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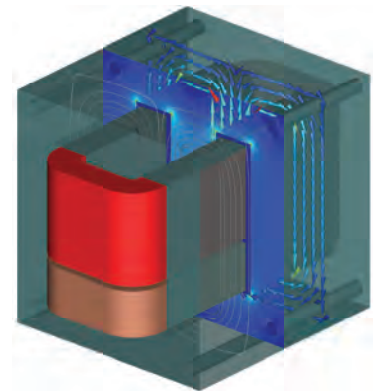
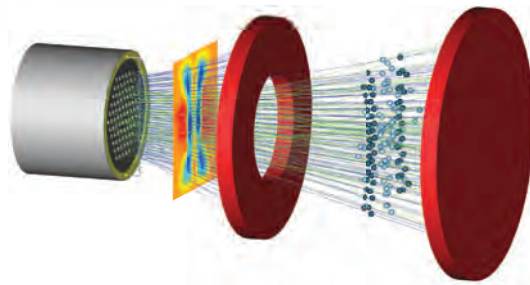
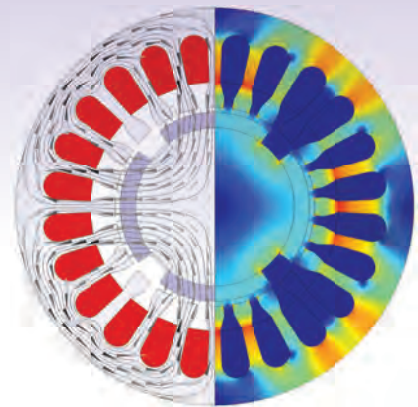
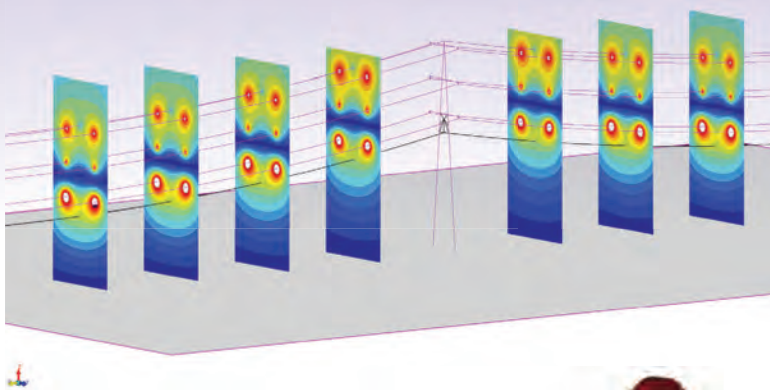
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From the Publisher's Desk

Managing Energy Security

With a view to cutting down the global oil demand by 2.7 million barrels a day (within four months – equivalent to the oil demand of all the cars in China), reducing the risk of a damaging supply crunch, which has been essential at this point of time because of the continuing Russian invasion of Ukraine resulting in lower supplies to oil markets ahead of peak, IEA (International Energy Agency) has recently proposed some emergency measures that are not only worth for this particular period but also very useful for all times.

These efforts would reduce the price pain being felt by consumers around the world, lessen the economic damage, shrink Russia's hydrocarbon revenues, and help move oil demand towards a more sustainable pathway.

IEA's recent report has also included recommendations for decisions to be taken now by governments and citizens to transition from the short-term emergency actions included in the '10-Point Plan' to sustained measures that would put countries' oil demand into a structural decline consistent with a pathway towards net zero emissions by 2050.

Most of the proposed actions in the '10-Point Plan' would require changes in the behaviour of consumers, supported by government measures. How and if these actions are implemented is subject to each country's own circumstances – in terms of their energy markets, transport infrastructure, social and political dynamics and other aspects.

Thus, as far as any country's energy security is concerned, the 'behaviour of consumers' matters a lot. As I feel, India has enough scope to reduce its oil consumption. However, political will matters a lot – and it has to be a united approach. I mean both the ruling party and opposition have to work together to mitigate the effect of distortion of the global oil supply chain.

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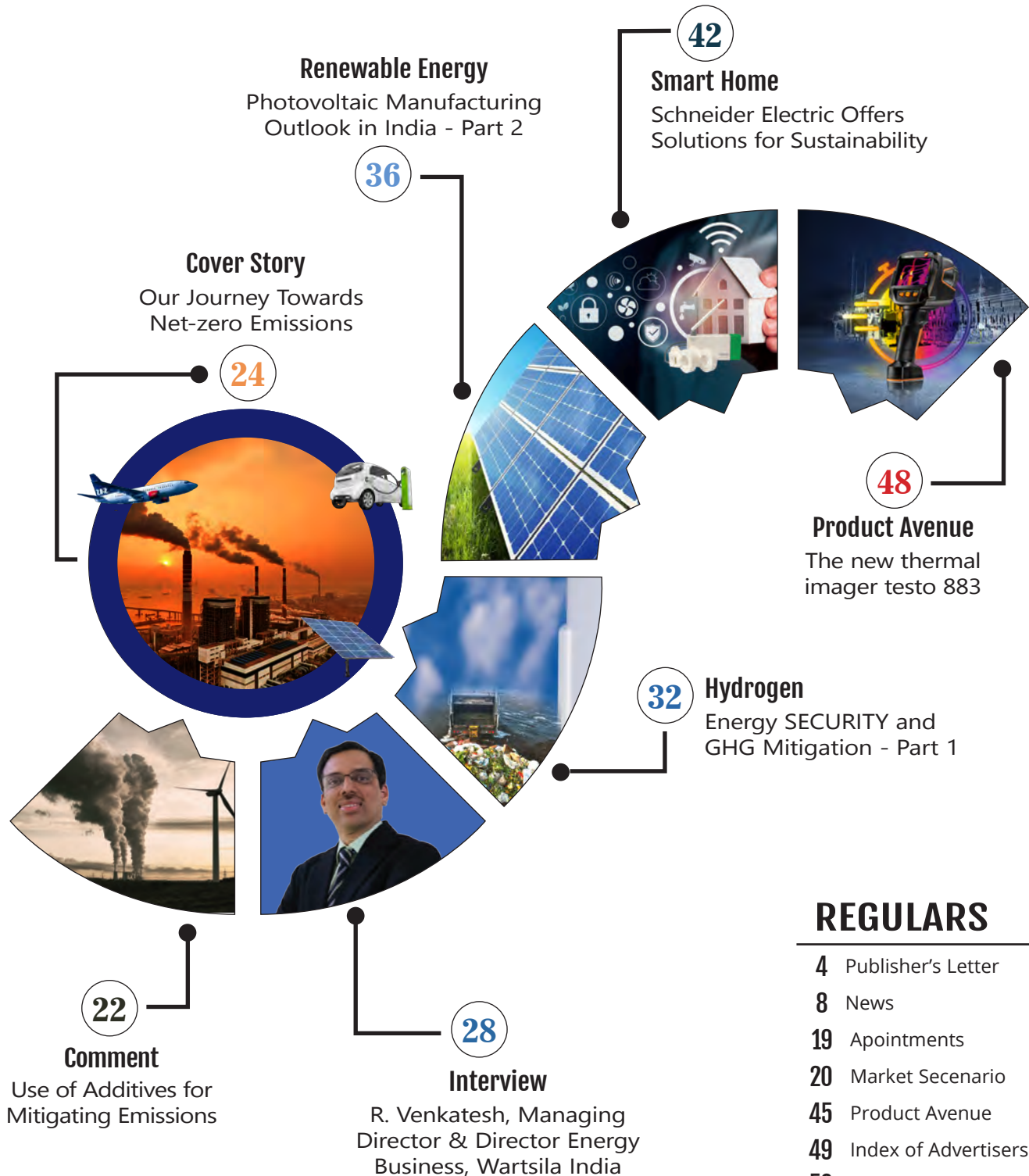
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NTPC COMMISSIONS ADDITIONAL CAPACITY AT RAMAGUNDAM FLOATING SOLAR PROJECT

NTPC has made commercially operational an additional 42.5 MW of power generation capacity at Ramagundam floating solar project in Telangana on 24th March, 2022. Earlier the company had commissioned 17.5 MW (Part-I) and 20 MW (Part-II) of the project.

With the addition of 42.5 MW, the total commercially operational power generation capacity of Ramagundam floating solar project has reached 80 MW. The project is of 100 MW capacity. The NTPC's total Installed capacity is 68,609.68 MW.

NTPC is India's largest energy conglomerate with roots planted way back in 1975 to accelerate power development in India. Since then it has established itself



A view of the Ramagundam Floating Solar Project...

as the dominant power major with presence in the entire value chain of the power generation business. From fossil fuels it has forayed into generating electricity via hydro, nuclear and renewable energy sources. This foray will play a major role in lowering its carbon footprint by reducing green house gas emissions. To strengthen its core business, the corporation has diversified into the fields of consultancy, power trading,

training of power professionals, rural electrification, ash utilisation and coal mining as well.

NTPC became a Maharatna company in May 2010. As of January 2020, there are 10 Maharatnas CPSEs in India. NTPC is ranked No. 2 Independent Power Producer (IPP) in Platts Top 250 Global Energy Company rankings. E1

CABINET APPROVES AMENDMENT IN MEGA POWER POLICY 2009

Policy guidelines for setting up of mega power projects were previously revised and issued vide MoP's letter of even number dated 2nd August, 2006...

The Cabinet Committee on Economic Affairs; which considers proposals for investment of more than Rs 1,000 crore, deals with industrial licensing policies and reviews rural development and the Public Distribution System; chaired by the Prime Minister, Narendra Modi, has recently approved the time extension (36 months) to identified 10 Provisional Mega certified projects for furnishing the final Mega Certificates to the Tax authorities.

Extension of time period for furnishing final mega certificate will enable developers to competitively bid for future PPAs and get tax exemptions as per Policy terms. The increased liquidity will boost the overall growth of the country and also ensure the revival of various stressed power assets.

The time period for the 10 Provisional Mega projects that are commissioned or partly commissioned for furnishing the final Mega certificates to the Tax authorities has been extended to 156 months instead of 120 months from the date of import. During this extended period, bids for firm power (combination of intermittent renewable energy, storage and conventional power) will be invited in co-ordination with Ministry of New & Renewable Energy (MNRE) and Solar Energy Corporation of India Limited (SECI) and these Mega projects will be expected to participate in such bids to secure PPAs. Ministry of Power will also develop an alternative in this period, based on present electricity markets while ensuring that benefits are passed onto consumers in a competitive manner. E1



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MoP ISSUES A REVISED VERSION OF CHARGING INFRASTRUCTURE FOR EVs

The Ministry of Power (MoP), Government of India has issued a revised version of “Charging Infrastructure for Electric vehicles consolidated Guidelines & Standards.” These Guidelines and Standards seek to proactively support creation of EV Charging Infrastructure, provide for affordable tariff chargeable from Public EV Charging station operators/owners and EV owners, enable EV owners to charge EVs at their residence/offices using their existing electricity connections, provide a revenue sharing model for land use to make operation of an EV Public Charging Station financially viable, prescribe timelines for providing connectivity for the Public Charging Station (PCS)

and for rollout of EV Public Charging Infrastructure, outline the infrastructure requirements for Public Charging Infrastructure. There are a number of salient features in the new Guidelines and Standards.



DISCOMs have been directed to provide electricity connection to PCS in accordance with the timelines specified...

Some of the salient features of the guideline include: Tariff for supply of electricity for Public Charging Station (PCS) shall be a single part tariff and shall not exceed “Average Cost of Supply” till 31st March, 2025. DISCOMs may leverage on funding from the Revamped Distribution Sector Scheme (RDSS) under “Part A – Distribution Infrastructure” for the general upstream network augmentation necessitated due to the upcoming charging infrastructure in various areas. The cost of such works carried out by the DISCOMs with the financial assistance from Government of India under Revamped Scheme shall not be charged from the consumers for Public Charging Stations for

EVs. Housing Societies, Malls, Office Complexes, Restaurants, Hotels, etc. are allowed to install PCS for charging of vehicles including charging of visitor's vehicles permitted to come in its premises. **ET**

MoP ISSUES CIRCULAR FOR TAKING TIMELY ACTION FOR ADEQUATE COAL AVAILABILITY

Non-operation of certain Imported Coal Based (ICB) plants in States had put more pressure on domestic coal demand leading to low coal stocks for Domestic Coal Based (DCB) plants...

The Ministry of Power (MoP) has been monitoring the coal supply situation in the country and has been taking steps to ensure adequate coal supply and coal stocks based on the domestic coal received from Coal India Limited (CIL), Singareni Collieries Company Limited (SCCL) and Captive coal mines.

As per the decision taken in the MoP in consultation with State GENCOs, IPPs and Central GENCOs, the domestic coal supply to all GENCOs will be in proportion to the coal received from CIL/SCCL for all the GENCOs and it will not be possible to give more coal other than on proportionate basis to make up any shortfall.

The MoP has issued a circular directing the

following: 1) Production in captive coal mines allotted to power plants may be maximized to the limit permitted. 2) It has been reported that a number of power plants are taking much longer time than the prescribed norms in unloading coal from railway rakes, which is affecting the turn-around time. CEA has been asked to monitor the unloading time at power plants and it has been decided that lesser number of rakes would be made available to such power plants where there is slackness in prompt unloading of coal from rakes. 3) A number of generating companies have overdues of coal companies running in several hundred crores of rupees. Therefore, it is necessary that the bills of coal companies are paid in due time. **ET**

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L&T SUPPLIES 700 MWe STEAM GENERATOR TO GHAVP AHEAD OF SCHEDULE

The Heavy Engineering arm of Larsen & Toubro (L&T), flagged-off the fourth Steam Generator (SG) for NPCIL's indigenously designed 700 MWe Pressurized Heavy Water Reactors (PHWR) to be set up at Gorakhpur Haryana Anu Vidyut Pariyojana (GHAVP) in Fatehabad district of Haryana. Steam Generators are heat exchangers that convert water into steam using the heat produced in a nuclear reactor core. It acts as a boundary between radiated and outside environment in a PHWR.

