric and gas utilities are increasingly targeting customers, regulators, and investors with the promise of "renewable natural gas," or biomethane, and hydrogen gas. In their promotions, the utilities have claimed that these technologies will allow them to build gas-fueled power plants and gas pipelines today while remaining on a pathway toward "net-zero" emissions climate goals. But RNG and hydrogen are not excuses to build or expand fossil fuel infrastructure, according to reports and studies released in recent years. Zero-emissions solutions to power and heat our homes and businesses are available today.

LNG

India & Denmark agree to work together on green fuels



India & Denmark agreed to initiate joint research and development on green fuels including green hydrogen, during the Joint S&T Committee meeting in January 2022. The Joint Committee discussed national strategic priorities and developments in Science, Technology, and Innovation of both countries with a special focus on green solutions of the future – strategy for investments in green research, technology, and innovation at the virtual meeting.

The committee emphasised on development of bilateral collaboration on mission-driven research, innovation, and technology development, including climate and green transition, energy, water, waste, food, and so on as agreed by the two Prime Ministers while adopting the Green Strategic Partnership – Action Plan 2020-2025. They agreed to organise 3-4 webinars for partnership development and stressed on promoting call for proposals in green fuels, including green hydrogen. The meeting was co-chaired by S. K. Varshney, Adviser & Head, International Cooperation, Department of Science & Technology (DST), Govt. of India.

Hydrogen demand set to 'take off' in mid-2030s



Hydrogen will account for 12% of global energy use by 2050, with demand set to "take off" in the mid-2030s, the International Renewable Energy Agency said in a report. At least 30% of hydrogen production could be traded across borders by 2050, a higher share than natural gas today, with over 30 countries and regions planning to get into the business in the energy transition from fossil fuels, IRENA said in the report, "Geopolitics of the Energy Transformation: The Hydrogen Factor." By the mid-2030s, green hydrogen produced from renewables such as solar or wind will be competitive with fossil-fuel hydrogen globally, and even earlier in some countries, such as China, Brazil and India, it said.

Interest in hydrogen is growing as a way to cut greenhouse gas emissions and because of the plentiful supplies, posing competition for fossil fuels such as oil and coal. IRENA estimates that the "technical" potential for hydrogen production "significantly exceeds estimated global demand." S&P Global Platts last year began carbon-neutral hydrogen price assessments for Northwest Europe, the Middle East, Far East Asia, Australia, California and the US Gulf Coast.

METHANOL

BHEL's Coal to Methanol (CTM) plant dedicated to nation



As part of the ongoing Azadi Ka Amrit Mahotsav celebrations, Hon'ble Union Minister for Heavy Industries, Dr Mahendra Nath Pandey dedicated India's first, BHEL-built Coal to Methanol (CTM) pilot plant, to the Nation. Dr Nalin Shinghal, CMD, BHEL, Shri Jeetendra Singh, Joint Secretary, Ministry of Heavy Industries, Functional Directors on the Board of BHEL and senior officials of the Ministry of Heavy Industries and BHEL were present in the virtual ceremony.

Dr Pandey also inaugurated an exhibition on 'Products Developed under Aatmanirbhar Bharat' organised at BHEL's Hyderabad unit. In addition, an audio-visual presentation was made on the 'Unsung Heroes of the Indian Freedom Struggle' belonging to the Telangana Region. BHEL employees joined the programme virtually. The Minister said that one of the important goals of Hon'ble Prime Minister Narendra Modi's vision is to build a self-reliant nation.

Indian Govt plans to convert inland waterways and army trucks into methanol engines

The government is planning to convert its inland waterways and army trucks into methanol engines with an aim to promote alternative fuel to reduce India's dependence on imported petrol and diesel. Top government official told that talks are on with Deccan Water Treatment to undertake the conversion of existing diesel engines into methanol as the government enhances focus on green fuel. "NITI Aayog is facilitating conversion of inland waterways at Haldia, Varanasi and Allahabad under this project," the official quoted above said. The project will be implemented through Deccan ScandiNAOS India, a 70:30 joint venture between Deccan Water Treatment and ScandiNAOS with the latter being the technology partner. The Aayog has drawn a comprehensive plan to replace 20% of crude imports from methanol alone which will help bring down pollution in the country by more than 40%. Under the plan, 500 barges will be converted to run on 100% methanol replacing heavy oil or bunker oil, resulting in reduction of pollutants into seas and rivers. This could be followed by conversion of army trucks into methanol and even diesel railway engines as India scales up domestic production of methanol. Even the production of methanol from coal is the most economically viable option for India.

VLSFO

Hambantota Port expects phenomenal growth



The Hambantota International Port (HIP), which continues to come under attack by the opposition, said it expects phenomenal growth in the services it offers. HIP in a statement said that it has received FSS certification (Fitness for Service) for their tank farm facility. The certification was issued by Lloyd's Register (LR), the World's leading provider of classification, compliance and consultancy services to marine and offshore industries. This is a landmark achievement that will further strengthen the HIP brand in the maritime world. The port was awarded Lloyd's certification, after a comprehensive approval process and an impartial third-party assessment. The entire process was handled by HIP's Department of Energy Services who worked with Lloyd's Register Marine & Offshore Asia LLP, in achieving the recognition. Located just 10 nautical miles (19 km), from the world's busiest maritime route linking Europe and Asia, HIP's fully functioning tank farm facility for bunker fuel supply, provides a huge advantage to the vast number of vessels plying this route.

BIOFUELS

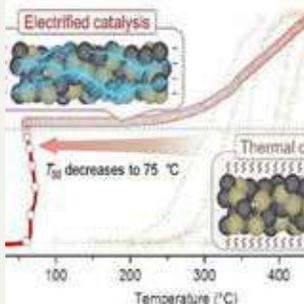
Biden weighing cuts to 2022 ethanol blending mandate



The Biden administration is considering lowering the 2022 ethanol blending mandate below the proposed 15 billion gallons amid backlash from the oil refining lobby and unions arguing the shrinking US ethanol industry can no longer support the target, according to two sources familiar with the administration's thinking. US President Joe Biden vowed to bring some normalcy back to laws requiring refiners to blend biofuels like corn-based ethanol into the nation's gasoline pool after his predecessor, Donald Trump, took unprecedented steps to relieve refiners from the requirement. But Biden is finding it difficult to live up to his promise. The Covid-19 pandemic has dampened fuel consumption and triggered a handful of ethanol plant shutdowns. Higher regulatory costs have refiners threatening to close refineries and shed high-paying union jobs. In December, the Environmental Protection Agency issued a long-awaited biofuel blending mandate proposal that cut ethanol requirements for 2020 and 2021 but restored them to 15 billion gallons for 2022.

COMBUSTION CATALYST

Researchers achieve low-temperature ignition



Using conductive metal oxides as catalysts, researchers have developed an electrification strategy aimed at decreasing the ignition temperature of soot. Relevant results were published in *Nature Catalysis*. This research was conducted by Prof. Zhang Jian's group at the Ningbo Institute of Materials Technology and Engineering (NIMTE) of the Chinese Academy of Sciences (CAS) and Prof. Zhang Zhaoliang's group of Jinan University. Catalytic soot combustion is the most efficient after-treatment technology for reducing diesel soot particulate emissions, which can trigger severe health and environmental problems. However, urban diesel vehicles idle frequently in traffic with exhaust temperatures reaching only 100–200 degrees Celsius, which is too low for catalytic soot combustion to occur. Aiming at realizing soot ignition at low temperatures, researchers at NIMTE and Jinan University designed an electrification strategy for soot combustion.