The ceremony took place at L&T's state-of-the-art Heavy Engineering Complex located at Hazira near Surat in the presence of dignitaries from NPCIL and L&T. The entire order was completed six months ahead of schedule creating a global benchmark in the nuclear manufacturing industry despite the COVID-19 pandemic. L&T Heavy



The 700 MWe steam generator for GHAVP is being shipped...

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Commenting on the achievement, Anil V. Parab, Member- L&T Executive Committee, Senior Vice President and Head, L&T Heavy Engineering, said, "We thank NPCIL for having entrusted L&T with the opportunity to be part of India's nuclear power program since its inception. We are proud to deliver this critical equipment

six months ahead of contractual delivery by overcoming the pandemic challenges. L&T is fully committed to Honorable Prime Minister's vision of 'Aatmanirbhar Bharat' and fast track the Indian Nuclear program, to contribute to India's commitments in COP26 to achieve net-zero carbon emissions."

ET

APL, IHI, KOWA SIGN MOU TO STUDY FEASIBILITY OF USING 20% LIQUID AMMONIA FOR CO-FIRING

To achieve de-carbonization of APL's coal-fired assets, the parties, by considering the possibility of ammonia co-firing through the studies, aim to de-carbonize APL's coal fired assets...

Adani Power Limited (APL), IHI Corporation, and Kowa Company, Ltd. (Kowa), have signed a Memorandum of Understanding (MoU) to study the feasibility on a modification to achieve 20% liquid ammonia co-firing ratio and thereafter extend this to a ratio up to 100% mono-firing at the Adani Power Mundra Coal Fired Power Plant.

APL aims to lead India's initiatives in achieving greenhouse gas reduction targets by evaluating the possibility of potential implementation of ammonia as a fuel in thermal power generation that will utilize Green Hydrogen-derived ammonia in the existing thermal power plant. Kowa supported APL by conducting a global survey of hydrogen and ammonia-related technologies being utilised for power generation. IHI Corporation has already successfully demonstrated its ammonia

co-firing technology at a large-scale commercial coal-fired power plant in Japan and responded to many inquiries related to ammonia co-firing globally.

These studies contribute to carbon neutrality in India in line with the "India-Japan Clean Energy Partnership (CEP)" announced by the Indian and Japanese governments on March 19, 2022. This will aim to promote energy cooperation between Japan and India through diverse and realistic energy transitions utilising all energy sources and technologies to ensure energy security, carbon neutrality and economic growth. In addition, the parties intend to conduct research and development, demonstration and commercial implementation in parallel with that in Japan to achieve early global implementation of fuel ammonia supply chain.

ET

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VIKRAM SOLAR'S COMMISSIONED LARGEST SOLAR PROJECT TO SAVE 4.57 TONNES OF CO₂ PER YEAR

Vikram Solar has completed an 85 MW solar plant project commissioned for National Thermal Power Corporation Limited (NTPC) at Bilhaur, Kanpur, Uttar Pradesh. Combining the latest 85 MW project at Bilhaur, UP with Vikram Solar's recently commissioned 140 MW project for NTPC at the same location; the (85 MW+140 MW) 225 MW capacity project becomes the largest solar project in a single location in the state of Uttar Pradesh.

The 85 MW solar project is spread across 400 acres and used about 3.5 Lac numbers of Vikram Solar modules and includes a 33/132 kV switchyard. The expected energy yield of this project in Uttar Pradesh is 200 million units



Saibaba Vutukuri, CEO,
Vikram Solar...

(MU). The plant is expected to reduce 4.57 tonnes of CO₂ and can power 88,905 houses per year.

Sharing his view on the occasion, Saibaba Vutukuri, Chief Executive Officer, Vikram Solar, said, "It was an honour for us to partner with NTPC for this prestigious project. This project presented the opportunity to increase our contribution to India's solar mission and we are proud to be chosen by NTPC to make such an effort. NTPC is one of our oldest clients and we have been partnering in several of their solar projects. We are proud to say that we have a portfolio of commissioned and under-construction projects totaling ~708

MW with NTPC, as it identifies our commitment and focuses on customer centricity. We are hopeful of a continued journey with NTPC towards realizing the company's green energy goals." 

AZURE POWER COMPLETES COMMISSIONING OF 300 MWS OF SECI PROJECT

On December 31, 2021, the company had 2,523 MWs of operating assets, i.e., 37% increase in capacity compared to that on December 31, 2021...

Azure Power, a leading sustainable energy solutions provider and power producer in India, has fully commissioned its 300 MWs Interstate Transmission System (ISTS) connected solar power project, Rajasthan 8, allocated by Solar Energy Corporation of India (SECI). The project is in Bhadla, Rajasthan and the power generated from the project is being supplied to SECI at tariff of INR 2.58 (~US \$3.7 cents) per kWh for 25 years.

Azure Power is a leading independent sustainable energy solutions provider, and power producer in India on a mission to create value for all stakeholders through high-performance Renewable Energy assets. The company developed India's first utility scale solar project in 2009 and since then, it has grown rapidly to become a leader in developing and operating

large utility-scale renewable energy projects in the country. Azure Power partners with commercial and industrial customers in their decarbonization journey by providing comprehensive solutions for their clean energy needs.

Following this, Azure Power has now operationalized 2,683 MWs of high-performing renewable energy assets in India. Commenting on this achievement, Ranjit Gupta, MD and CEO, Azure Power, said, "We are extremely delighted with the progress we have made in operationalizing our under-construction projects, despite the health and supply chain challenges in the last two years. We have operationalized close to 700 MWs in this fiscal year so far, which reflects our strong project development and execution capabilities." 



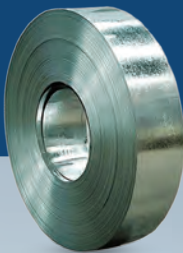
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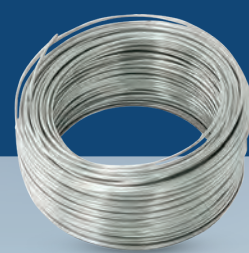
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WESTINGHOUSE'S MICRO-REACTOR RECEIVES GOVERNMENT OF CANADA'S FUNDING

Westinghouse Electric Canada has recently announced along with the Honourable François-Philippe Champagne, Minister of Innovation, Science and Industry, an investment of C\$27.2 million from the Government of Canada's Strategic Innovation Fund (SIF). This investment will support funding for the eVinci micro-reactor, which will bring carbon-free, transportable, safe, and scalable energy anywhere Canada requires reliable, clean energy.

Commenting on the funding, François-Philippe Champagne, Minister of Innovation, Science and Industry, said, "As our government moves swiftly with our green economic recovery, we are laying the foundation for a better-prepared and more prosperous climate-oriented future. Westinghouse's innovative technology will help deliver cleaner energy sources across Canada, especially in remote communities.



A view of the Canada event...

This investment will play a critical role in fighting climate change and build on Canada's global leadership in SMRs, and securing jobs in Ontario's energy sector."

Building on decades of Westinghouse innovation, the eVinci micro-reactor will bring clean energy to off-grid sites, remote communities and islands, decentralized generation, industrial sites, mining operations,

data centres, universities, marine propulsion, hydrogen generation, and water purification. The flexibility of a transportable eVinci reactor as a primary energy source, or in tandem with other sources such as renewables, will help in reducing Canada's energy costs by limiting the need for permanent infrastructure.

This funding will enable Westinghouse to create and maintain many new permanent jobs in Canada while partnering with the country's world-class nuclear supply chain and academic institutions. **ET**

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With several organizations going back to a work from home model due to the second wave of COVID-19 in India, UPS systems that support remote working have become a requirement for availability. The resultant increased loads on data centers have also made power back-up solutions critical in supporting business continuity, including increasingly critical small and remote applications.

Under such backdrop, Vertiv has introduced the Liebert GXT MT+ CX4 1K SB, a true double conversion online Uninterruptible Power Supply (UPS) system with an inbuilt battery designed to provide a capacity of 1 kVA. This solution is available now in India.

Liebert GXT MT+ CX4 1K SB provides complete protection of the load from the mains aberrations,

along with an inbuilt battery and a compact design that makes the system ideal to support work-from-home, data networks, small data centers and VOIP applications. The UPS has a 50/60 Hz automatic frequency converter mode and an inbuilt Over Voltage Cutoff Device (OVCD). The UPS features a new graphical LCD display which provides UPS status, load level, battery level, input/output voltage and discharge timer. It also automatically sets off alarms in case of any battery malfunctions or overload, and helps in faults diagnostics and trouble shooting.

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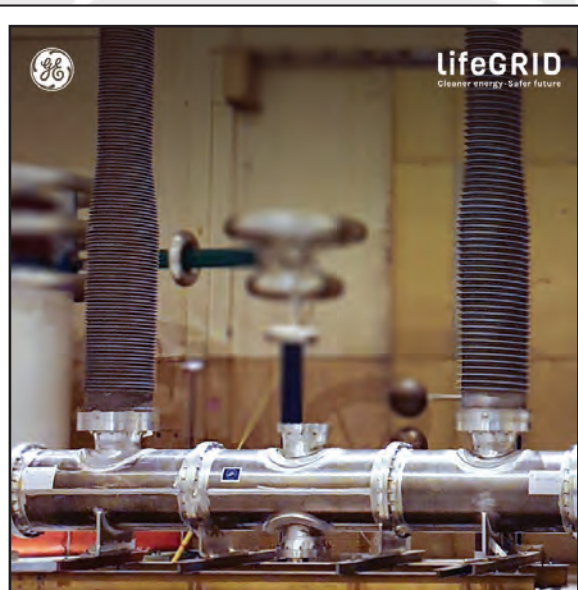


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GE UNVEILS WORLD'S 1ST 420 KV SF₆-FREE G³ CIRCUIT-BREAKER

GE Renewable Energy's Grid Solutions has unveiled the world's first 420 kV, 63 kA g³ Gas-Insulated Substation (GIS) circuit-breaker prototype. The g³ circuit-breaker has been presented to a group of leading transmission utilities from across Europe, at a recent virtual roundtable event. The performance achieved by the prototype means that the industry will soon have a viable SF₆-free alternative for high voltage products. GE's 420 kV fully g³ GIS, which includes the g³ circuit-breaker, is expected to be commercially available in 2023.

This new circuit-breaker relies on GE's g³ (pronounced 'g'-cubed) gas-insulating and switching technology. g³ technology allows GE to build electrical equipment with



World's first 420 kV, 63 kA g³ GIS circuit-breaker's prototype...

the same high performance and compact size as traditional SF₆ products, along with a gas CO_{2e} impact reduced by 99%.

Commenting on the significance of the development, Vera Silva, Chief Technology Officer at GE's Grid Solutions, said, "The development of GE's 420 kV g³ circuit-breaker is a historical milestone for the power industry as it will allow utilities to accelerate the decarbonization of their electrical grids. Until today, there was no viable alternative to SF₆ for GIS at the 420 kV level, the highest voltage level in Europe. This means that

the g³ technology can also be applied to all existing main voltage levels around the world. We are proud to be at the forefront of the effort to create a cleaner grid and are currently developing other g³ circuit-breaker types, according to our roadmap." E1

VOLTALIA LAUNCHES CONSTRUCTION OF SSM3-6, NEW 260 MEGAWATTS SOLAR POWER PLANT

The company provides all or part of the services associated with the development, construction and maintenance of the sold or retained plants...

Voltalia, an international player in renewable energies, has started the construction of SSM3 to 6, taking the Serra Branca complex to a new level: 80% of its 2.4 gigawatts potential is now under construction or in operation. Voltalia is launching the construction of the SSM3-6 (Solar Serra do Mel 3, 4, 5 & 6) solar power plant. With a capacity of 260 megawatts, the plant will begin production in the first half of 2023.

The SSM3-6 plant is backed by a 14-year power sales contract with Copel, a Brazilian Utility and historical partner of Voltalia. Copel has been Voltalia's partner in the SMG wind farm (108 megawatts) since 2015 as a minority shareholder. In 2021, Copel

acquired 100% of the VSM2 and VSM4 wind farms (187 megawatts in total), which will continue to be maintained by Voltalia over the long term. Copel is one of the buyers of electricity from the SSM1&2 solar park (for 270 megawatts), currently under construction.

SSM3-6 is part of the Serra Branca complex. Entirely developed by Voltalia and located in the Brazilian state of Rio Grande do Norte, Serra Branca is the largest wind and solar complex in the world with a potential capacity of 2.4 gigawatts. Voltalia is the controlling shareholder of a significant portion of the projects located in the complex, the other projects being sold to partners. E1

R. SINGHI JOINS AMP ENERGY AS SENIOR DIRECTOR



He has been previously associated with managing over a GW of renewable energy projects...

Ritesh Singhi has joined Amp Energy India as Senior Director – Procurement and SCM. The company is strengthening its management capabilities to capitalize on future growth opportunities as it continues to progress on an accelerated growth path.

Singhi has about 25+ years of extensive experience in Project & Operation Management, Global Sourcing and Supply Chain Management. An alumnus of Government Engineering College, University of Rajasthan, Jaipur, Singhi was a part of Mahindra Susten and CleanMax Solar.

Commenting on his appointment, Pinaki Bhattacharyya, Amp Energy India–Co-Founder, MD & CEO, said, “Mr. Singhi joins us as we are strengthening our leadership team in India in line with our business strategy and his experience in sourcing, manufacturing and supply management etc. would ensure Amp Energy India’s offerings always remain competitive. I am happy to have him on board to further build on the strong momentum of our continuous sustainable growth path in the renewable energy sector.”