FUEL ADDITIVES

Indonesia raises 2022 biodiesel allocation



Indonesia has lifted its domestic biodiesel allocation to 10.151mn kilolitres (kl) in 2022 from 9.21mn kl last year. Jakarta is maintaining a 30pc biodiesel blending (B30) mandate but expects overall transport fuel consumption to rise as the country emerges from Covid-19 restrictions. Indonesia's state-owned refiner Pertamina will receive the largest share of 8.3mn kl, followed by its trading arm AKR Corporindo taking 730,501 kl and PT Exxonmobil Lubricants Indonesia with 687,947 kl. Wilmar, Musim Mas and Apical are the three biggest of the country's total 18 suppliers that will be distributing the biodiesel. Wilmar's share has slipped to 2.4mn kl from 3.09mn kl last year and Musim Mas' to 1.23mn kl from 1.43mn kl. But Apical's share has swelled to 1.9mn kl from 882,242 kl alongside a doubling of its production capacity to around 2mn t/yr. Fuel sellers hit nearly 98pc of the 9.21mn kl target for 2021, which the energy and mineral resources ministry estimates led to \$4.54bn in foreign exchange savings.

TECHNOLOGY

Scientists devise a cheaper way for producing green hydrogen



As the race is on for ample clean energy sources to mitigate climate change, hydrogen is being seen as a promising source of renewable energy. Green hydrogen emits no carbon, but there is a downside: its production remains complex and costly. Scientists worldwide are working on more efficient and affordable ways of producing no-carbon hydrogen such as through the electrochemical process of water splitting, which involves running electricity through water in the presence of catalysts to split the liquid into its chemical constituents: hydrogen and oxygen. As part of such efforts, researchers at the Georgia Institute of Technology and Georgia Tech Research Institute have jointly developed a new process and materials whereby green hydrogen can be produced far more affordably as a source of renewable energy. Currently, catalysts for producing hydrogen are made of noble metals such as platinum and iridium, which are both expensive and rare.

A new internal combustion engine produces nearly zero harmful emissions

The world is increasingly turning away from the use of internal combustion engine (ICE) vehicles, but some companies aim to repurpose the tried and true technology to allow it to live in harmony alongside climate change requisites. One example comes from Astron Aerospace, which unveiled the Omega 1, an engine designed to give internal combustion a new lease of life amid increasing curbs on fossil fuel consumption, according to a report from Motor1.com. The Omega 1 was designed to work with several different fuels, and its creators claim it can run while producing very low emissions. On its website, Astron Aerospace says the Omega 1 produces "extremely low to zero harmful emissions", and that it is the "ultimate range extender". The company says it has a working prototype of its engine and that it will release more information in the not-too-distant future. In the meantime, it has revealed that, much like a Wankel engine, the Omega 1 doesn't feature an offset crankshaft, eccentric shaft, or reciprocating pistons. However, unlike Wankel engines, the Omega 1 comes with a pre-chamber, connected to a pair of chambers, that separates cold intake air from exhaust gas, removing the issue of exhaust gas overlap.

POLICY

Panel formed to prepare energy transition roadmap for India



The government is planning to draw up an energy transition roadmap for the oil and gas sector that could prove to be a key step on India's path to net-zero emissions by 2070. The oil ministry has set up the Energy Transition Advisory Committee headed by former petroleum secretary Tarun Kapoor, who demitted office in November, to draft the strategy. The panel will include representatives of all public-sector oil and gas companies and will reach out to other stakeholders in the sector. The committee has until the middle of 2022 to recommend a roadmap for the sector's transition. "Oil companies are already preparing their respective plans to increase clean energy portfolio and set net-zero targets, and these efforts will get captured by the committee's broader energy transition plan for the sector," said Kapoor. As part of its efforts, the committee will review and take into consideration existing initiatives while developing an action plan.

A new carbon capture method turns CO2 into solid carbon 'in an instant'

A new decarbonisation technology developed by RMIT University researchers in Australia instantaneously turns CO2 into solid carbon, a press statement reveals. The team claims their method is commercially viable and that it could soon be deployed in aid of global efforts to reduce the ongoing effects of the climate crisis.

The new method is based on an existing experimental carbon capture technique that utilizes liquid metals as a catalyst. "Our new method still harnesses the power of liquid metals but the design has been modified for smoother integration into standard industrial processes," explains Associate Professor Torben Daeneke, a co-lead researcher of the project. "As well as being simpler to scale up, the new tech is radically more efficient and can break down CO2 to carbon in an instant," he continues. The RMIT team's technique uses liquid metal heated to between 212-248°F (100-120°C). This heated metal is then injected with CO2 to kickstart the required chemical reaction. The CO2 gas bubbles up to the surface of the liquid metal, leaving flakes of solid carbon behind in a reaction that only takes a second. The team of researchers has filed a provisional patent application and RMIT has signed a 2.6 million dollar agreement with environmental tech

startup ABR, aimed at commercializing the technology. It is one of many carbon capture methods in the process of being commercialized globally. Another team of researchers from the University of California, Los Angeles, recently announced that it had developed a technique that mimics the seashell forming process to suck carbon out of the oceans. This would have a positive knock-on effect, as the less carbon there is in the ocean, the more it can absorb from the atmosphere. In Scotland, meanwhile, a new carbon capture facility will remove up to 1 million tons of CO2 from the atmosphere per year. While carbon capture technology does have the potential to help in efforts towards carbon neutrality, scientists do caution that it must not be viewed as a replacement for widespread initiatives aimed at curbing the emissions of the fossil fuel industry. In July last year, for example, the U.S. Center for International Environmental Law wrote that carbon capture could act as a "dangerous distraction" that could delay the transition away from fossil fuel consumption.

EU proposes rules to label gas and nuclear investments as green

Investments in some gas and nuclear power plants would be labelled as sustainable under rules proposed by European Commission on Wednesday, a plan that has split countries and investors,

and which some lawmakers will attempt to block. Brussels has taken more than a year to decide if gas and nuclear energy should count as green investments in the EU's taxonomy, an investor rulebook designed to help raise massive amounts of private capital to meet EU climate change targets. In final rules published, gas power plants would be labelled green this decade if they emit less than 270g of CO2 equivalent per kWh, or have annual emissions below 550kg CO2e per kW over 20 years. That could include gas plants with relatively high CO2 emissions today, provided they switch to low-carbon gas or reduce their running hours in later years. Gas plants must switch to run on low-carbon gases by 2035. A requirement in a previous draft, for plants to start switching in 2026, was dropped. New nuclear plants must receive construction permits before 2045 to get a green investment label, and be located in a country with a plan and funds to safely dispose of radioactive waste by 2050. "We're setting out how gas and nuclear could make a contribution in the difficult transition to climate neutrality," EU financial services chief Mairead McGuinness said. "We're putting in place strict conditions for their inclusion in the taxonomy." The rules, which arrive as Europe grapples with surging energy prices and concerns about its reliance on imported Russian gas amid political tensions over Ukraine, have faced opposition on multiple fronts, including from campaigners, the EU's expert advisers, some investors and countries.



DECARBONISING MINING MOVING TOWARDS ALTERNATIVE FUELS

Mining industry is one of the biggest producers of carbon dioxide. The constantly growing sector is currently responsible for 4 to 7 per cent of greenhouse gas (GHG) emissions globally. Of late, after the recent COP26 world climate summit at Glasgow, the mining sector is also facing pressure from governments, investors, and society to reduce emissions.

There is a paradigm shift in the approach towards climate change and usage of fossil fuels in mining operations. A lot of countries have recently pledged to set NetZero emission target dates across the industries.

As the global economy will continue to grow out to 2050, under our base case Energy Transition Outlook (ETO), Wood Mackenzie forecasts that it would double between 2020 and 2050. Therefore it would have dramatic implications for the need to decarbonise. Current CO₂ intensity per unit of GDP is around 0.4 kg, which should fall to 0.2 kg by 2050. Under an accelerated 1.5 °C pathway, carbon intensity needs to fall to less than 0.05 kg per unit of GDP – an extremely challenging target. If global economic growth were to be constrained more than we are currently assuming, the knock-on effect would be a reduction in the need to lower CO₂ intensity per unit of GDP.

It is therefore has been necessitated for mining industry to act promptly and put brakes on the increasing carbon

emissions. The challenge for the industry lies in costing, and properly calculating the capital required to make the switch to low-carbon equipment and energy sourcing at individual mine sites. Decarbonising mining is seen not just as a challenge, but it's also considered to be a great opportunity for operational optimisation.

Decarbonising mining

According to the International Council on Mining and Metals (ICMM), the world's top 10 miners have even prior to COP 26 summit pledged that they are committed to a goal of netzero direct and indirect carbon emissions by 2050 or sooner.

"ICMM members' collective commitment to net zero scope one (direct) and two (indirect) greenhouse gas emissions by 2050 is a pivotal moment in our history," **Rohitesh Dhawan, President and CEO, ICMM**, said in an open letter signed by the 28 chiefs of the world's largest miners. He further said, "Direct and



indirect emissions will be lowered by accelerating the use of renewable energy and reducing or eliminating the use of diesel trucks".

Many miners including Anglo American, Rio Tinto, and BHP, under pressure from environmental activists and shareholders, have already committed to netzero by 2050 in direct and indirect emissions.

On the aspects decarbonisation in mining, **Mark Hannan, Global Manager for Mining Decarbonisation at Shell** said, "Mining companies often



see decarbonisation as a cost and something that's imposed on them rather than a cohesive part of their overarching business strategy." He further explained, "But actually, it can offer a lot of cost benefits, as well as improving operations and the safety and experience of employees."

Sonia Van Ballaert, Global Client Director at IBM Global



Markets, said "Operations are focused on optimisation – optimisation of costs, schedules, planning etc. – and I see decarbonisation as just another optimisation parameter. We need to ask how we can trade off all of these aspects against CO2 reductions."

Favouring the electrification of the mining equipment, **Max Luedtke, ABB Vice President of Global Mining** says, "Mining has a bad reputation because of what it's done in the past, but mining itself is a very important business in our society. Even if we want to go all-electric (as a society), our electric cars will need more mines. But we need more mines in the right way."



A World Bank report in 2020 emphasised how "all stakeholders along the mineral and renewable energy supply chains have a vital role to play in the transition to a cleaner energy system to achieve Sustainable Development Goal 7 (Affordable and Clean Energy for All), while ensuring that it does not come at the cost of the

MINE OF THE FUTURE

Climate change is one of the key global challenges of our time and building resilience today means reaping rewards tomorrow. ICMM members commit to being part of the solution to climate change by implementing operational level adaptation and mitigation solutions and continuing to contribute to the sustainable production of the commodities which are essential to the energy and mobility transition.

Supporting emissions reductions from the maritime transportation of produces by perusing low carbon chartering choices and promoting technology to optimise voyages.

Engaging with downstream stakeholders to support the development of technologies capable or reducing emissions in the production of steel and aluminium.

Supporting critical minerals for the renewable energy technologies that will fuel a low carbon world.

Supporting the principles of a circular economy to keep materials in service for longer and avoid unnecessary use of minerals and metals.

Accounting and reporting Scope 3 emissions along value chains to identify emission reduction opportunities.

Renewable energy is an increasingly viable technical and competitive alternative to fossil fuels for both grid connected and off-grid mine sites.

Promoting innovations for GHG-free surface mining vehicles by 2040 through ICMM's ICSV initiative.

AT THE MINE SITE

ALONG THE VALUE CHAIN

SUPPLYING CRITICAL MINERALS

ICMM
International Council
on Mining & Metals

climate, the environment, and people” and “the deployment of renewable energy is essential in helping us meet the Paris Agreement, even if it means that more minerals will be needed to get there”.

According to the world’s top miner BHP, steelmaking is one of the world’s most heavily polluting industries and the shift to focus on netzero emissions from the use of its raw materials by the sector marks an escalation in its efforts. The definition of reaching net zero however includes the use of carbon offsets. Those emissions represent 96 per cent of BHP’s total reported emissions, which during last financial year stood at 418.7 million tonnes of carbon dioxide equivalent.

But, steelmaking is expected to be one of the slower sectors to decarbonise because it requires the combustion of carbon and iron at high temperatures, creating carbon dioxide as a byproduct. The technology to produce carbon-free steel has not yet been proven.

Although steelmakers and Australia’s iron ore miners are currently working on the production of carbon-free steel from iron ore, potentially using hydrogen, the process is not expected to become economic until late this decade at the earliest.

Types of emissions in mining

The emissions from mining sector are categorised into three types including scope 1, scope 2 and scope 3. The scope 1 emissions are incurred through mining operations, and scope 2 emissions are incurred through power consumption, both of which account for about 1 per cent of global emissions. Fugitive-methane emissions from coal mining are estimated at 3 to 6 per cent, while a significant share of global emissions - 28 per cent - would be considered scope 3 or indirect emissions, including the combustion of coal.

Today 40 to 50 per cent of CO2 emissions come from diesel used in mobile equipment, with another 30 to 35 per cent from non-renewable electricity. However, the emissions

INDIAN MINING INDUSTRY – ON PATH TO DECARBONISATION

- Indian miners have responded positively to the target of decarbonisation efforts. Several steps to decarbonise mining have been taken by miners
- An oil checking lab was inaugurated at the Komatsu India facility located 20km off Nagpur-Amaravati Road. The lab is meant for testing oil used in the equipment as an indicator of its condition. The company through its Indian dealer L&T has introduced Komatsu small and mid-sized machines running on bio-diesel in the Indian market.
- Coal India Limited (CIL), one of India’s largest coal producers plan to retrofit its diesel-run heavy mining equipment like dumpers with LNG kits in a bid to significantly reduce carbon emission and save around \$6.72 million annually. Through this green push, under its pilot project CIL is retrofitting two 100-tonne dumpers with LNG kits to study the efficiency and outcome on the performance parameters of the heavy machinery used for transportation of coal in mines.
- **Kaustubh Gupta, CEO, Rawmatt Industries** said, "The retrofitting of diesel vehicles with LNG kits or CNG kits points towards the shift in adoption of greener vehicles to lower carbon emission. We are working with various stakeholders across channels and investing in research and development of technology that enables efficiency and output through alternative fuels."



“Mining has a bad reputation because of what it’s done in the past, but mining itself is a very important business in our society. Even if we want to go all-electric (as a society), our electric cars will need more mines. But we need more mines in the right way.”

MAX LUEDTKE
ABB Vice President of Global Mining



intensity varies widely across mines: for example, within copper and iron ore, we see a twentyfold spread among the emissions intensity of mines.

In the equipment category the haulage trucks are the single biggest

source of emissions from the mine (accounting for 20 to 25 per cent of the total), followed by comminution or crushing equipment (approximately 20 per cent of emissions), bulldozers (7 per cent), and excavators (5 per cent). Addressing carbon emissions from these four types of equipment offers a substantial opportunity to make a step change in reducing overall mining emissions.

The majority of emissions in this sector originate from fugitive coal-bed methane that is released during coal mining (1.5 to 4.6 gigatons), mainly at underground operations. Power consumption in the mining industry contributes 0.4 gigaton of CO2e. Further down the value chain - what could be considered Scope 3 emissions - the metal industry contributes roughly 4.2 gigatons, mainly through steel and aluminum production. Coal combustion for the power sector contributes up to roughly ten gigatons of CO2.

MINING EQUIPMENT MAKERS MOVING TOWARDS ENERGY TRANSITION

Scope 1 and 2 emissions in the mining industry are caused by mining operations and power consumption respectively. Owing to the growing awareness regarding the risks of climate change, organisations globally are fervently working toward a reduced-carbon future.