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PROF. S. SHARMA JOINS TATA POWER AS CHIEF – STRATEGY, INNOVATION & BUSINESS COLLABORATION



At IIM Ahmedabad, he has held key administrative positions including Chairperson for the one-year MBA...

Prof. Sunil Sharma has joined Tata Power as Chief – Strategy, Innovation & Business Collaboration, from March 1, 2022. Sunil has brought his expertise in chartering the strategic roadmap for transformation at Tata Power, collaborating within and outside the organization to put the strategy into execution, and harnessing innovation and business collaboration for growth. He is working closely with, Dr. Praveer Sinha, CEO & MD, Tata Power.

Sunil has joined from IIM Ahmedabad, where he had been a faculty member

in Strategic Management, Strategy Implementation, and Strategy & Innovation. His specialization is in strategy formulation under uncertainty, innovation management and organizational capabilities.

Commenting on Sunil’s appointment, Dr. Praveer Sinha, CEO & MD of Tata Power said, “Sunil brings in tremendous value, with a unique combination of academia and corporate. We look forward to Sunil contributing to the transformation and growth journey at Tata Power, towards achieving its long-term goals and becoming the ‘Utility of the Future.’”

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P. LAMBERT TAKES OVER AS CEO OF ZETES



He had been the CFO of Zetes for more than twenty years...

Pierre Lambert, the current Chief Financial Officer of Panasonic Corporation’s (a global leader developing innovative technologies and solutions for wide-ranging applications in the consumer electronics) wholly owned subsidiary Zetes (Headquarters: Brussels, Belgium), has recently taken over the role of the company’s Chief Executive Officer.

Zetes is an international corporation specialising in the provision of identification and mobility solutions. Alain founded Zetes in 1984, and has

lead the company for over 35 years, developing it into a technology company specializing in supply chain optimization and citizen identification solutions. At present, Zetes employs over 1,300 people and is present in 22 countries across the EMEA region.

Furthermore, Alain played an important role in the deal to integrate Zetes into the Panasonic Group in 2017. The newly appointed CEO Pierre Lambert had been working closely with Alain to grow the company to where it is today.

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A Remarkable Growth for Gas Insulated Switchgear Market is Expected

A recent Gas Insulated Switchgear Market report offers a 360-degree overview of the market and factors promoting and demoting growth, accompanied by challenges and upcoming opportunities. Here is a glimpse of the report...

As per a recently published report by Fortune Business Insights, titled; “Gas Insulated Switchgear Market Size, Share and Industry Analysis, By Voltage (Up to 66 kV, 66 kV - 170 kV, 170 kV - 550 kV, and Above 550 kV), By Installation (Indoor and Outdoor), By End User (Utility, Industrial, Commercial, and Others), and Regional Forecast, 2019-2026;” the market value stood at USD 21.13 billion in 2018 and will rise at a CAGR of 7.2% during the forecast period, 2019 to 2026.

The global Gas Insulated Switchgear Market size is projected to reach USD 36.60 billion by 2026 on account of the increasing demand for energy worldwide. Gas insulated switchgear is a substation with high voltage – wherein major electrical equipment is placed in a sealed environment with an insulating medium, i.e., sulphur hexafluoride gas or SF₆. All electrical switching equipment such as busbars, earth switches, isolators, circuit breakers, and others are completely enclosed inside modules filled with the SF₆ gas.

Regional segmentation

Geographically, Europe will hold the dominant gas insulated switchgear market share on account of upgradation of hydropower plants, increasing power consumption, and government initiatives that were taken for improving grid infrastructure. Additionally, the increasing investments in the expansion of distribution and transmission networks will help Asia Pacific hold a notable share. Besides this, the North America market will witness significant growth on account of major investments made for the enhancement of transmission, distribution, and the overall performance of the generation of electric power for avoiding losses. Most companies located in this region are acquiring their substation for efficient and reliable power transmission that will ultimately add significant value to the regional market.

The Middle East and Africa market, on the other hand, will rise remarkably on account of the dominance of oil and gas plants that further emphasizes the enhancement of distribution and transmission of electric

power. Countries in Africa are emphasizing on increasing their grid infrastructure for aiding in the expansion of the market in the forecast period.

Market drivers

Factors adding momentum to the gas insulated switchgear market growth include the increasing demand for energy and power, rise in construction and upgradation of the power grid, and the rise in investments in transmission and distribution infrastructure. On the contrary, factors such as the high cost of equipment and stringent government laws imposed on environment and safety regulations will affect the market negatively. Nevertheless, the increasing focus on renewable energy production is likely to create lucrative growth opportunities for the market in the forecast duration.

Competitive landscape

Players operating in the global market for gas insulated switchgear are adopting various strategies to gain a competitive edge in the market. These strategies include mergers and acquisitions, contracts, agreements, and partnerships, joint ventures, and others. Players are also investing heavy amounts on the construction of new substations for attracting high gas insulated switchgear market revenue in the forthcoming years.

A few key developments

November 2018 – Bergenshalvoens Kommunale Kraftselskap (BKK Nett) awarded a contract to Siemens Energy Management for supplying the world’s first SF₆-free GIS with vacuum and clean air interruption systems for a voltage level of up to 145 kV.

December 2019 – Italy’s Transmission System Operator (TSO) awarded a USD 100 million contract to ABB for supplying GIS and building – high-voltage substations in Obermooweler, Baden-Wuerttemberg. 

For further information: <https://www.fortunebusinessinsights.com/enquiry/request-sample-pdf/gas-insulated-switchgear-market-103092>

Global Switchgear Demand is Expected to Rise

The switchgears are used by residential, commercial and industrial end-users. According to a recent report from the Reportlinker.com, Asia Pacific was the largest region in the switchgear market in 2021. Western Europe was the second-largest region in the switchgear market...

The switchgear market consists of sales of switchgears and related services that are used in various applications such as in transmission and distribution utility, residential, commercial and industrial. A switchgear refers to collection of the switching devices that are used for controlling, protecting, and switching the electrical circuits and equipment.

The global switchgear market is expected to grow from \$72.08 billion in 2021 to \$82.24 billion in 2022 at a Compound Annual Growth Rate (CAGR) of 14.1%. The growth is mainly due to the companies rearranging their operations and recovering from the COVID-19 impact, which had earlier led to restrictive containment measures involving social distancing, remote working, and the closure of commercial activities that resulted in operational challenges. The market is expected to reach \$128.01 billion in 2026 at a CAGR of 11.7%.

Types of products

The main product types of switchgear are high voltage, medium voltage and low voltage. The products are installed indoor and outdoor as Gas-Insulated Switchgear (GIS), Air-Insulated Switchgear (AIS) and others.

GIS (Gas-Insulated high-voltage Switchgear) is metal-encapsulated switchgear that contains high-voltage components such as circuit breakers and disconnectors and can be safely operated in confined spaces. Extensions, city buildings, roofs, offshore platforms, industrial plants, and hydropower plants are all examples of places where GIS is used.

Market drivers

The demand for electricity generation is projected to drive the switchgear market. The availability of electricity has become essential for economic development and poverty alleviation.

Development of industrialization, urbanization requires continuous electricity supply, and the reliability of the electrical supply depends heavily on the performance of the switchgear. Therefore, the demand for electricity generation is driving the demand for switchgear in the forecast period.

For instance, global demand for electricity rises at 2.1% per year to 2040 in the Specified Policies Scenario, double the rate of primary energy growth by 2040.

Risk factors

Unstable prices of raw materials are restraining the growth of the switchgear market. Price fluctuation is due to the availability of low-quality materials at cheaper prices. The use of low-quality products increases the risk of breakdown of insulation layers or short circuit conditions and other failures. Thereby inconsistent pricing in raw materials of the switchgear is expected to hinder the market growth.

Encouraging factors

The last few years witnessed a rising demand for installation of electric substations to restore normal power supply as fast as possible in case of emergencies. The installation of mobile substations enables the restoration of electricity under outdoor conditions or in unforeseen circumstances and is functionally designed to provide temporary power supplies as soon as possible.

Also, these mobile substations incorporate generator, transformer, metal-clad switchgear, outdoor load break switches and breakers, which are used for network extensions, and temporary switching stations. For instance, Siemens delivered two mobile substations for national grid SA, and Aktif group delivered 10 mobile substations to the ministry of electricity Iraq.

Final words

Therefore, increasing the adoption of mobile substations is one of the latest trends that will positively impact the switchgear market.

In January 2020, Siemens Ltd, a Germany-based engineering and electronics company acquired C&S Electric Limited for Rs 2,100 crore (294.4 million). With this acquisition, Siemens aimed to cater to the demand for reliable and efficient power supply in India. C&S Electric Limited is an India-based switchgear and power equipment manufacturing company. 

For further information: https://www.reportlinker.com/p06247501/?utm_source=GNW

Use of Additives for MITIGATING EMISSIONS

This is to comment on P.K. Chatterjee's judicious article from December 2021 in Electrical India "MITIGATING EMISSIONS from Coal-based Power Plants"...

Although it may become almost unrecognizable in the next 25 years, I believe coal derived baseload power will be with us for a very long time. And my beliefs are bolstered by the fact that almost every country on earth is expanding the role of coal in their energy supply futures.

It is obviously important to mitigate the emissions from combustion-based power plants using the best available and affordable technology. It is clear why countries turn to coal for electricity production, it is cheap, available, and reliable, and while it has its share of emissions problems, we continue to improve ways to mitigate them. Regulating emissions is certainly a necessity but doing so specifically to eliminate the use of a specific resource is, at best short sighted and at worst, totally misguided.

In this article, I will discuss the use of additives and how they might fit in as cost-effective methods to curtail worldwide emissions directly at the source

'inside the fence'. I will also introduce our product line of efficiency and emissions mitigation additives that can serve as cost-effective alternatives to very capital-intensive hardware emissions equipment. Of course, with efficiency, (lower CO₂ and cost) as a major driver these days, additives can also find use as adjuncts in fully equipped facilities with hardware emissions mitigation.

The additive approach to emissions mitigation is not new with particulates, SOx, NOx, CO, mercury, lead, aerosols, and HAPS all being the targets of government regulation, industry oversight, and public opinion over many decades. Additive usage often precedes expensive hardware mitigation and there are hundreds of patents touting additives as the solution to coal emissions problems. However, as I talk to people in the industry, I get regaled with stories of miracle additives that didn't really work out when comprehensively tested. As a chemist I know that catalysts can do some amazing things, however, they offer

certain challenges such as temperature specificity, and limitations such as sensitivity to poisoning that must be considered. My catalysis experience at Exxon Research and General Motor Research have provided me with a unique background to help me address these challenges and limitations.

Over the last four decades the additive approach to mitigation has been all but superseded by use of hardware solutions that, while they are very good at mitigating emissions, their capital expense and operating costs leave them unobtainable in many places and applications.

We have developed two additives to improve the profile of coal emissions. The first, CETALYST, is an oxidation catalyst designed to provide a Heat Rate Improvement (HRI), by:

- Providing a quicker heat release from the fuel
- Permitting operation with reduced excess oxygen with reduced LOI, (lower pumping and sensible heat losses)
- Providing the engineers with a wider operating window

The components of our patent protected product were carefully designed to be environmentally friendly and safe to both humans and the boilers to which they are introduced. With an application rate of 0.5-2 pounds per ton of coal, the catalyst can demonstrate an HRI of 1-3%, dramatically reduce carbon PM 2.5 particulate emissions, and reduce the other criteria emissions, NOx, SOx, CO, and Mercury as well. This type of coal oxidation catalyst is not a new idea, but its individualistic design is. The catalyst is tailored for the chemical environment afforded by the coal used and the furnace configuration.

Our second product, CENOX, is a calcium-based absorbent designed to absorb SO₂, NOx, mercury and lead as well as acid aerosols. It is a fine dry powder that is utilized as a post combustion Dry Sorbent Injection (DSI) product. It works by forming tiny, hollow, porous cenospheres that have a very high surface area and a great affinity for absorbing most of the criteria pollutants. This type of chemistry is used in incinerators to remove flue gas NOx, SOx, and acids.

We are currently looking for strategic partners for further testing and additional investment. Interested parties should feel free to contact me.

Chatterjee does a good job at describing the emissions at power plants including CO₂ and the criteria pollutants that include particulates (PM2.5 and below), NOx, SOx, CO, and heavy metals (mercury and lead). He also makes

it clear that the solutions for some of these problems in India is NOT to spend hundreds of billions of rupees to retrofit the existing power plants.

Chatterjee stated “Recently, to fight the chronic winter smog, India has temporarily shut down five coal-fired power plants around the capital New Delhi, which is one among the world’s most polluted capital cities. There are other such instances.”

He goes on to explain the approaches taken in India “High efficiency Electrostatic Precipitators (ESPs) have been installed to capture Particulate Matters (Fly ash) from Flue gases. Low NOx burners have been installed for reducing NOx emission from flue gases. SO₂ emission control is achieved through dispersion of flue gases through tall stacks (275 metres) to reduce the concentration of polluting gases at ground level.

Concerning newer coal plants Chatterjee explains, “In India, supercritical technology has already been adopted for thermal power generation. The design efficiency of supercritical units is about 5% higher than typical 500 MW subcritical units. They have comparatively low fuel consumption and CO₂ emissions in ambient air. All future projects (if at all) will have supercritical technology.”

Supercritical technology uses higher steam temperatures and pressures in the heat exchangers, which are post combustion. There is an additional Heat Rate Improvement possible, during the combustion process, whether it’s a subcritical or supercritical plant, with the simple addition of a combustion catalyst.

Chatterjee and everyone else would have to agree that any additional Heat Rate Improvement for little or no cost is very desirable.

India has a tough monetary balancing act on its hands. They are using expensive ESPs, to address smoke and fly ash particulates, in certain key locations. However, they are not installed country wide, and they are not using bag filters for particulates, scrubbers for SO₂ (and mercury) or SCR units for NOx (and mercury). Why? Because the cost of the equipment and operating expenses are simply, too high. Perhaps there is an additive solution in India’s future. 