- **Caterpillar Inc.** CAT recently announced that it will begin offering 100 per cent hydrogen fuelled generator sets. The company has also commenced roll out of power generation solutions that can be configured to operate on natural gas blended with up to 25 per cent hydrogen. Hydrogen is now being considered as a promising alternative energy source to fossil fuels given its abundance, versatility and zero-emissions.



- **BHP Group** announced a partnership with Caterpillar to develop and deploy zero-emissions mining trucks at its sites to help reduce GHG emissions.



- **Miner, Anglo American**, is working toward developing the world's largest hydrogen-powered mine haul truck.



- **Komatsu Ltd.** KMTUY, has started a hydrogen development programme to develop hydrogen power as an alternative to diesel for heavy-duty mining dump trucks with an aim of launching its first vehicles in 2030.



- **Mining and construction equipment major Liebherr** has joined the eFuel Alliance eV in June, 2021. The eFuel Alliance is committed to the development and promotion of the worldwide production of synthetic fuels from renewable energies and their application.



- **Copper mining giant Freeport-McMoRan Inc** is converting its fleet of diesel trucks and other machinery to electric or hydrogen power, a transition required to fight climate change.



- **The Innovation for Cleaner Safer Vehicles (ICSV)** programme brings together 27 of the world's leading mining companies and some of the best-known truck and mining equipment suppliers to collaborate in a non-competitive space to accelerate the development of a new generation of mining vehicles.

renewable-energy use. Capital investments are required to achieve most of the decarbonisation potential, but certain measures, such as the adoption of renewables, electrification, and operational efficiency, are economical today for many mines.

- Significant growth of low-carbon technologies will occur if industries commit to cutting emissions in line with Paris Agreement targets. Technologies that support decarbonisation include wind turbines, solar photovoltaics, electric vehicles, energy storage, metal recycling, hydrogen fuel cells, and carbon capture and storage.
- Emerging technologies such as hydrogen fuel cells and carbon capture would boost demand for platinum, palladium, and other catalyst materials, while rare earths would be needed for wind-turbine magnets.
- When it comes to CO₂ within mining, it is a must eliminate all diesel-driven equipment, replacing trucks with belt conveyors, which move mined material much more efficiently.
- Over the last decade miners have started to establish in-pit crushing and conveying (IPCC) systems on a large scale, substituting their truck fleets powered by fossil fuels with continuous material transportation on conveyor belts powered with electrical drives. The positive environmental impact of these systems is enormous, while the use of IPCC systems increases the degree of automation and digitalisation bringing additional efficiencies.
- Digitalisation is an important lever to accelerate the journey towards zero emissions in cement and mining and the pandemic has accelerated customer adoption of digitalised operations and remote support. "Over the past year we have seen a step-change in customers' willingness to adopt

Solutions for reduction of carbon emissions in mining

There are several new solutions and concepts that aim to lower CO₂ emissions and the climate footprint of the mining industry. Till date, mining companies have viewed sustainability mostly through a local lens, but achieving a 1.5°C to 2.0°C pathway will require significant global action.

- A move toward sustainable sourcing, fuels, and drivetrains, as well as a switch to green electricity is considered the best way forward towards decarbonisation of mining.
- Mines theoretically can fully decarbonise (excluding fugitive methane) through operational efficiency, electrification, and

NET-ZERO COMMITMENT

ICMM members collectively commit to a goal of net-zero Scope 1 and 2 GHG emissions by 2050, or sooner.

All parts of society need to work together on more integrated approaches that strike the right balance between environmental, social and economic outcomes, to promote the prosperity of people and the planet. As stewards of the minerals and metals that are critical to decarbonisation and sustainable development, we embrace our responsibility to minimise the impact of our operations on the environment.



Setting Scope 1 and 2 targets:
We will build clear pathways to achieving net zero Scope 1 and 2 GHG emissions by 2050 through meaningful short and low medium-term targets.

Covering all material sources:
Our targets will cover all material sources of emissions, aligning to the GHG Protocol definition of organisational boundaries and materiality.

Accelerating action on Scope 3 GHG emissions:

We recognise that Scope 3 is critical to minimising our overall impact and we will set Scope 3 targets if not by the end of 2023, as soon as possible. Although all Scope 3 action depends on the combined efforts of producers, suppliers and customers, some commodities face greater technological and collaborative barriers than others. We will play a leading role in overcoming these barriers and advancing partnerships that enable credible target setting and emission reductions across value chains.

Disclosing openly and transparently:

We will report our progress on Scopes 1, 2 and 3 annually, obtain external verification over our performance, and report in alignment with the recommendations of the Task Force on Climate-related Financial Disclosures.

Focussing on absolute reductions:

For some operations, intensity rather than absolute targets may be more appropriate in the short and medium term. Where intensity targets are used we will disclose the corresponding absolute increase or decrease in GHG emissions.

Applying robust methodologies:

We will use target-setting methodologies that are aligned with the ambitions of the Paris Agreement and disclose in detail the assumptions we use.

our remote support solutions and digitalised optimisation of operations," said **Thomas Schulz, CEO, FL Smidth**, which provides innovative engineering, equipment and service solutions to the global mining.



- A legislated carbon price could also shift the competitive dynamics. A local price on carbon - in any form - affects advantages in different mining regions, commodities, processing routes, and companies. In Europe, for example, the Emission Trading System (ETS) is entering a new phase of emission-reduction targets. The so-called Green Deal on emission regulations, while in its early stages, could lead to a higher carbon price for European primary industries, resulting in possible competitive disadvantages for some companies in global markets.

- The Task Force on Climate-related Financial Disclosures (TCFD), a coalition with support from more than 300 investors with nearly \$34 trillion in assets under management, recommends that companies report their "transition risks" under a 2°C decarbonisation scenario.
- Decarbonising the mining industry would require a serious effort by the coal industry, particularly in tackling fugitive methane.
- Several big mining companies have installed their own sustainability committees, signalling that mining is joining the wave of corporate sustainability reporting and activity.

There are short-, mid-, and long-term opportunities for decarbonisation. In the short-term the focus could be on cost-positive alternatives with technology available today to ensure no-regret moves. The short-term measures also includes to search for green energy alternatives and purchase them if available, or invest in renewable

capacity; and switch to existing drop-in sustainable fuels. During this first stage, up to 60 per cent of emissions can be reduced over the next three to five years.

The mid- and Long-term measures include switching to fully electric mobile equipment fleet, with haulage trucks charged on pantograph and others charged using a battery-swap approach. Using FCEV mobile fleet, combined with a build-up of green hydrogen capacity derived from wind or solar.

Decarbonisation presents a significant opportunity for ambitious players to differentiate themselves and lead the way toward zero-carbon mining. For this to happen at scale across the industry, multiple stakeholders including mining houses, OEMs, suppliers, oil and gas players, commodity customers, and others need to work together to develop the potentially cost-positive abatement approaches that are currently unavailable. [E&E](#)

A clean energy revolution will hinge on getting mining right



As renewable energy starts to outpace fossil fuels, it will need to avoid the ways coal, oil, and gas bulldozed through communities at great costs to people and the environment. And if decision-makers can chart a path for a just transition to renewable energy, they might be able to heal more than the damage our demand for energy has inflicted on the climate.

By Justine Calma

The clean energy sector finally started grappling in earnest with one of its biggest challenges: how to get enough minerals to build solar panels, wind turbines, and big batteries for electric vehicles and energy storage. Figuring that out will be critical for escaping fossil-fuelled ecological disaster. It'll also be crucial for policymakers and industry to move forward without throwing certain communities under the bus in the transition to clean energy.

Instead of cutting through landscapes with oil and gas wells and

pipelines, clean energy industries and their suppliers will open up the Earth to hunt for critical minerals like lithium, cobalt, and copper. Compared to a gas-fired power plant, an onshore wind turbine requires nine times more mineral resources, according to the International Energy Agency. Building an EV requires six times more minerals than a gas-powered car.