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OUR JOURNEY TOWARDS NET-ZERO EMISSIONS

Putting in the simplest way, 'net zero' means to achieve the balance between the amount of greenhouse gas produced and the amount removed from the atmosphere. We reach net zero when the amount we add to atmosphere is not more than the amount removed. Globally, all nations are now trying to achieve this equilibrium.

How is India doing?

- P. K. Chatterjee (PK)

Whether India will be able to achieve its ambitious target of net-zero emissions by 2070 that is a debatable question, however, the current trend of public, private and public-private-partnership (PPP) for developing renewable energy-based projects is quite satisfactory. Some of the recent projects show our nation's inclination and intention towards adopting clean energy and I am quite optimistic that the process will continue.

Although electricity generation contributes to around 25% of CO₂ (equivalent) generation, more amount (around 29%) of CO₂ (equivalent) originates from the transportation sector, which can be reduced through introduction of Electric Vehicles (EVs). However, as far as the mass-scale deployment of EVs on the Indian roads is concerned, besides others, the most prominent challenge is the lack of availability of charging stations.

Thus, in this article, I will talk about a few of the recent projects that reflect our nation's burning desire and active action to scale down our country's carbon footprint.

Running an airport completely on renewables

Cochin International Airport Ltd. (CIAL)'s Arippara Hydroelectric power



A view of the
Cochin International
Airport...

project was inaugurated by the Chief Minister of Kerala Pinarayi Vijayan on November 6, 2021. The plant is expected to generate 14 million units of power annually. On the occasion of inauguration of the plant, Vijayan revealed that his government's intension is to implement low-cost environment-friendly power projects based on non-conventional energy sources in collaboration with local self-governments and co-operative bodies.

The power plant at Arippara is a landmark in the history of CIAL as it runs the airport fully on solar power. The entire world appreciates this solar power project. Considering almost the entire project was done along the river banks, it had to overcome multiple challenges including devastating floods of 2018 & 2019. The original design had to be modified at several areas during construction as a lot of extra precautions had to be taken. Like many other projects, it too had faced shortage of manpower during the pandemic.

This project was awarded to CIAL by the State Power Department as per the Kerala Small Hydro power policy under the Build-Own-Operate-Transfer (BOOT) basis for a lease period of 30 years. CIAL has constructed a weir dam across Iruvazhinji River and hydro-mechanical and electro-mechanical systems at Arippara, near Kodencheri in Kozhikode district. It is expected to generate around 1.08 lakh unit of power a day during peak flow days and is estimated that the plant could be running with full capacity for 130 days in a year.

As it is a run-off of the river project, the CIAL small hydro project works on limited storage of water, thus, it is in no way harmful to the environment.

Cement company progresses on its energy commitment

As part of its long term commitment towards renewable energy transition, Dalmia Cement (Bharat) Limited (DCBL), a leading Indian cement major and a subsidiary

of Dalmia Bharat Limited, has recently added its ground-mounted solar power plant capacity to 17.1MW (from 2.4MW in 2014), in Cuttack (Odisha). Spread over 49 acres, the solar power plant is set to generate 25.52 MU/PA, to be utilized for the energy requirements of its Kapilas Cement Manufacturing Works (KCMW), Odisha.



Dalmia Cement has increased capacity of its solar plant in Cuttack...

Furthering Dalmia Cement (Bharat) Limited's sustainability goal of becoming carbon negative by 2040, this initiative will enhance the plant's energy efficiencies. The 17.1 MW plant aims to reduce KCMW Cuttack plant's day-time power requirement dependency on fossil fuels by over 40% and replace it with a clean, emissions-free, and renewable energy source.

Commenting on the development, Ganesh Jirkuntwar, National Manufacturing Head of Dalmia Cement Bharat Limited, said, "As one of India's leading cement companies, we remain committed to responsible environmental stewardship by providing green building solutions and embedding sustainable mechanisms within our organizational value chain. We see the solar power plant expansion at our KCMW plant in Cuttack as providing the right impetus for our endeavours to continually adopt the cleanest and most economical fuel.

We are confident that this move will help bolster DCBL's sustainability target of RE100 by 2030 as we march towards taking our overall installed cement capacity to 110 -130 million tonnes by 2031."

This project was executed in a record time of two and a half months and will reduce conventional power consumption by 27%. Power consumption from the solar plant will ensure seamless production at the KCW, Cuttack plant, especially during emergencies such as preventive maintenance or breakdowns.

Drawing attention on the effort to transiting to solar energy, Bhavesh Wala, Plant Head at Dalmia Cement (Bharat) Limited, KCMW (Cuttack), said, "By shifting to solar power and other renewable energy sources at our facility, we are progressively reducing our overall carbon footprint while meeting our sustainability commitments and heading towards RE100 by 2030. This will also enable us to meet our capacity expansion plans over the years for which we see a balanced energy mix as a key advantage."

In line with its business philosophy – Clean and Green is profitable and sustainable – Dalmia Bharat reduced its carbon footprint by 22% in the last decade while growing three times to double its profitability. Today, the company has one of the lowest carbon footprints globally and is committed to becoming carbon negative by 2040.

Private companies collaborate to set up EV Charging infrastructure

Tata Power has recently collaborated with Rustomjee Group to provide end-to-end EV charging solutions across all its residential and commercial projects in Mumbai Metropolitan Region (MMR). Under this collaboration, Tata Power will install dedicated charging infrastructure for residents of Rustomjee in Mumbai MMR. EV owners

will have the access to a 24x7 charging facility along with maintenance support. Customers can connect through the Tata Power EZ Charge mobile application for all services including remote vehicle charging monitoring & e-payments. The partnership will enable Rustomjee residents' access to a uniform and ubiquitous EV charging experience.

This customized EV charging solutions form the infrastructure backbone for a growing EV ecosystem and provide customers access to energy-efficient options with ease. The company through its Tata Power EZ Charge offering has already set up over 100 EV charging points in Mumbai and over 1300 charging points across the country.

Talking about the collaboration, Sandeep Bangia, Head- EV, Tata Power said, "We are happy to partner with Rustomjee Group and feel our collaboration will hasten the transition to EV adoption in Mumbai. It's a step towards decarbonizing the transportation sector and making EVs more mainstream."

Haroon Siddiqui, Vice-President – Corporate Head, MEP, Rustomjee Group, said, "At Rustomjee, we are always looking at working towards building a sustainable society for all of us to co-exist in, this collaboration is yet another step in that direction. We are happy to collaborate with Tata Power and work towards co-creating a better future for all of us. This association is a small step towards the larger goal of a carbon-free tomorrow".

Tata Power has been rapidly setting up EV charging infrastructure across the country, helping India adopt environment-friendly mobility. The company already has a partnership with Apollo Tyres, HPCL, TVS Motors, amã Stays & Trails and others to set up and enhance the EV charging infrastructure. It has deployed over 1300 EV charging points across different cities under the EZ Charge brand along with a digital platform to facilitate an easy & smooth customer experience.

Final words

Although the CORONA pandemic has made our progress slow during the last more or less two years, our country has done a lot in this period. The way our industries are working to fulfil our prime minister's commitment in COP 26, I feel, it is excellent.

Although the Indian industry is divided into many sectors and segments, each category is related to many others, thus, more and more cross sectoral partnerships will help in reaching towards the goal faster.

BI



Representative Image: Tata Power has been rapidly setting up EV charging infrastructure across the country...



Reliable Power Systems



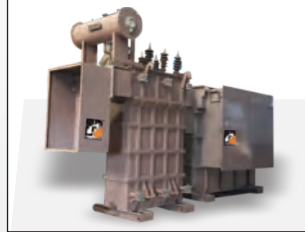
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- ELECTRICAL CONTROL PANELS
- ACTIVE HARMONIC FILTER AND DYNAMIC VOLTAGE STABILIZERS



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3150 kVA Transformer with OLTC 33 KV / 0.433 KV



50 KV Isolation Transformer



Rectifier oil cooled



IGBT Based Rectifier



Electrical Control Panel



Dry Type Transformer 11 KV / 0.433 KV



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**“THE INDUSTRY SHOULD
HOLISTICALLY LOOK
AT THE NET COST
OF THE SYSTEM...”**



Since the early 1980s, Wartsila Pvt. Ltd. (Wärtsilä) has contributed immensely to the Power Segment of India. The company has 30 years of experience in providing complete lifecycle power solutions to the Indian Marine & Energy markets. In an exclusive e-interview, R. Venkatesh, Managing Director & Director Energy Business, Wartsila, India, is communicating his views on the present scenario and needs of the Indian Power Sector to P. K. Chatterjee (PK). Excerpts...

What's your comment on the Indian government's mission to achieve Net Zero carbon emissions by 2070 through renewables' capacity additions?

Renewables are challenging thermal. The government has ambitious targets for renewables. Coal usage will become less in India in times to come but it will remain as solar and wind cannot be available all the time. Coal will continue to be the baseload for some time to come.

More focus is required on renewables. There is a need to have a clear policy on battery storage solutions for renewable energy. Earlier, there were power shortages, but now that India has achieved near adequacy, there is a need to focus on quality of reliable power. Battery storage solutions are required for efficient transmission and distribution in order to achieve grid stability. They can also be used in another scenario, where (say) there is no way to absorb power. Hence, battery storage equipment manufacturing will play a crucial role going ahead.

We are also in discussion with various states, utilities and regulators regarding the role that renewables can play in meeting future electricity needs and strategies to efficiently

integrate renewables in the grid. The industry should holistically look at the net cost of the system and not just at the variable cost.

How will the energy storage market grow in India in the next 5 to 10 years?

Wärtsilä is leading the transition as the Energy System Integrator – we understand, design, build and serve optimal power systems for future generations.

Wärtsilä acquired Greensmith Energy Management Systems Inc., a market leader in grid-scale energy storage software and integrated solutions. This acquisition has enabled us to rapidly expand our footprint in the energy storage market globally and position us as a premier energy system integrator.

We have introduced a new hybrid solar PV and storage solution. It integrates solar PV generation and storage to deliver a true ‘renewables as baseload’ solution that is not only climate-friendly, increases resilience and efficiencies but also can be supported by a power producer’s existing grid infrastructure. As our global energy ecosystem evolves, hybrid solar represents a ground-breaking approach to electricity production and power generation.

The energy storage market is already growing rapidly with the advent of new plants and more storage capacities that are in the pipeline. The Ministry of Power has already announced its plan to install 4000 MWh of storage capacity across 4 regional load dispatch centres. Furthermore, as more corporates begin to adopt renewable energy, the energy storage market will gradually grow to help balance the chain of supply and demand. Adopting new modes of energy can take time, especially in a country like India as the energy system is heavily dependent on fossil fuels but over the next 5-10 years, we expect to see noticeable growth in the energy storage market.

How has Wartsila geared up to support the government’s missions?

Wärtsilä leads the transition towards a 100% renewable energy future. We help our customers in decarbonisation by developing market-leading technologies. These cover future-fuel enabled balancing power plants, hybrid solutions, energy storage and optimisation technology, including the GEMS energy management platform. Wärtsilä Energy’s lifecycle services are designed to increase efficiency, promote reliability and guarantee operational performance.



Wartsila to support renewable energy in India through storage systems...

Back in the mid-2000s, we started to see the potential of renewables and developed our solutions towards that. We have been talking about the use of flexible gas-based engine power plants to help integrate renewables in the power system for the past 15 years, and now the engine power plants are an important element in providing flexibility and reliability to power systems with renewables. We have seen various power systems, in various markets for a long time, which can provide a lot of insights due to our vast experience.

It’s important for a company like ours to go to our customers with fact-based solutions. That’s where things like the Wärtsilä Energy Transition Lab (<https://www.wartsila.com/energy/transition-lab>) or the Atlas of 100% Renewable Energy (<https://www.wartsila.com/energy/towards-100-renewable-energy/atlas-of-100-percent-renewable-energy#/>) come in to play.

Wärtsilä supports integration of renewable energy through solutions that provide the required system flexibility, i.e., flexible engine-based power generation, energy storage and in the future, new technologies such as Power-to-X. Together with flexible balancing power plants, future fuels can meet the critical demand for long-term storage solutions that balance grids in an affordable and sustainable way. That is why Wärtsilä is investigating, researching future fuels and helping develop Power-to-X technology.

In India, we are directly engaging with stakeholders, be it states or utilities, to educate and help them bring clarity to their own planning processes and decision-making. We want to help them in making the right decisions and prepare them for the future, and that is what we will continue to do. We are in discussion with various states, utilities, and regulators regarding the role that renewables can play in meeting future electricity needs

Energy plants to be created to manage supply and demand of sufficient energy...



and strategies to efficiently integrate renewables in the grid. The industry should holistically look at the net cost of the system and not just at the variable cost.

What are your most advanced solutions to optimize the power generation assets?

Wärtsilä is a global leader in smart technologies, and both energy storage and engine power plants are part of our offering. Both energy storage and flexible gas-based engine power plants will play key roles in transitioning power systems towards a 100% renewable future. While energy storage solutions will provide daily balancing, gas-based engine technology can ramp up and ramp down fast to accommodate the fluctuating renewables, especially during longer periods.

In order to reach a power system running on 100% renewable energy, there is a need to develop new solutions. Wärtsilä is investing and developing Power-to-X solutions and exploring opportunities with green hydrogen. Power-to-X allows the creation of carbon neutral synthetic fuels, by capturing carbon dioxide and combining it with hydrogen extracted from water. Hydrogen will be a key building block in future power systems and can be used as is or further processed into other synthetic fuels, such as methane and methanol.