It's about time to scrutinize what that hunger for minerals might cause, given the recent boom in pledges from countries and companies alike to reach net zero greenhouse gas

emissions. Digging up the necessary minerals is already proving to be a minefield. Protests are popping up at proposed mines that no one really wants in their backyard. The conflicts that cropped up in 2021 are just the beginning of a challenging road ahead.

The International Energy Agency (IEA) issued a warning in May 2021, that the world isn't mining enough of the minerals that are the building blocks of a clean energy future. And supply chains for many critical minerals are vulnerable, according to the IEA's report. "Left unaddressed, these potential vulnerabilities could make global progress towards a clean energy future slower and more costly – and therefore hamper international efforts to tackle climate change," Fatih Birol, executive director of the IEA, said in a statement at the time. "This is what energy security looks like in the 21st century."

The cobalt used in EV batteries, for example, mostly comes from the Democratic Republic of Congo. A majority of the world's rare earth minerals, used in EV motors and



wind turbines, are produced and processed in China. So if anything rattles production in those countries, the whole world might feel the effects. On top of that, the concentration of power over vital resources in specific countries and companies creates the potential for environmental and human rights abuses, which have plagued supply chains for cobalt and rare earth minerals. Investigations into cobalt mines that are essential suppliers to the EV battery industry have already found widespread labour abuses.

To make things harder, the Covid-19 pandemic has put even more pressure on clean energy supply chains. Rising shipping and commodity prices could delay or even cancel solar projects slated for 2022, according to research firm Rystad Energy. Soaring metal prices could slow down the entire transition to renewable energy throughout the decade, says the International Monetary Fund.

Regardless, Joe Biden has committed the US to halving its emissions from peak levels this

decade. Longer term, he's pushing for a clean-energy grid by 2035 and net zero emissions by 2050. In order to reach those goals, the US will need large quantities of minerals, which is why the Biden administration has made securing them a priority since stepping into office this year. By June, Biden had announced a "whole-of-government" effort to shore up domestic supply chains, with a big focus on critical minerals and advanced batteries used for renewable energy and electric vehicles. As the administration sees it, domestic supply chains can help the US wean itself off dirty fossil fuels, while also minimizing its reliance on mining in other countries — especially where labour abuses are a big problem.

But even in the US, clean energy-related mining can come with costs, and it's already looking like Native Americans and other marginalized groups might bear a disproportionate burden of those costs. One high-profile tussle is building up at Nevada's Thacker Pass, the site of the largest lithium resource in the country. If a proposed lithium mine moves forward, it will dig up a potential gravesite that's sacred to members of the Fort McDermitt Paiute and Shoshone Tribes and other local tribes. Residents are also worried about how the mine might harm wildlife and use up water in a state suffering a historic drought. The Nez Perce Tribe in Idaho faces the prospect of a new mining project tearing up their landscape to produce gold, a key ingredient for many electronics, and antimony, that could be used in futuristic batteries. Then there's the proposed copper mine at Oak Flat in Arizona that would desecrate lands sacred to members of the San Carlos Apache Nation and other Indigenous peoples in the region. Copper is widely used across the grid and for solar and wind energy technologies.

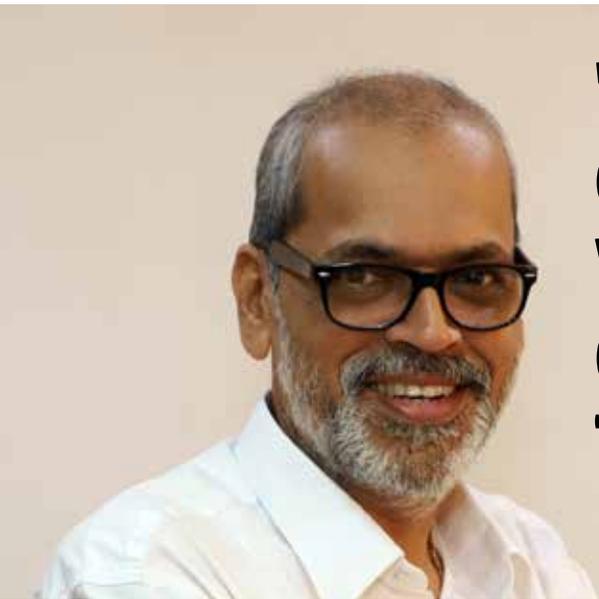
Around the world, the race is on

to find new sources of the minerals needed for clean energy. Mining companies are now eyeing patches of the seafloor that contain polymetallic nodules rich in cobalt, rare earth elements, and other metals. While companies argue that mining the seafloor is one way to avoid polluting communities near land-based mines, their eagerness to bring heavy industry to a largely unexplored environment has alarmed hundreds of marine scientists, who published a statement in September saying such activity could irreparably hurt deep-sea ecosystems. Despite their concerns, the International Seabed Authority (ISA), which oversees activities on the high seas, is seemingly poised to push through new rules that could open up the world's oceans for deep sea-mining after convening earlier this month.

There are ways to get the minerals the clean energy revolution needs while minimizing the impact on people and the planet. Startups are figuring out how to get better at recycling lithium batteries. Joe Biden campaigned on a promise to create millions of clean energy jobs while defending workers' right to unionize, which might offer workers in US mines more protections. Tribes are entitled to "free, prior, and informed consent" to any project that might affect them or their territories, under the United Nations Declaration on the Rights of Indigenous Peoples. We can also boost energy efficiency, use more public transit, and consume less.

As renewable energy starts to outpace fossil fuels, it will need to avoid the ways coal, oil, and gas bulldozed through communities at great costs to people and the environment. And if decision-makers can chart a path for a just transition to renewable energy, they might be able to heal more than the damage our demand for energy has inflicted on the climate. [E&E](#)

Source: *The Verge*



"WE ARE NOT CERTAIN WHICH WILL BE THE FUEL OF CHOICE FOR TRANSITION"

Q. After COP26 summit at Glasgow, the focus is back on strengthening measures to cut down GHGs in global shipping with green transition? Do you think the agenda on green fuel transition in shipping is heading in right direction?

If one is to take larger direction then surely we have been in the right direction. We as a generation need to be mindful of those coming behind us. The fury of climate change is been seen by all of us, so yes the direction is correct, but the direction is also broken and that has to with the fact that we are still early days today as there is still a great sense of uncertainty about what path to take. What is being proposed versus what finally will be executed as a product is not known. **A ship owner is today standing at a junction or several options are before him, and it would be extremely difficult for him to choose what path he has to take.** In addition to this one of the other important things we are making is as a world we are making a lot of motherhood statements, but execution of those motherhood statements, I find that my members specially lack the direction that is to be adopted for the execution of them. This will happen over a period of time. Yes, we are in right direction but a lot more clarity needs to be happen so that entire

As the shipping sector is gearing up to move towards energy transition, **Anil Devli, Chief Executive Officer (CEO), Indian National Shipowners' Association**, in an exclusive interview with Future Fuels explains the perspectives of fuel transition from the Indian ship owners point of view.

ecosystem needs to come to a place.

Q. What should the industry association and government do in the initiative towards decarbonisation?

Obviously, there is no choice for us but to come in line with the thinking of the world, as our Prime Minister himself has set a target of NetZero 2070 at the recent COP26 summit. At the end of the day shipping is an international business we cannot be different from what world is doing. At this stage I must also mention and complement our DG Shipping as we asked him will this extend to our coastal shipping as well he unequivocally said that this going green will have to be practised by everyone.