Our engines can currently run on natural gas, biogas, synthetic methane or hydrogen blends of up to 25% hydrogen. This development is part of the company's strategy to future-proof its engine technology in line with the global trend towards decarbonisation of the energy and marine markets. In addition to hydrogen,

other potential renewable synthetic fuels are being studied for future applications, and Wärtsilä engines are already capable of combusting 100% synthetic carbon neutral methane and methanol.

Which are the most significant projects in India that currently you are working on?

In India since the early 1980s, Wärtsilä has contributed immensely to the power segment. Wärtsilä has 35+ years of experience in providing complete lifecycle power solutions for the Indian Marine & Energy markets. As a leading solutions provider of rapid and flexible power plants for Utilities, Industry and IPPs, the Wärtsilä name is now synonymous with decentralised energy market.

Wärtsilä has delivered around 250 power plants to India with total output of over 3,500 MW. Wärtsilä takes care of the operation and management on behalf of its customers in over 35 power plants with a total output of over 1,300 MW in India.

Amongst the projects underway, there are couple of them in North-East India, which are significant. We have supplied a 70 MW Smart Power Generation Plant to Assam Power Generation Corporation Ltd. This includes seven Wärtsilä 34SG engines running on natural gas. Another one is our recent 30MW power plant for Oil India, a premier Indian National Oil Company, which will be delivered under a full engineering, procurement, and construction contract. We won this project through International Competitive Bidding Process.

Globally, our track record comprises 74 GW of power plant capacity and more than 80 energy storage systems delivered to 180 countries.

Will India be able to achieve 500 Giga Watt (GW) renewable energy capacity before the deadline of 2030?

Indian power sector is undergoing a significant change that has redefined the industry outlook. Sustained economic growth continues to drive electricity demand in India. The Government of India's focus on attaining 'Power for all' has certainly accelerated capacity addition in the country.

The highlight of the year gone by certainly has to be the total installed renewable energy capacity in India, excluding large hydro, crossing the milestone of 100 GW. India today stands at 4th position in the world in terms of installed renewable energy capacity, 5th in solar and 4th in wind in terms of installed capacity. This is a

commendable achievement as the country aims to have 500 GW of renewable energy capacity by 2030. Having said that integrating renewables in a cost-effective manner is an area that needs attention.

What should be the ideal energy harnessing model to achieve India's overall green energy target?

Through the year gone by, we have conducted multiple modelling studies, which have further reinforced the need for flexibility in the system and highlighted the accomplishments and the areas which need immediate focus going forward.

India will need more market-based reforms to achieve the green energy target announced by our Hon'ble Prime Minister. Our joint study with KPMG on Electricity Market Reforms for procurement of ancillary services unveiled the current status of the ancillary services market in India along with recommendations. It demonstrates that supply-side flexibility is needed at the pan India level for an efficient and cost-effective

integration of 500 GW of renewables by 2030. However, a step change is required in the way ancillary services markets are procured and markets are structured in India. Moreover, the pricing of ancillary services should also encourage investments in the desired flexible generation technologies. India's power grid could benefit immensely by jointly procuring the energy and ancillary services (co-optimized) in the same day-ahead and real time market, while tightening resource adequacy rules. The state-level analysis of RE rich states included in modelling revealed that the addition of 1,000 MW of thermal balancing power plants, together with 500 MW 4-hour of battery storage in the electricity mix in each state, even in 2021. This optimizes the existing power plants' dispatch for better efficiency, lower O&M costs, and reduced renewable curtailment and projects a cost savings of at-least Rs. 3.2 – 7 crore per day for each modelled state. Thermal balancing plants have the capability to achieve 100% loading in less than 5 minutes.

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ENERGY SECURITY AND GHG MITIGATION PART 1



Two of the biggest challenges humans are continually facing in this century are ‘waste disposal’ and ‘climate change’. This trend is unlikely to change unless some serious action is taken. India with its fast urbanising population will be at the forefront of this challenge. ‘Waste Disposal’ often seems like a futile argument but very few people realise the gravity of the problem. At 500g per person, India produces about 6.5 million tonnes of waste, every single day. Thanks to the adoption of a western lifestyle, we are seeing an exponential growth in waste generation. Landfill and incineration processes do not ease our problem as they emit more greenhouse gases and pollute our air. A sustainable waste management system blended with the adoption of a much cleaner fuel, Hydrogen, can help overcome much of the problems we are going to face in the near future. Hydrogen sourced from energy recovery processes and conversion of waste materials is a clean and green alternative. Waste-to-hydrogen, therefore, can become a part of the zero-carbon future energy mix and serve as one of the cleaner hydrogen sources, which is economically viable and environmentally friendly...

We have arrived a long way from the days when people debated whether global warming is real, some of us would ridicule our ageing nerves and heightened perceptions for it. The days people debated whether global warming is anthropogenic-contributed by human activity are long gone. There was a time when countries debated whether they need to mitigate aggregate or per capita GHG emission to reduce long term global average temp rise by 2 Deg Centigrade. Now we stare at runaway global warming, the frightening prospects of white layers of glaciers melting and the earth as a consequence receiving more heat, the corpses lying under deep snow cover exposed rotting and emitting more methane thickening the GHG layer further. As a result, the target of long term global average temperature rise is stiffened to 1.5 Deg Centigrade and countries have declared their dates to achieve Net Zero. India has declared 2070 as the year to achieve Net Zero. As per a Deloitte report,

climate change is a 35 Trillion threat for India and a 11 Trillion dollar opportunity. Thus 46 Trillion Dollars is up for grab [6].

Fourteen out of the world's most-polluted 20 cities are in India			
City	*PM2.5	City	*PM2.5
Kanpur	173	Gurgaon	113
Faridabad	172	Jaipur	105
Varanasi	151	Patiala	101
Gaya	149	Jodhpur	98
Patna	144	Baoding	93
Delhi	143	Ulaanbaatar	92
Lucknow	138	Hengshui	87
Agra	131	Xingtai	87
Mazaffarpur	120	Anyang	86
Srinagar	113	Liaocheng	86

For a country with the dubious distinction of 14 out of top 20 polluted cities this could be a big win-win in the triad of energy autonomy, environment and economy.

In order to meet the targets of the Paris Agreement it was necessary to reduce the energy related CO₂ emissions by almost 3.5% per year till 2050, followed by more reductions eventually. Considering additional reductions from direct use of renewables, 75% share is increased whereas when energy efficiency is added, the share increases to 90%. The Indian government committed to deploy expansive solar and wind energy capacity and foster the necessary climate actions to forge a low carbon future. Due to the arduous efforts of the government, India made remarkable progress in meeting targets of Paris Agreement. India has committed to achieve about 40% of cumulative electric power installed capacity from non-fossil-fuel energy resources by 2030. The prime minister of India has committed in the UN's climate Week in New York to a target of 450 gigawatts (GW) of renewable energy installations, likely by 2030-equivalent to five times more than India's current installed renewable capacity (82.6 GW) and bigger than the size of India's electricity grid size in 2019 (362 GW). India aims to reduce the emissions intensity of its GDP by 33 to 35% by 2030. Over the period of 2005-2014, India's emission intensity has reduced by 21%.

Yet, Electricity constitutes only 18% part of India's total energy consumption, which can be decarbonized using RE. Balance 82% includes hard to abate sectors like Oil Refining,

Steel, Cement, Fertilizers, Transport etc. Some of them can't be fully decarbonized as they need decarbonisation to meet the COP 26 commitments. Besides, India's installed capacity at about 392 GW including about 150 GW RE including large hydro. Maximum peak load is hardly 200 GW and baseload is much less. The COP 26 target of 500 GW RE entails substantial difficulties in Grid stability and is highly intermittent in nature. It requires energy storage to meet demand supply mismatch and make RE despatch available round the clock.

India imports more than 70% of its petroleum requirement, so has a huge energy security concern, which is bound to increase over the years. Disruptions like COVID or Russo-Ukrainian war may only aggravate the situation further. India's effort to tap its reserves of natural gas, KG Basin has not yielded the desired result. While there is growing demand for natural gas, which is a cleaner fuel in comparison with coal – besides it is fuel on the road (CNG), fuel for the kitchen (PNG), raw material for fertilizer plants and fuel for power plants CCGT with 55% efficiency. This situation can be improved if we tap methane from bio-waste and utilize to bridge the gap between demand and supply of natural gas. We can improve the situation further if we produce hydrogen from methane, hydrogen from natural gas and mix it with natural gas to increase heat value of the fuel besides reducing GHG emissions. 20-30% of hydrogen can be blended with Natural gas and can be used with existing engines and turbines.

Hydrogen Economy Perspective

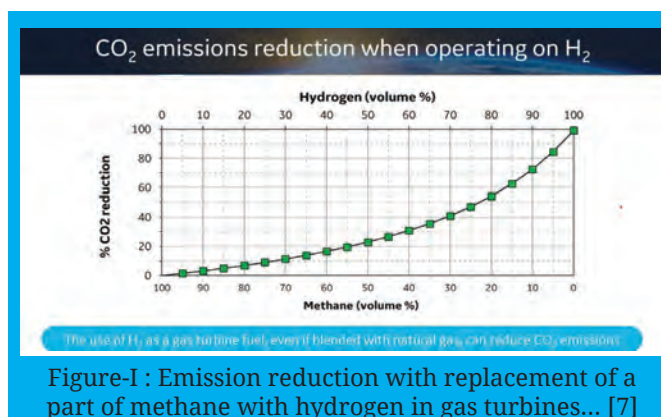
The perspective for hydrogen economy has to be understood keeping the above background in view. Hydrogen can provide required storage and also can supply baseload Power through Fuel Cell reducing dependency on Fossil fuels. Hydrogen Storage Systems (HSS) can provide large scale energy storage of the order of 1 GWh to 1 TWh, Batteries in contrast store between 10 kWh to 10 MWh, compressed air storage & pumped hydro between 10 MWh to 10 GWh. Converting excess power to Hydrogen using when required in microgrids for desired application at convenient locations.

As a step in this direction on August 15, 2021, during the 75th anniversary of India's independence, Prime Minister Narendra Modi announced the commencement of the National Hydrogen Energy Mission (NHEM), with the goal of reducing carbon emissions and increasing the use of renewable energy sources. The mission's broad goal is to increase Green Hydrogen production

Hydrogen

and promote its applications while also aligning India's efforts with worldwide best practices in technology, policy, and legislation. The NHEM has identified pilot projects, infrastructure and supply chain, research and development as broad activities for investment proposing a financial outlay of Rs 800 crores for the next three years. NHEM targets to utilise the abundantly available Hydrogen element for clean energy initiative.

- Hydrogen can help with energy time-shifting, peak load capacity substitution, load following, renewable dispatch and curtailment avoidance.
- The use of hydrogen produced for grid services and FCEVs could lead to a viable commercial solution.
- Studies indicate 18-20% hydrogen blended with methane reduces CO₂, CO, and total hydrocarbon (HC) emissions associated with NG burning.
- The lean burning capacity of natural gas will be extended due to the lean burn properties of hydrogen, and the lean burning capacity will rise with the amount of hydrogen added.
- The thermal efficiency of the hydrogen-added natural gas is improved due to hydrogen's excellent combustion characteristics. When hydrogen is added to natural gas, a higher percentage of energy is successfully used. Except for NO_x, all emissions were decreased to near-zero levels since hydrogen has no carbon particles.
- Many researchers have sought to reduce NO_x emissions, and they have done so by switching to a leaner mixture below 0.7 and recirculating exhaust



gas. This will lower the flame temperature, lowering the NO_x level without sacrificing thermal efficiency.

- The transportation industry is one of the most significant contributors of greenhouse gas emissions. Using hydrogen-added natural gas resulted in lower power output. As a result, further study is needed to make hydrogen competitive, as well as ascertain the environmental benefits of green hydrogen use in various industries. Research, development, and innovation are required throughout the value chain to reduce the cost of green hydrogen and to optimise it.

EnergyAustralia and GE are successfully innovating the country's very first power plant that can operate on a blend of natural gas and hydrogen. GE's highly versatile 9E.05 turbine is the right fit for this project, as it's hydrogen-capable and able to operate on a variety of fuels like natural gas and diesel – but also configurable for LPG, ethanol, bio-diesel, and more[8].

Colour of Hydrogen	Source	Method	Tons of CO ₂ released per ton of Hydrogen produced
Grey Hydrogen	Methane	Steam Methane Reforming SMR	09
Black/Brown Hydrogen	Coal/ Lignite	by Gasification	18
Blue Hydrogen	Hydrocarbons	Steam Methane Reforming SMR	04 The carbon dioxide produced is largely captured and is stored or utilised.
Pink Hydrogen	Nuclear Energy	Conventional electrolysis/ Thermochemical cycles/ hybrid technologies such as the high temperature steam electrolysis (HTSE).	0
Green Hydrogen	Solar, Wind	Conventional electrolysis	0
	Bio Waste	Themo-chemical involving gasification and pyrolysis.	Negative
		Biochemical ones (e.g., fermentation)	Negative

Table-I: Colours of Hydrogen

Hydrogen can be classified into four categories based on the source of production and carbon emission:

Green Hydrogen from Bio-Waste

In case of Hydrogen generation from renewable sources like bio-waste whatever CO_2 gets released was absorbed by plants during growth unlike fossil fuels. Hydrogen from waste can be produced in very cost-effective manner and also can help in waste management and unlocking precious Landfill sites. Also, it can utilise sewage sludge, agro-waste and other biowastes and avoid water contamination through leachate and air pollution and methane escaping with decomposition of waste. Additionally, the by-products like green manure, biochar etc., help in natural carbon sequestration by a reduction in use of synthetic fertilisers. Various wastes may include wet waste, organic waste, garden waste, jungle waste, sewage sludge, food waste, mandi waste, slaughter house waste, etc. These waste when these rot in landfills emit methane generated by the action of anaerobic bacteria. Methane has 25 times GWP in comparison to Carbon Dioxide. At COP 26 in Glasgow more than 100 countries signed the Global Methane Pledge to cut emissions by 30% from 2020 levels by 2030. Thus, this H_2 can be highly carbon negative.