We as Indian ship owners are there to do what needs to be done. I am proud to say that our members have already taken several steps with

respect to short-term immediate goals like Energy Efficiency Ship Index (EEXI) and Carbon Intensity Indicator (CII) and then we move to complete transition. But there is a lot that needs to be done by the government; the first is the awareness itself. Except DG shipping, and Ministry of shipping and our media outside our community very few people understand importance of what we are doing. The other issue that often comes along is that if you look at shore-based industries, shipping industry per say worldwide is the lowest in terms of carbon emissions, yet there is a pressure on shipping to perform. We are happy that I can say this on behalf of our leading companies like Great Eastern, Seven Islands, Sanmar Shipping, continuously at the board meetings they are discussing ways and means

to educate first of all what we need to do in order to carry out this transition and what is that we are doing. To give a few examples our members today are engaged in doing various activities some of them are putting speed limit devices, another owner has gone in for hull structure painting another owner was mentioning to me that they have got into use of biofuels. As India we are not a large shipping nation though we should be, but even within that restricted size all my members and all ship owners have taken whatever steps needs to be done. One ship owner I was talking to yesterday told me that he has been able to report 10% increase in efficiency, thanks to just these small measures. This is really encouraging but we need a lot of support coming from the government. These are voluntary measures today we are taking at a cost but not huge. But when we take larger steps they involve huge costs and there needs to be an environment to be created and I trust with great understanding whatever needs to be done on the coastal and foreign going ships will be done and Indian shipping industry will comply with decarbonisation goals.

Q. There are several options for shipping to go green like hull painting, fitting scrubbers, using alternative fuels or biofuels, and fuel additives? What in your opinion is going to happen or which technology will prevail?

The favourite here seems to be hydrogen, of late, everybody is talking about hydrogen. Maersk has put a big bet on Hydrogen, obviously when Maersk does something it would be a well-researched and thought out thing. But my personal favourite is ammonia, though it's a little bit hazardous but there seems ammonia has a greater chance of becoming one of the preferred fuels in this transition. If one has to start planning and building new vessels the values have gone up considerably so this is not the time to go and buy assets. Nevertheless, ships are now being built with new

propulsion system but the question that comes up here is what sort of propulsion these ships will have. As of today people are talking about dual fuel engines, whether we reach and have hydrogen as one of the main fuel for engines we do not know. All of this is fraught with a lot economic issues. If you look at the European Union (EU) wanting to have the emission trading scheme. There is a proposal where they wanted to impose some levy on ships not meeting the emission standards. But the point here is that the cost of doing all of this cannot be borne by the ship owner this will have to get passed on to the consumer. So when you are talking about new fuels also one has to worry about the ability of shipping to economically carry out that service. When you go for green obviously the costs will increase and the question is who will bear that cost and how that cost will be offset by the trade. We are not certain which will be the fuel of choice, as it will be driven by science. But people who are senior to me in the industry agree that ammonia is at fore front, though hydrogen seems to be politically popular choice for everybody else. LNG and others will also be a choice but not necessarily a choice in terms of emissions.

Q. In this phase of transition what is that you are expecting from the Indian government?

This is one of the most important issues we are working as an association and as a representative of Indian ship owners. There are two things we need from the government one is support in terms of awareness and support in terms of financial assistance. There are two types of costs involved one is capital cost and the other is revenue expenditure, the former involves changing the equipment and propulsion system the latter involves daily costs like changing the fuel.

What most ship owners now thinking is will it be feasible to convert and retrofit the old assets so that it can run for another three to five years depending on the age of the vessel. As

you are aware that Indian's main line fleet has an average age of 22 years and this year it has come down to about 21 years thanks to the new tonnage that has increased due to new subsidy scheme announced by the government.

But there are some vessels which may not fit with the retrofitting and those vessels will have to be scrapped and they can be replaced with new builds so there is huge investment involved. We are looking for a long-term support from the government subsidies and offering long-term loans. We are not saying that government should bear all the costs; we want the government to become a partner with us in all of this where they give us some kind of rebate for us like they have given to cars and other sectors. If the cost is about Rs 100 one can say Rs 20 or Rs30 will be borne by the government through subsidy, another Rs 20 or Rs 30 can become long term loan, and the rest of the costs will be borne by ship owner.

This way, ship owners can be incentivised to carry retrofitting. But if you see this from consumer's point of view with all this retrofitting and other equipment changes will lead to increase in the cost of transportation and the impact all of this on the economy is something that the government will have to look at. Obviously the costs will increase across world in all sectors including maritime and transport sectors as the initiative to go green will happen in all sectors. Here, there will have to be awareness about the increase in costs. We believe that the government needs to handhold us in this transition. We were hoping that the government would see something in this Budget, but I was told by our senior members that it is too early to expect anything, as proper framework has to be prepared and we will have to discuss with government and only then a they will be able to come up with some kind of response to assist us. But I can say that both DG Shipping and Shipping Ministry have already began engaging with us in ascertaining what is that the industry will need. **EF**



What is the Fuel of future?

Like many industries, the maritime industry needs to transition to renewable energy sources – the health of the planet demands it.

The International Maritime Organisation (IMO) has introduced regulations that require the shipping industry to reduce its greenhouse gas (GHG) emissions by at least 50 per cent by 2050. As part of the efforts several technological solutions and alternative energy sources are being introduced for the effective decarbonisation of shipping sector.

Alternative energy in maritime industry

Of late, in the transport sector, a shift away from combustion engines is evident and a strong trend towards battery-electric drives with more or less similar performance of fuel energy vehicles has been happening. But direct electrification with batteries as energy storage systems in maritime industry is possible only on certain niches, like short-time ferries. The battery-powered systems however, cannot meet the operating and safety requirements of the large

ships on the sea such as container ships, tankers and bulk carriers.

Currently, Liquefied Natural Gas (LNG) is a promising fuel which can meet both environmental standards (NOx, SOx) and reduce dioxide emissions by up to 20 per cent. But decarbonisation won't stop with LNG and in order to reach carbon neutrality more significant CO2 reductions are necessary. Therefore, the future belongs to climate-neutral fuels produced from green hydrogen and renewable energy sources. These fuels include synthetic natural gas (methane), green ammonia and methanol as well as hydrogen for shorter distances.

There is much research currently undertaken on the evaluation of other fuels that can gradually replace LNG in maritime energy transition.

Hydrogen

It is expected that green hydrogen electrolyzed from water using renewable electricity to play a crucial role as a feedstock for the production of synthetic gaseous fuels that will sustain the decarbonisation of the shipping sector. Among the most interesting fuels which can be

produced from green hydrogen will be synthetic natural gas (methane), ammonia and methanol.

Even processed to a liquid, hydrogen has an energy density of 4.5 times lower than HFO or MGO. Additionally, to liquefy hydrogen it needs to be cooled down to -253°C , and even then it occupies several times the volume of LNG. Moreover, the equipment required to hold the hydrogen in its liquid state is large and complex. As a result, in practice, a total installation space factor of 6 – 7 is used for complete hydrogen fuelling systems compared to liquid fuel equipment.

Synthetic natural gas

Proposals are well advanced for the production of carbon-neutral synthetic hydrocarbon gases such as methane utilizing green hydrogen and carbon captured from the atmosphere or other carbon sources. Significantly, synthetic natural gas (SNG) is methane (CH_4), and hence, chemically the same as the main combustible constituent of LNG. Its chemical constitution makes SNG ideally suited for combustion in both two- and four-stroke dual-fuel engines.

Achieving fuel supply aboard ship will be straightforward although not trivial – as with LNG. The new gaseous fuel will have to be held at cryogenic temperatures prior to bunkering (-162°C in the case of both LNG and SNG). However, an already established LNG infrastructure on-board can also be used for fuelling with SNG.

Ammonia

The major advantage of ammonia as a fuel is that its chemical composition, NH_3 , contains no carbon and hence no CO_2 is formed during its combustion. Another advantage is: like methanol, ammonia is already produced in significant quantities on an industrial scale, and globally traded on a large scale, for example as feedstock for fertilizers. However, as with methanol,

ammonia production is not green yet, but production using green hydrogen from renewable energy sources is in prospect. Green ammonia production will use nitrogen derived from air, likewise using renewable power.

In terms of its suitability as an engine fuel, NH_3 is rather slow burning and as a result, presently suited for two-stroke diesel combustion. Research is currently being done on developing the use of ammonia in four-stroke engines.

Possible formation of nitrous oxide (N_2O , “laughing gas”) during combustion remains one of the issues that need to be resolved. N_2O is a GHG with a factor of 270 compared to CO_2 . Moreover, ammonia is also a rather toxic substance, but less flammable or explosive than hydrogen in all its concentrations.

Methanol

Methanol’s popularity is growing as a clean burning, low carbon fuel and methanol-fuelled engines are already in use today. However, the fuel is still conventionally produced. To advance the Maritime Energy Transition the gradual development of climate-neutral methanol production from renewable green hydrogen and captured carbon must progress.

But first steps are already underway: recently, shipping giant Maersk announced plans to off-take green methanol from a dedicated plant in Denmark for its first carbon-neutral vessel a 2,100 TEU feeder. The new ships are capable to run on green methanol and have the potential to save the company around 1 million tonnes of carbon emissions per year.

The major attractions of methanol as an alternative fuel are that it can be stored as a liquid at ambient temperatures and pressures and it has a favourable energy density. Thus, while its production as a green fuel is a complex process, its handling costs are low, reducing the complexity of storage and bunkering infrastructure

at ports. As a cargo, methanol is already present in many sea ports around the world and safe procedures already exist for its handling as both a cargo and a fuel.

Liquefied Petroleum Gas

Like LNG, liquefied petroleum gas (LPG) is a fossil fuel with a relatively high energy density and immediate GHG advantages compared to HFO and MGO. With a potential of up to 18 per cent reduction in CO_2 emissions, LPG is enjoying growing popularity in the first stages of marine engine decarbonisation. It is also relatively easy to store and handle.

However, as LPG is still a fossil fuel it is perceived – as LNG – not as a long term-prospect but rather as an enabler to start the Maritime Energy Transition until carbon-free alternatives can take centre stage.

Biofuel

Of late, there is increased interest for naturally carbon-neutral biofuels which can be burnt in two- and four-stroke engines with minimal engine modifications. If available in sufficient quantities, biofuels could thus make a significant contribution to decarbonisation in all engine applications, both a main fuel but also as a pilot fuel to ensure full carbon-neutrality of dual-fuel engines. There is however, considerable doubt with regards to the availability of these fuels to satisfy the increasing demand.

Keeping the steadily increasing world population in mind, agricultural land will most likely need to be dedicated to food crops. In addition, there is already increased scrutiny over which biofuels can truly claim to be produced sustainably, for example, without destroying rain forests and the natural habitats of threatened wildlife. On the other hand, there is clear potential for biofuels derived from organic waste, which can play a small but significant part in the supply of carbon-neutral fuels for marine engines. 

Source: MAN Energy Solutions

It's time for O&G industry to be on path to decarbonisation



The oil and gas industry is one of the major energy users and responsible for a large proportion of greenhouse gas (GHG) emissions in the world. This sector too is facing multiple sustainability-related transformation pressures, forcing the industry to adapt to changing market conditions.

If the world is to come anywhere near to meeting its climate-change goals, the oil and gas (O&G) industry will have to play a big part. The industry's operations account for 9 per cent of all human-made greenhouse-gas (GHG) emissions. In addition, it produces the fuels that create another 33 per cent of global emissions.

The emissions in O&G sector

The air emissions have similar chemistries in both on shore and offshore operational areas in O&G sector. The currently applied technology for producing oil and gas from various installations results in three main types of gas emissions.

- Combustion gases consisting of carbon dioxides and minor amounts of carbon monoxide, nitrous oxide, N₂O, SO₂, and un-combusted hydrocarbons methane and volatile organic compounds.
- Hydrocarbons consisting of

methane and primarily aliphatic VOCs vented to the atmosphere or escaping from the hydrocarbon processes through fugitive emissions.

- Releases of halon and other Chlorofluorocarbon (CFC) gases from fire-fighting and refrigeration systems.

Options for decarbonisation in O&G sector

The transition to a low-carbon economy will require O&G industry to adopt decarbonisation technologies like advanced biofuels, green hydrogen and carbon capture and storage (CCS). As the pressure to act on climate change builds post-COP26 climate summit at Glasgow, it time for oil companies to consider a range of options for decarbonisation.

In order to play its part in bringing climate change to the degree required, the oil and gas sector must reduce its emissions by at least 3.4

gigatons of carbon-dioxide equivalent (GtCO₂e) a year by 2050, compared with currently planned policies or technologies - a 90 per cent reduction in current emissions. Reaching this target would clearly be easier if the use of oil and gas declined. But even if demand doesn't fall much, the sector can abate the majority of its emissions, at an average cost of less than \$50 per ton of carbon-dioxide equivalent (tCO₂e), by prioritising the most cost-effective interventions. Process changes and minor adjustments that help companies reduce their energy consumption will promote the least expensive abatement options.

The specific initiatives a company chooses to reduce its emissions will depend on factors such as its geography, asset mix (offshore versus onshore, gas versus oil, upstream versus downstream), and local policies and practices (regulations, carbon pricing, the availability of renewables, and the central grid's reliability and proximity).

Already, many companies have adopted techniques that can substantially decarbonise operations -for example, improved maintenance routines to reduce intermittent flaring



and vapour-recovery units to reduce methane leaks.

Cutting emissions is not necessarily expensive. An onshore operator found that about 40 per cent of the initiatives it identified had a positive net present value (NPV) at current prices and an additional 30 per cent if it imposed an internal carbon price of \$40/tCO₂e on its operations.

One option is to implement initiatives that offset emissions by tapping into natural carbon sinks, including oceans, plants, forests, and soil; these remove GHGs from the atmosphere and reduce their concentration in the air. Plants and trees sequester around 2.4 billion tons of CO₂ a year.⁴ The Italian energy giant ENI has announced programs to plant 20 million acres (four times the size of Wales) of forest in Africa to serve as a carbon sink. Other companies are looking at how to fund these offset programs; Shell offers Dutch consumers the possibility of paying to offset emissions from retail fuel. The cost of carbon sinks is uncertain; estimates range from \$6 to \$120 per tCO₂e in 2030, depending on the source and the sequestration target.

Any company can invest in offsets. On the whole, however, upstream and downstream operators have different sets of options at their disposal.

The role of upstream operators in decarbonisation

Upstream operations account for two-thirds of sector-specific emissions. There are some ways in which oil and gas companies are taking action. They are exploring many ideas, such as energy efficiency and the electrification of low- to medium-temperature heat and energy. But they have distinctive options as well.

Energy efficiency: Efficiency is a factor in every part of the industry, of course, but new downstream-specific technologies can make a big difference. Waste-heat-recovery technology and medium-temperature heat pumps in refineries, for example, reduce the amount of primary energy used in distillation. One company saved €15 million in capital expenditures by forecasting its required steam usage hour by hour and incorporating this into a thermodynamic model to determine the required specifications for replacement equipment.

Green hydrogen: Hydrogen production through electrolysis has become both more technically advanced and less expensive. Bloomberg New Energy Finance estimates that the cost of hydrogen could drop as much as two-thirds by 2050. Using renewable energy rather than steam methane reforming (SMR) to power the electrolysis could offer refineries a way to reduce emissions - a result known as “green hydrogen.” An alternative, “blue hydrogen,” uses SMR plus CCUS. The attractiveness of the different technologies depends on the local economics - in particular, the availability of cheap storage capacity for CCUS or cheap renewable electricity.

Green hydrogen is not a

speculative technology in oil and gas. Shell and ITM Power, a UK-based energy-storage and clean-fuel company, are building the world’s largest hydrogen electrolysis plant at a German refinery, with support from the European Union. Revenue will come from selling hydrogen to the refinery, which will use it for processing and upgrading its products and for grid-balancing payments to the German transmission system. That business model justifies the installation.