The thermochemical processes of gasification and pyrolysis is faster than the biochemical fermentation has higher stoichiometric hydrogen yields, higher conversion efficiencies and shorter reaction times. However, biochemical processes are less energy intensive as they operate under moderate energy conditions leading to lower hydrogen yields. [1].

The picture below depicts one of the most widely used methods of Waste to Hydrogen wherein, the arrows

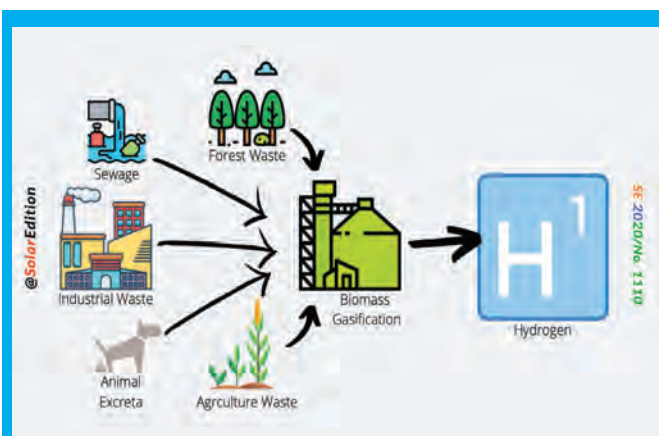


Figure-I : Emission reduction with replacement of a part of methane with hydrogen in gas turbines... [7]

indicate flow direction or transport from various sources. Ideal locations for the development of biochemical systems would be the ones closest to the sources of raw materials in order to limit various operation and transportation costs.

The popular methods for converting Biomass and Waste to Hydrogen are as follows:

- Gasification
- Plasma Gasification
- Pyrolysis
- TAD (Thermally accelerated Anaerobic Digestion)
- Converting waste/biomass to methane and then to Hydrogen.

These processes however, require biomass and residual waste to be treated before going forward with the above processes. But technologies like plasma gasification do not require any pre-treatment. The pre-treatment is mainly carried out in three different stages to separate the heavy metals, non-ferrous and ferrous metal.

...To be continued ⑤

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PHOTOVOLTAIC MANUFACTURING OUTLOOK IN INDIA -PART 2

As prolonged dependence on the imports raises the severity of the associated risks, India needs a sustainable, vertically integrated domestic solar manufacturing ecosystem. In addition to the PV manufacturing landscape, this article delves into other key aspects...

Several policy uncertainties (regarding Open Access, Net Metering regulations etc) in various states also can be attributed to the reduced demand.

FY2022 is expected to be a significant year for solar PV imports, owing to the resumption of construction activity of solar projects delayed in FY2021 due to the pandemic. The expiry of SGD in July 2021 also will enable a major uptake in imports. However, 40% Basic Customs Duty (BCD) applicable on solar module and 25% on cells from April 2022 is again likely to lead to lesser imports post-FY2022.

Domestic PV Manufacturing Landscape

Currently, India has a cell manufacturing capacity of 4.3GW and a module manufacturing capacity of ~18GW.¹² These are however, just nameplate capacities. Actual production output at any given time is significantly lower as most of India's solar manufacturing facilities operate at

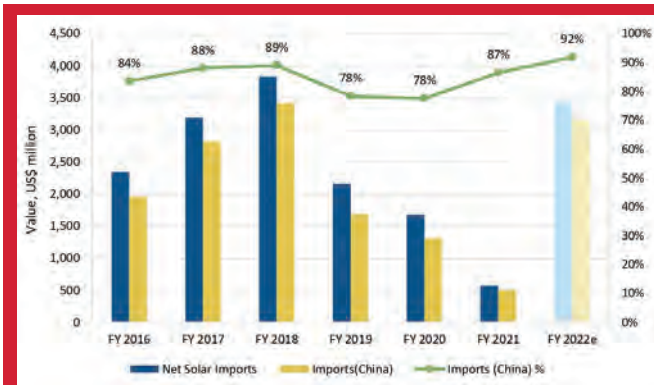


Figure 6: India Solar PV Import Trend
Source: Ministry of Commerce and Industry.

CUF 40-50% or less, as discussed in detail in the Key Challenges section of this report.

India has made substantial progress in expanding domestic module manufacturing capacity in recent years but greater impetus is needed to achieve the renewables target of 500GW₁₃ (300GW of solar) by 2030. Prolonged dependence on imports increases the potential for severe associated risks. Shortages of raw materials, power price hikes in China and surges in international freight charges pushed up module prices by more than 25% in 2021. This highlights the need to have sustainable, vertically integrated domestic solar manufacturing.

India has been a big laggard in manufacturing, not just upstream PV components such as wafers and cells but also of modules.

In May 2020, the Atmanirbhar Bharat Abhiyan (Self-reliant India) campaign was launched to benefit all sectors of the national economy. In line with this objective, the government approved the Ministry of New and Renewable Energy (MNRE)-proposed Production-Linked Incentive (PLI) scheme in April 2021 to encourage domestic manufacturing of globally competitive solar PV modules.

Despite major plans announced by several domestic manufacturers, to date there is no upstream manufacturing of materials such as wafers or ingots. So strong was the industry response to the PLI scheme for integrated manufacturing of “High Efficiency Solar PV Modules” – from domestic and international companies – that the government increased the PLI funding for the segment from Rs 4500 crore to Rs 24,000 crore. This scheme alone,



Figure 7: Stages of Solar PV Manufacturing

if judiciously implemented, can increase the integrated solar module, cell and wafer domestic manufacturing capacity several times over in the next three to four years.

Cell Manufacturing Capacity

As of November 2021, the total domestic cell production (nameplate) capacity in India was 4.3GW, or nearly a quarter of domestic module production capacity. Lack of vertical integration of domestic solar fabs is one reason for the gap between cell and module manufacturing capacities. Also, the demand for India-made solar cells is generally low because module suppliers demand cells of higher grade (in terms of wattage, efficiency etc.). Further, the narrow production scale of solar cell fabs means domestic cells are more expensive, so the general preference in cell demand is for the cheaper yet superior import counterparts.

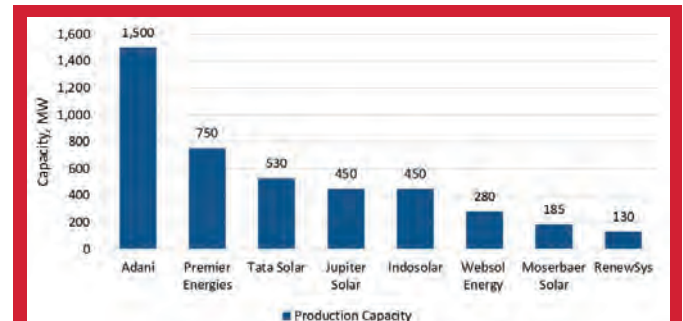


Figure 8: Leading Domestic Solar Cell Manufacturers in India (December 2021)
Source: JMK Research.

Module Manufacturing Capacity

Over the past five years (see figure 5), India has made substantial progress in solar manufacturing. Solar module manufacturing capacity has trebled from 5.8GW in 2016 to about 18GW in December 2021. However, as much as these numbers paint a positive outlook, there is still a long way to go in achieving self-sustenance.

Vikram Solar, with the opening of a new factory in Tamil Nadu, became India’s largest solar module manufacturer at 2.5GW capacity in mid-2021. Adani expanded its

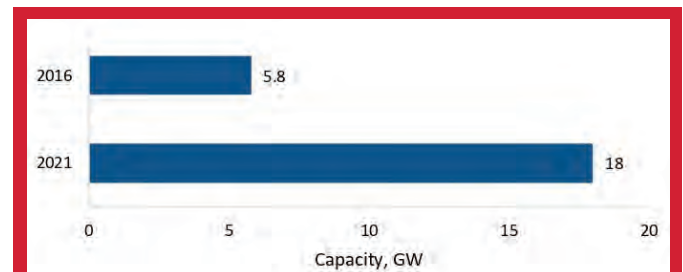


Figure 9: Domestic Solar Module Manufacturing Nameplate Capacity (2016 vs 2021)
Source: JMK Research.

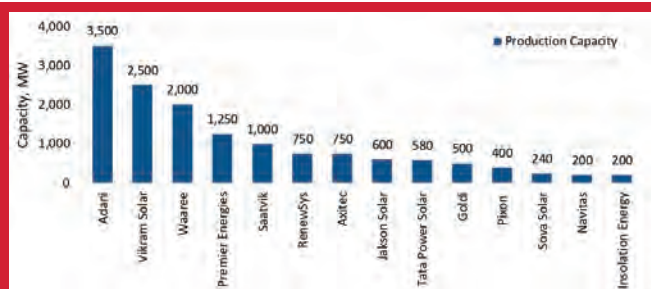


Figure 10: Leading Domestic Solar Module Manufacturers in India (December 2021)
Source: JMK Research.

solar fab by 2GW in December 2021, regaining its position as the largest domestic module manufacturer. As several leading companies have announced major expansion plans in solar manufacturing, it is highly likely that the domestic player rankings for cell and module manufacturing will change often in coming years.

It's also interesting to note that most of the solar module manufacturing is concentrated in a few states. Easy access to ports (for international trade), cheap land and available power near Special Economic Zones (SEZ) are among the reasons for the concentration of solar module manufacturing in these states. Gujarat will continue to host the majority of manufacturing capacity.



Figure 11: Domestic Solar Module Manufacturing Capacity by State
Source: JMK Research.

Wafer Manufacturing Plans

India has no existing manufacturing capacity for the initial stages of the PV value chain, namely from polysilicon to wafer. For raw materials, Indian solar manufacturers still depend on imports, mainly from China. China is the leading producer of silicon wafer with a 97.4% share of the global market, and polysilicon with 67% share.¹⁴

India cannot achieve self-sustenance in solar technology without a holistic and integrated manufacturing approach. Without large-scale domestic manufacturing of upstream PV value chain products,

there remain overarching risks of logistics and commodity price fluctuations posed by huge solar imports.

Several manufacturers now entering the field of solar manufacturing are looking to build an integrated facility that includes all PV value chain components from polysilicon to solar module. Among those looking at wafer manufacturing are big private Indian conglomerates such as Reliance and Jindal, as well as one of the world's biggest coal companies, Coal India. Reliance invested \$29 million in German wafer manufacturer NexWafe GmbH. Reliance will use NexWafe proprietary technology for manufacturing solar wafers in its coming PV factory in Jamnagar. There has been interest from U.S.-based CubicPV, a merger of 1366 Technologies and Hunt Perovskite Technologies (HPT), two disruptive technologies in the solar manufacturing domain – 1366 via its direct wafer process and HPT using Perovskite Crystal Technology. Credit must be given to the PLI scheme for the immense impact it has had on how businesses, domestic and international alike, view solar manufacturing in India.

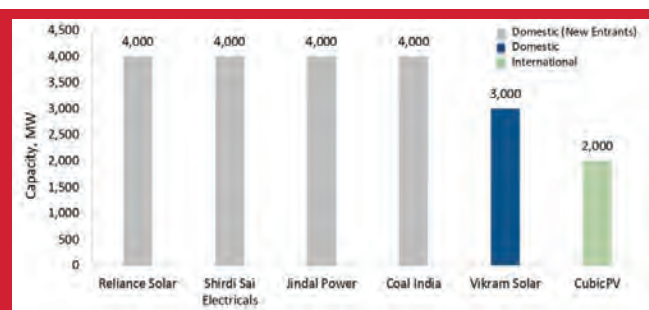


Figure 12: Wafer Manufacturing Plans (For Next 3-4 Years)
Source: JMK Research.

Addition of these capacities in the Indian solar industry in the medium term will be a welcome move to boost upstream solar manufacturing.

Domestic Manufacturers' Expansion Plans

Announcements in the past year by industry leaders or new entrants exploring the market indicate solar manufacturing will be a key area of growth domestically. Cumulatively, about 33GW of module and 29GW of cell production capacity are in the pipeline to add to existing domestic capacity by 2025.¹⁵ For domestic solar module manufacturing, this represents an impressive CAGR of ~30%. Despite the industry's short-term challenges, manufacturers are very optimistic about the long-term sustainability of the solar sector.

To reach the 500GW target of non-fossil fuel-based installed capacity by 2030, India needs about 30GW of solar installations each year. Current domestic output cannot meet such demand. Based on expansion plans announced by several manufacturers, it is estimated domestic capacity is likely to exponentially increase to fulfil that 30GW/year requirement by the end of 2023.

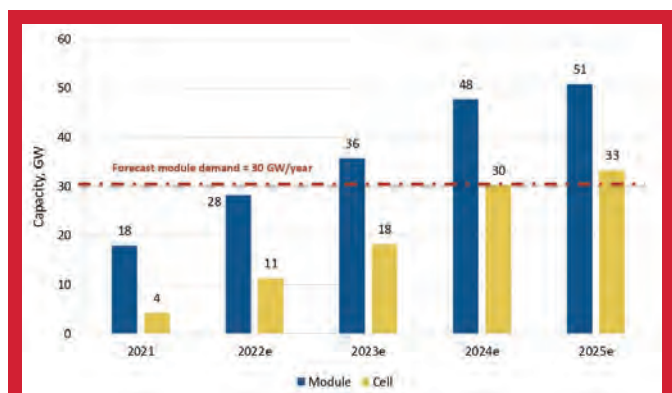


Figure 13: Proposed Cumulative Manufacturing Capacity (to 2025)

Source: JMK Research.

In this projected increase of solar manufacturing capacity in coming years, much will depend on the timely and efficient implementation of government policies.

New Entrants Looking to Explore the Market

Favourable scenarios for solar manufacturing have generated huge interest from several companies and these conducive conditions can make India a solar manufacturing hub in years to come.

- **Favourable government policy environment** – With the introduction of schemes such as PLI, Approved List of Models and Manufacturers (ALMM) and BCD, the government is betting big on making India self-sustainable in solar equipment. These schemes are either in the pipeline or have been implemented and the positive impact of the policies can already be felt. PLI tender for Solar PV manufacturing received bids worth 54.8GW against a total sanctioned bid of 10GW.
- **Augmentation of required demand** – India has promised to reach 500GW renewable energy capacity in 2030, including about 300GW from solar. To add about 30GW of solar capacity a year, existing and imminent players see the sense of keeping supply as close as possible to the demand.
- **Availability of raw materials** – Access to raw

materials such as polysilicon, wafers etc, critical to manufacturing of solar cells and modules, has been a major hurdle for Indian major manufacturers scaling up and competing with Chinese counterparts in price and quality. Impending entries include big Indian conglomerates such as Reliance Group and powerful state Public Sector Undertakings (PSUs) such as BHEL and Coal India (which declared plans for wafer and polysilicon manufacturing within the country). It seems highly likely that Indian manufacturers soon will not have to depend entirely on exports and contend with the risks associated with critical raw materials.

- **Easier financing options** – It is widely accepted that the quality of funding influences the selling price of the product. According to leading players, the outlook of investors, banks and Non-Banking Financial Companies (NBFCs) towards investing and lending funds/loans for solar manufacturing installations has changed. Loans are easily available at a stable 7-8%. Various firms are looking at going public, following the recent Initial Public Offering (IPO) of ReNew Power. Waaree Energies filed for IPO in September 2021, with approval awarded in January 2022. The issue size of the IPO will be Rs1500 crore (US\$201m), the proceeds to be used for new solar cell and module fabs.
 - **Predicted technological changes** – Over the years, cells and wafers have become bigger and more efficient and the underlining technology has evolved, e.g., from the once-dominant poly-Si to mono-Si at present. It is estimated that “mono PERC bifacial” will be the dominant technology in five years. Original equipment manufacturers (OEMs) around the world have prepared for this and the solar module and cell lines under construction are such that they can handle various cell and wafer size. Market entrants have an opportunity, if planned properly, to invest in a low-risk, high-profit business.
- Those entering solar manufacturing in India are targeting big installation capacities as well as upstream integration in line with what the Government of India (GoI) is trying to achieve with its PLI scheme for solar modules. India is currently not a hub of solar manufacturing but there is great potential, and confidence, in its solar growth story.

Renewable Energy

Major project developers such as ReNew Power and Avaada are entering the solar manufacturing space to exploit the advantages of vertical integration. As solar modules make up 50-60% of the total cost of solar projects, using in-house modules reduces the considerable risks and so overall project cost. Most of the coming plants are in coastal states with easy access to ports. ReNew Power's under-construction integrated solar cell and module fab has a capacity of 2GW. Avaada Group intends to set up a 5GW integrated solar cell and module manufacturing unit. The trend of project developers venturing into solar manufacturing to have better control of their input costs is expected to grow in the coming years.

Coal India, one of the biggest coal suppliers in the world, will install 4GW of integrated wafer, cell and module manufacturing fab in India. India's largest power generation equipment manufacturer, BHEL, has begun solar module manufacturing. Clearly, Indian PSUs that have long been associated with conventional sources of energy have realised the significance of RE. Many PSUs are expected to invest in solar manufacturing at various scales. With central government oversight, PSUs could become one of the leading players in domestic solar manufacturing.

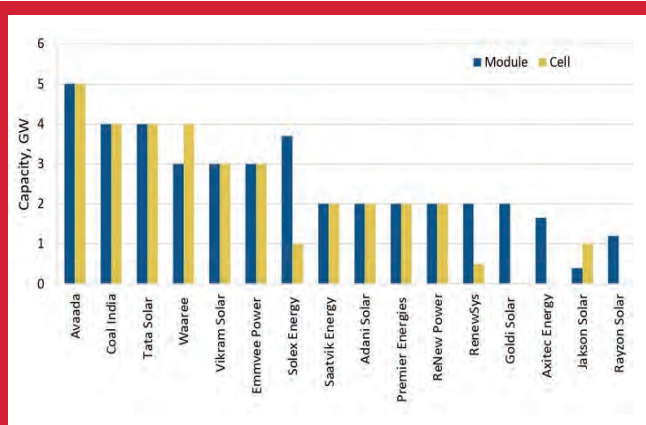


Figure 14: Proposed Additional Manufacturing Capacity (Until 2025)

Source: JMK Research.

With encouraging government policies and in anticipation of huge demand in India in the coming decade, several international players see huge potential in solar manufacturing in India. This is demonstrated by the move of U.S. manufacturers First Solar and CubicPV to set up facilities in India in coming years. Both bid for the PLI scheme. First Solar, interestingly, is betting on its

thin-film modules to make a comeback in India by setting up a 3.3GW facility.

Numerous Indian conglomerates are also expected to enter the solar manufacturing business. Reliance, Jindal Power and Shirdi Sai Electricals were declared the winners in the first tranche of the PLI scheme and combined are looking to set up about 12GW of integrated manufacturing. Tata is already manufacturing solar modules and cells, but at a smaller scale. With capital backing and manufacturing at scale, the conglomerates can be a major game-changer in the nation's global standing. However, if the entry of conglomerates diminished the visibility of small and medium players, it would create concerns of business shutdown.

Backed by huge capital, Reliance plans to target every renewable energy segment

Going big in renewables and backed by huge capital, Reliance plans to target every RE segment, not just solar manufacturing. The newly formed entity Reliance New Energy Solar Limited aims to invest US\$10bn in clean energy, adding significant capacity at every vertical in renewables and acquiring talent, experience and technology expertise. Recent acquisitions of companies such as NexWafe (a wafer manufacturer), REC Solar holdings (solar module manufacturer) and taking a 40% stake in Sterling and Wilson Solar Limited illustrate the intent to be a market leader in renewables in the long term.

It is also expected that PLI winners might use substantial sanctioned plant capacity for captive consumption in their coming solar projects. This will

New Entrant	Country of Origin	Type	Planned Capacity
First Solar	U.S.	Private	3.3GW of total module manufacturing capacity. - Technology: Thin Film - Investment of US\$684m
Reliance Industries Limited	India	Private Conglomerate	4GW capacity of integrated manufacturing from metallic silicon to modules. - Technology: Heterojunction technology (HJT) mono-Si - Investment of US\$10.1billion in clean energy. - PLI beneficiary. - Acquisition/Strategic investments in REC Solar and NexWafe.
JINDAL POWER	India	Private Conglomerate	4GW capacity of integrated manufacturing from M.G. Silica to modules. - PLI beneficiary.
SSE	India	Private	4GW capacity of integrated manufacturing from M.G. Silica to modules. - PLI beneficiary.
Coal India Limited	India	PSU	4GW capacity of integrated manufacturing from Ingot to modules.
CUBIC PV	U.S.	Private Merger	2GW capacity of wafers and cells. - Expand to 10GW over five years. - Total planned investment: US\$1.1bn.

Table 1: New Entrants Looking to Explore the Indian Domestic Solar Manufacturing Market

Source: JMK Research, Industry news articles.

help reduce procurement expenses and increase overall profits significantly. The entry of conglomerates such as Reliance and Jindal into solar manufacturing gives further traction towards renewables in India.

Policy Support and Government Initiatives

This section discusses the updates over the past year on key government initiatives to support a domestic PV manufacturing industry.

Domestic Content Requirement (DCR)

The DCR mandates the use of solar cells and modules manufactured domestically as per specifications and testing requirements fixed by MNRE. Under this program, government subsidies are provided for the following schemes.

Central Public Sector Undertaking (CPSU) Scheme

The CPSU scheme was introduced in 2015 to implement 1GW of grid-connected solar PV power projects using domestic cells and modules, to be set up by CPSUs/ Government of India organisations with Viability Gap Funding (VGF) to cover the cost difference between imported and domestic solar cells and modules. The government producer receives the funding through a bidding process using the VGF amount as a parameter to select the project developer. In phase 2 of the scheme, approved in 2019, the target was revised to 12GW by FY2022/23. The Indian government sanctioned VGF support of Rs 85,800m for phase 2, capping funding at Rs 7m/MW.

Under MNRE guidelines for implementation of phase 2, the power generated by the government producers can be used on payment of mutually agreed usage charges

of not more than Rs 2.45/kWh for self-use or use by the Government or its entities, directly or through discoms. The maximum permissible VGF was later reduced to Rs 5.5m/MW, via an amendment from MNRE.

Of the targeted 12GW capacity, 9.5GW of aggregate capacity has been tendered by multiple authorities (SECI, NTPC, IREDA and APDCL). So far, 7GW of the tendered capacity have been allotted, of which ~53% has been allotted to NTPC.

...To be continued 

15. JMK Research.



Jyoti Gulia is the Founder of JMK Research. Jyoti has about 15 years of rich experience in the Indian renewable sector. Her core expertise includes policy and regulatory advocacy, assessing market trends, and advising companies on their business strategy.



Prabhakar Sharma is a Senior Research Associate at JMK Research with expertise in tracking renewable energy and battery storage sector. He has previously worked with Amplus Solar.



Akhil Thayillam is a Research Associate at JMK Research. Akhil is a renewable sector enthusiast with experience in tracking new sector trends as well as policy and regulatory developments.



Energy Economist **Vibhuti Garg** has advised private and public sector clients on commercial and market entry strategies, investment diligence on power projects and the impact of power sector performance on state finances. She also works on international energy governance, energy transition, energy access, reallocation of fossil fuel subsidy expenditure to clean energy, energy pricing and tariff reforms.

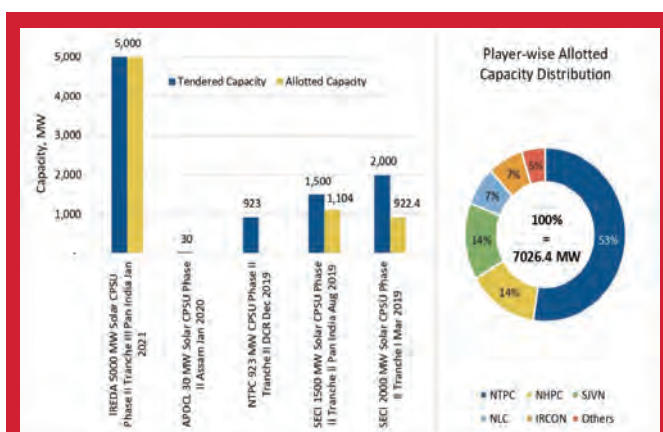
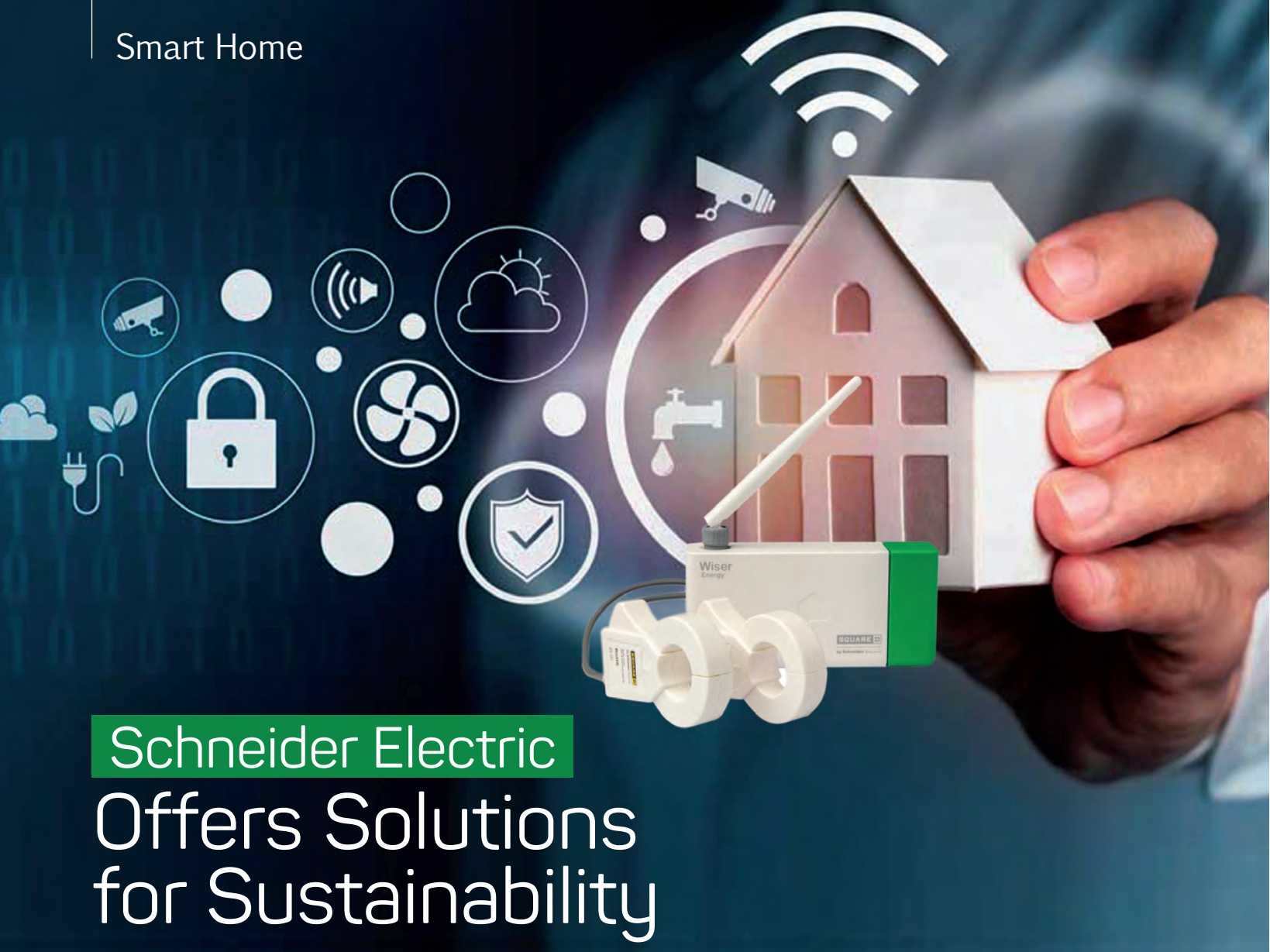


Figure 15: Capacity Allotment Status Under CPSU Scheme

Source: Relevant Tendering Authorities, JMK Research.