High-temperature electric cracking: In refining, several pilot projects use electric coils (instead of fuel gas) to provide heat. The technology is still at an early stage and small in scale. Moreover, the economics are sensitive to the price of electricity compared with gas and to the options for selling the fuel gas. Those economics improve if investment is coordinated with the natural investment cycle to support additional capital expenditures—and, of course, if power can be purchased or generated under favorable financial terms.

Greener feedstocks: Replacing some conventional-oil feedstocks in refineries with biobased feedstocks or recycled-plastic materials (initially, through pyrolysis or gasification) would also reduce emissions - not only Scope 1 but also, to a large extent, Scope 3 emissions. In an increasingly decarbonising world, this may extend the lifetime of refining assets.

The oil and gas sector will play an important role in the global energy transition; how it will face that future is a matter of strategy. As transparency increases, so may expectations. Customers, employees, and investors are already starting to distinguish the leaders from the laggards. Oil and gas companies that get ahead of the curve could find themselves better positioned for change. [EF](#)

Source: McKinsey

We are working on development of green hydrogen

Industrial steam boilers are used to generate steam for process applications and/or to generate electricity for the plant. Fuels commonly fired in steam boilers are fossil fuels. Harjinder Singh Cheema, Chairman, Cheema Boilers Ltd (CBL), in an exclusive interview with Future Fuels has disclosed how his company is getting prepared for the fuel transition.



Q. What type of fuel you currently use for operations?

We are leading boiler manufacturing company and using all type of non-conventional energy sources to produce steam. All type of agriculture residue including rice straw (stubble burning) and cane trash as fuel

Q. After the recent COP26 summit at Glasgow there seems to be a shift in the fuel policy by governments to move towards using green fuels across the industries, will it have any effect on your business?

Considering that, we are working on development of green hydrogen as alternative fuel.

Q. What role can the boilers play in the transition to a net zero emissions economy?-

Boilers play a major role in in this matter.

Q. What is your vision for the boilers in the coming years from a sustainability standpoint?

Distillery waste slope fired incineration boiler: As we know govt. of India has allowed addition of ethanol in petrol and diesel with the result number of distilleries are producing this product from sugarcane

molasses. To produce 1 lakh Lt of ethanol 10 lakh Lt of water is wasted/ polluted. This dirty water if enters a river kills fish and if put on land the land goes barren. We have come out with a highly economical solution to this problem. Where we concentrate this dirty water and fire in boiler as fuel to produce power. This is 1st research worldwide and patented by us.

The technology has following advantages:

- **Water Saving:** Since we are using evaporation technology for concentration of distillery effluent. In this process we get 50 per cent water recovery. Thereby, we need to draw only 50 per cent water from the land i.e., for a 100 KL distillery we need to draw 5 KL instead of 10 KL. Thus there is a huge saving as the distillery capacity ranges between 100 KL and 300 KL/ day.
- **Fuel Saving:** We are using only 25 per cent as support fuel and rest is replaced with this concentrated effluent. Thereby, fuel saving to the tune of 75 per cent in case of molasses based distilleries.
- **Power Saving:** Since we are

producing total steam at high pressure and passing through turbine. Thereby, total distillery electrical load is replaced by this bi product power.

Distillation of Ethanol from rice

straw: We, along with a Pune company, are jointly doing this project with Indian Oil Corporation at Panipat wherein we will produce ethanol after fermentation from rice straw. This will generate ethanol directly from rice straw. Thereby the rice straw will fetch high value and solve today's pollution problem of rice straw burning.

The technology has following advantages:

- **Straw burning & air pollution:** In this technology 4-5 kg of rice straw will generate 1 lt of ethanol which will be added into petrol and diesel. Thereby, fetching high price which will automatically get transferred to the producer farmers and this problem of straw burning in fields causing air pollution shall be eliminated from root. This is another step to eliminate the problem from root. **FF**



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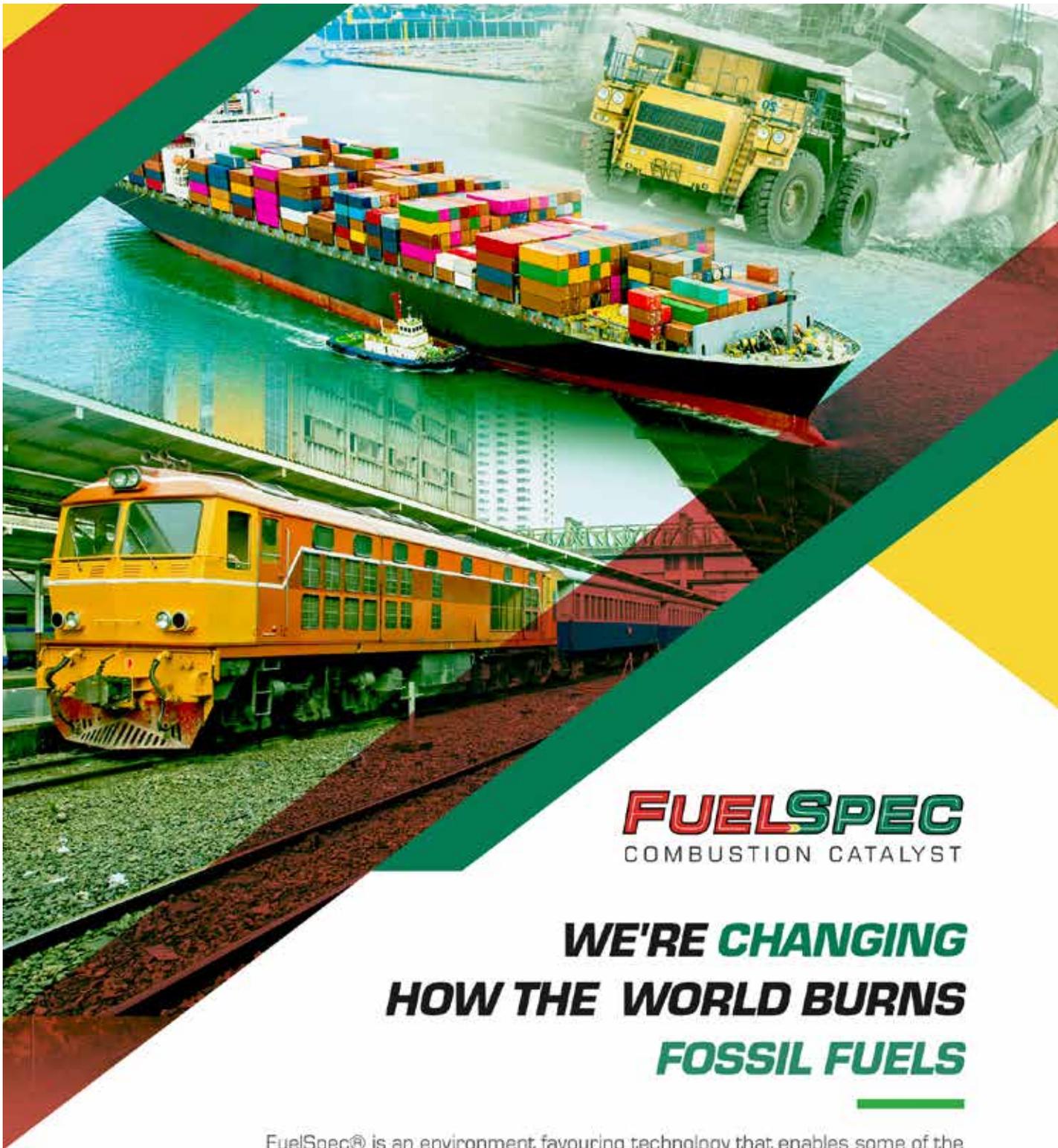
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