JMK Research & Analytics is a boutique consulting firm for all kinds of research and advisory services for Indian and International clients focusing on Renewables, Electric mobility, and the Battery storage market. For further information: contact@jmkresearch.com



Schneider Electric Offers Solutions for Sustainability

Although sustainability has been a buzzword for quite some time, it needs much more dissemination. Interior designers can play a big role in explaining the concepts and benefits of sustainability to their clients...

Long before there was such a thing as “influencers,” Interior Designers had influence over their client’s purchasing decisions. For environmentally-focused designers like Jo Alcorn, Founder and Principal of Alcorn Home Design & Build, smart home technology is part of the picture, in steering homeowners towards a sustainable future.

While Alcorn says that she has been designing things since she was a kid, sustainability has been a core principle since she launched her company in 2005. She says, “I think sustainability should be our everyday way of thinking. I only source sustainable products.” She feels that it can be hard for clients to add extra upfront costs into their budget. “It can be a major sales pitch.”

But she feels that things are changing. With smart home technology becoming more prevalent and growing



Building sustainable homes with a modern design...
Photo: Business Wire

concerns about rising energy costs, talking about energy conservation “is becoming a very easy conversation,” says Alcorn, particularly with products such as the Wiser Energy Smart Home Monitor, which she finds “sells itself.”

Wiser Energy Smart Home Monitoring System

Alcorn says, “I recently learned about the Wiser Energy Smart Home Monitor and I thought it sounded fabulous.” At the first opportunity, she presented the system to a client who was equally enthusiastic and is installing it in their home. “It was an easy sell once they saw what it could do,” says Alcorn. She adds further, “It’s like an Apple Watch for your house, monitoring its heartbeat and so on.”

The Wiser Energy Smart Home Monitor gives owners 24-hour a day monitoring of their household appliances, lighting, heating, and cooling systems, and more. The system provides real-time energy consumption data and the peace of mind that they can manage the system remotely. Worried you might have left the stove on? You can check via the app. You can also use the app to turn some lights on for added security wherever you are.

WiFi-enabled Square D Switches

Schneider Electric also has a full line of stylish Square D, X, and XD WiFi-enabled switches that put even more control and monitoring capabilities into the hands of homeowners. These WiFi-enabled switches and outlets can be controlled via the Wiser Home app, and Alexa or Google Home. This gives homeowners the ability to, for example, create custom lighting sequences while simultaneously monitoring energy consumption.

These stylish, durable, easy-to-install smart switches also offer homeowners unprecedented design versatility. The screwless covers simply snap into place, allowing owners to effortlessly change the colours, style, or finish of their smart switches and outlets.

These new features consolidate into fewer products giving customers every benefit in any device they do pick with a minimalist, easy to clean aesthetic. It’s all a variation on the same theme: flush-mounted, easy to install, and connected options.

“I am so excited that this product has come out. It makes so much sense when it comes to the design aesthetics,” says Alcorn. “I use them for all of my projects. I can’t stand looking at the screwheads on the old system. Why wasn’t this invented earlier?” she adds.

“We’re all overworked and stressed. We really need to find balance in our lives, and smart home technology is one of the things that can help us do that,” she says. According to her understanding, “It gives you that peace of mind knowing that all of your stuff – the lights, the oven, the heating system – is monitored.”

The energy savings that come from being able to monitor your energy consumption and make adjustments become part of the sales pitch. While there are some additional upfront costs, Alcorn can confidently tell her clients, “You’ll save a lot of money in the future.”

Changing Perspectives

But Alcorn wants to impart her perspective beyond just her own clients. She says, “As Designers we have to start the conversation about sustainability.” According to her opinion, “This is something we should have been talking about years ago.”

Still, she feels reason for optimism, and says, “I really think that sustainability is beginning to become the norm.”

As smart home technology, including Wiser Energy Smart Home Monitor, becomes increasingly accessible and easy to use, more homeowners will be able to track their electrical usage and make sustainable living part of their lifestyle.

As a designer, take the opportunity to educate your clients on how these new discoveries can help them do their part for the environment, while also making their lives easier and more manageable.

19

Managing the Menace of Voltage Variations

Voltage variation is a very common phenomenon. In India, all electrical equipment is designed for 230/400 volts single/three-phase. The input voltage is generally low during day time and high during night hours. Voltage variation is everywhere, at some places it is high/low or sometimes even both (fluctuating).

Effects of high or low voltage

At the high Voltage condition, current of electrical/electronic equipment increases accordingly. This high current increases the losses of equipment resulting overheating the insulation of electrical/electronic equipment and becomes the cause of pre-mature failure of electrical/electronic equipments. It also increases the power consumption & MDI etc.

At low voltage condition, the electrical/electronic equipment does not work/operate properly. Repeated tripping of the system ultimately leads to wastage of time/loss of production.

Automatic Voltage Controller (AVC)

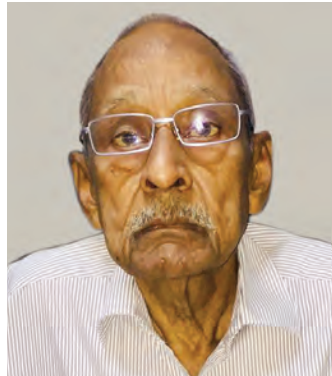
To solve the challenge of voltage variation, Automatic Voltage Controller (AVC) is required. The main part of AVC is the Voltage Regulator.

There are two technologies of Voltage Regulator available in the world:

- **Dimmer Type** Toroidal wound with copper wire and sliding contact carbon brush assembly unsuitable for continuous load with higher losses up to 8% at rated current.
- **Linear Type** Vertical Wound with copper strip and have compensating winding Carbon Rolling Contact Assembly Rolls over the Regulator Coils both side for plus minus purpose for continuous current having trouble free working life more than 15 years with losses less than 1% at rated current.

In 1990 we developed the linear regulator

This is suitable for continuous load with lesser losses i.e. 1% maximum at rated current. The material used in linear voltage regulator i.e. copper, lamination and size is three times the conventional type voltage regulator.



B. B. Jindal
Founder, Jindal
Electric &
Machinery Corp.

Energy Audit

Any power consumer can do Energy audit or check the voltage variation in their premises with the help of digital power analyzer, which is easily available in the market at a very nominal cost (approx. Rs. 6,000/- with accessories & Software). It records the data after every 15min. interval for 7 days as shown in the chart below:

Date & Time		System Voltage (Volt) in each phase			System Current (Amps) in each phase			Power consumption
Date	Time	Rn	Yn	Bn	Ir	Iy	Ib	kW
xx/xx/xxx	00.00	234	235	240	85	90	90	50

According to the voltage variation / current pattern, a consumer can decide whether he/she needs the Automatic Voltage Controller or not.

The payback period

1. The benefit of installing an Automatic Voltage Controller is to reduce the failure rate of costlier electrical/ electronics' equipment.
2. The Automatic Voltage Controller is not a power saving device. This is added advantage at high voltage.
3. The input voltage increases payback period decreases accordingly may be 4-12 months.

Due to not reliable technology of Voltage Regulator available the voltage correction system could not become popular. 

For more information:

contact at E-Mail: jemc@jindalelectric.com

Crawling through danger - robot-controlled maintenance operations with igus e-chains on board

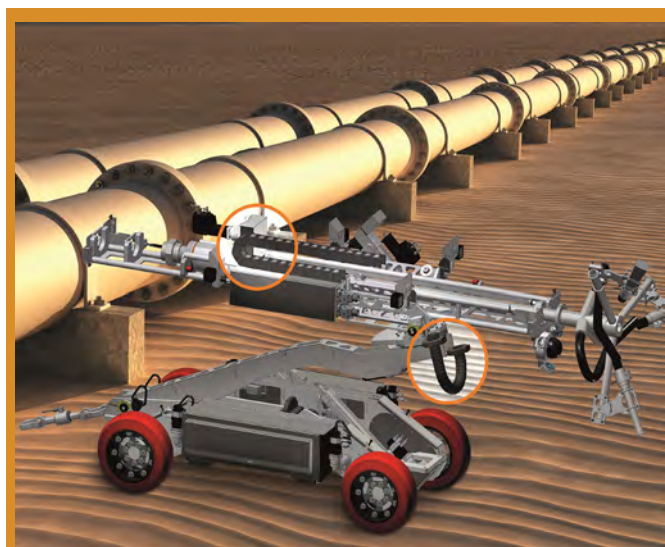
Equipped with igus energy supply systems, the “Crawler” takes on lethal maintenance operations in pipelines...

It undertakes work that is lethal for humans: the remote-controlled robot “Crawler” restores the inner walls of pipelines in power plants. An automation that needs to be regularly maintained in order to protect the power and data cables from the harsh environmental conditions. Here, the US manufacturer Remote Orbital Installations LLC relies on the collaboration with igus.

In 2007, a tragic accident at a power plant in Colorado showed just how dangerous working in pipelines can be. When workers applied an epoxy coating inside a penstock that carries water to turbines, the flammable solvent ignited. Five people lost their lives. It is a fate that Remote Orbital Installations (LLC) and Big Sky Engineering want to spare other workers. The two U.S. companies have therefore developed the Crawler - a remote controlled robotic platform on four wheels that travels through pipelines, cleans the inner walls with a blasting tool and relines them with epoxy resin. The workers remain safe at the other end of the control cable. Before the Crawler was ready to use, the engineers had to overcome various challenges. One challenge was to find components that could withstand the dirty and humid environment inside the pipeline. Failures could result in workers having to enter the pipe and exposing themselves to danger. These components included guides designed to protect the robot's power and data cables from damage due to uncontrolled movement.

“The longevity of igus products was crucial for success”

On the other side of the Atlantic, the US designers found what they were looking for at igus. The plastics motion specialist's energy chains provide guidance of energy and data cables at several points. For example, they guide the cables of the mechanism that adjusts the wheel width of the Crawler to the pipe diameter.



The Crawler performs important maintenance tasks in pipelines. The e-chains from igus reliably protect the installed cables... (Source: igus GmbH)

Also cables of the boom, which is responsible for the height adjustment of the tools. And the safety of hanging cables is ensured by enclosed energy chains from the triflex series, which enables controlled, three-dimensional movements with twistable chain links. All energy chains in the Crawler are made of a wear-resistant, robust, chemical-resistant and corrosion-free high-performance plastic that can reliably withstand even the most adverse environments for years. “The longevity of igus products was crucial to the Crawler's success,” confirms engineer Mike Kronz. “We've done several projects and haven't had a single failure.”

Bold energy chain solutions: application for the vector award 2022

The robot Crawler is an example of an application of energy chains that is characterised by economic efficiency and the courage to be creative. 

For further information: E-mail: aheinzelmann@igus.net, Website: www.igus.in



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The new thermal imager testo 883

Advanced assistance for those who work in predictive maintenance, condition monitoring and facility management...



Measuring technology expert Testo is offering efficient assistance to its customers involved in predictive maintenance and facility management, in the form of the new thermal imager testo 883. This thermal imager, which offers the best image quality and automatic image management, was developed, and manufactured entirely in Germany. This remarkable camera greatly reduces the day-to-day workload of those who specialize in the efficient operation of plants.

Maintenance makes all the difference

In the day-to-day work, maintenance, safety auditors and facility management experts can make all the difference between experiencing a successful day with achieved production targets or less productive days with losses due to unplanned downtime. To add to that, their work is made more difficult by constant high time pressures, administrative and documentation efforts that are not very often productive and inadequate tools could be a challenge too. That is the reason why the experts require the best maintenance equipment.

The image quality is what matters

The testo 883 thermal imager offers an infrared resolution of 320 x 240 pixels, which can even be expanded up to 640 x 480 pixels with the built-in testo SuperResolution technology. And the manual focus always guarantees the user full control of the thermal image.

Automatic image management

A typical problem in maintenance occurs due to a lot of similar measuring objects, for example, from switch cabinets a lot of similar thermal images can be obtained during inspection. In order to clearly allocate the images after an inspection, earlier it was necessary

to create elaborate lists or add a voice comment to each thermal image. Testo Site Recognition technology solves this problem by automatically recognizing the measuring location and saving and managing the thermal images.

Networked working

The testo 883 thermal imager integrates seamlessly into Testo's digital measuring technology portfolio. With the testo Thermography App, thermal images can be quickly analysed on a smartphone/tablet or shared with colleagues, decision makers and managers. Readings from the testo 770-3 clamp meter and testo 605i smart thermo-hygrometer are also integrated directly into the thermal image.

Application areas

Early identification of imminent malfunctions, wears, damages or defects on plants and machines is critical and same goes for electrical components like switching cabinets. Similarly, serious threats like hotspots, short circuits, cracks, corruptions can jeopardize the power output of solar PV plants and its components. For such predictive maintenance application, Wi-Fi enabled testo 883 is the ideal instrument.

Health of a building, construction quality, improper heat transfer, leaks, cracks, or moulds in the structure can also be easily monitored.

The testo 883 thermal imager is available as a separate instrument or in a kit with telephoto lens, additional battery and charging station, from specialist dealers or directly from www.testo.com. 

For more details, login to our website www.testo.com or write back to us on info@testo.in

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