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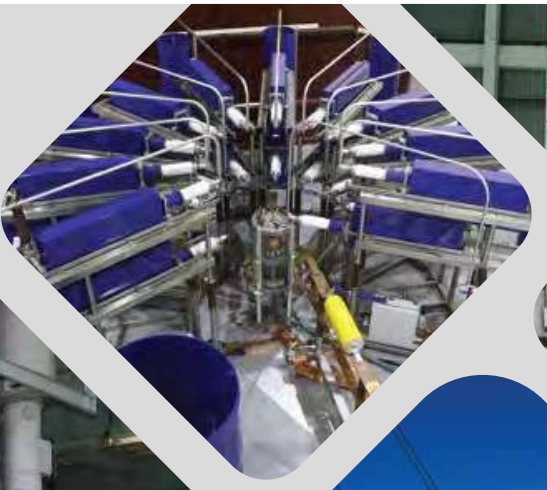

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From the Publisher's Desk

Launching of new Indian electrical equipment

The leading global technology research and advisory company, Technavio, which has been monitoring the electrical equipment market in India, pointed out a few months back that the market here is poised to grow by USD 70.69 bn during 2020-2024, progressing at a CAGR of 16% during the forecast period. As the prolonged lockdown period has slowed down the accelerated growth trend of the global power industry, to what extent the figures will change that falls under wait-and-watch category. However, one thing is sure as far as development of new technologies and delivering new and highly efficient equipment is concerned, COVID 19 could not discourage the spirit – and that presents a good light of hope that in the post-COVID 19 scenario the industry will do well.

The Technavio report stated that the Indian market is fragmented, and the degree of fragmentation will accelerate during the forecast period. ABB Ltd., Bharat Heavy Electricals Ltd., CG Power and Industrial Solutions Ltd., EMCO Ltd., Fuji Electric Co. Ltd., Larsen & Toubro Ltd., Schneider Electric SE, Siemens AG, TD Power Systems Pvt. Ltd., and Toshiba Energy Systems & Solutions Corp. are some of the major market participants here. According to Technavio, to make the most of the opportunities, market vendors should focus more on the growth prospects in the fast-growing segments, while maintaining their positions in the slow-growing segments.

Exactly that is happening now. It is praiseworthy that the infestation of COVID 19 has literally failed to limit the indomitable spirit of the Indian electrical equipment manufacturers. It gives me immense pleasure to think that it is not only the big companies, but also the small manufacturers are now coming out with exciting, unique and indigenous products.

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NTPC DADRI TAKES METICULOUS MEASURES FOR POLLUTION CONTROL

NTPC Dadri is striving to become the cleanest coal fired plant in the country and is complying with all the CPCB guidelines on emissions. All the emission parameters are being monitored online and transmitted to Central Pollution Control Board (CPCB) on real time basis. As per a statement issued by NTPC Ltd, the PSU under Ministry of Power, the Flue gas emissions and Particulate matter are well within the CPCB norms with high efficiency ESP (Electrostatic Precipitators) in service in all the 4 nos. 210 MW & 2 nos. 490 MW units.

A view of NTPC Dadri…

For SOx reduction, Dry Sorbent Injection (DSI) system has been installed in 210 MW units for the first time in the country with technology from UCC (United Conveyor Corporation), USA and now all the four units are meeting emission norms. FGD system is in advanced stage of implementation in 490 MW units by BHEL with technology from Mitsubishi Power Works, Japan.

All the 210 MW units were already compliant to NOx emission norms. In 490 MW units, SOFA (Separated Overfire Air) system has been installed and all the units now comply with the norms for NOx.

NTPC Dadri has also pioneered co-firing of Biomass pellets along with coal in the boilers. The pellets are made of husk or agro-residue, which would have been burnt otherwise in the fields increasing the pollution in NCR region. More than 8000 Tons of pellets have been fired in the boilers.

NTPC GROUP RECORDS A DOUBLE-DIGIT GROWTH

NTPC is working towards various waste to energy projects. It is also taking every possible step to make its energy portfolio greener…

NTPC Group companies under Ministry of Power, recorded a double-digit growth of 13.3% in generation in 2nd Quarter from July to September 2020, compared to the same period last year. Group generation in first half of the current financial year from April to September 2020, was 145.87 BU, higher by 0.4% than the same period last year.

As per a statement issued by NTPC Ltd., NTPC coal stations have maintained high availability of 94.21% during April to Sept'20 as against 90.26% during the same period last year, demonstrating high levels of operational excellence.

With a total installed capacity of 62.9 GW, NTPC Group has 70 Power stations comprising 24 Coal, 7 combined cycle Gas/Liquid Fuel, 1 Hydro, 13 Renewables along with 25 Subsidiary & JV Power Stations.

Contextually, NTPC is leading the energy transition to a decentralised, decarbonised and digitalised energy in the country. The company provides broad framework for the company's priorities to meet the challenges in Decarbonisation & Air emissions control, Water & Biodiversity Conservation, Circular Economy, Health and Safety, Community Development, Strong Finance & Ethics and Sustainable Supply Chain. As part of its commitment towards the environment, NTPC has undertaken many 'firsts' for the sector. NTPC is working towards utilising agro residue for power generation to discourage in-field crop residue burning. It is also striving hard to install sulphur dioxide-reducing technology Flue-Gas Desulphurisation (FGD) at all its plants across the country.

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FLY ASH TRANSPORT ACROSS THE COUNTRY BIGINS

NTPC Ltd., India's largest power producer and a PSU under Ministry of Power, has started to collaborate with cement manufacturers across the country to supply fly ash as part of its endeavour to achieve 100% utilisation of the by-product produced during power generation. The power producer is leveraging Indian Railways' sprawling network to transport fly ash in economical and environment-friendly manner.

NTPC Rihand is sending conditioned fly ash to cement manufacturers…

As per a statement issued by NTPC Ltd., NTPC Rihand is the first power plant in the State of Uttar Pradesh to send conditioned fly ash to cement manufacturers. The plant recently transported 3,834 Metric Tonnes (MT) of conditioned fly ash in 59 BOXN wagons to Dalmia Cement (Bharat) Ltd.'s plant at Nagaon, Assam. Earlier, the rail rakes of conditioned fly ash were dispatched to ACC plants in Tikaria (U.P), Kymore (M.P) and Ropar (Punjab).

During the financial year 2019-20, almost 44.33 million tonnes of fly ash was utilised for various productive purposes. NTPC produces approximately 65 Million Tonnes of Ash annually, out of which 80% (approx. 52 Million MT) is Fly Ash. Presently, about 73% of total ash is being utilized for production of cement and fly ash bricks, road embankment construction, mine filling, low-lying land development, and ash dyke raising. The group has over 20 GW of capacity under construction, including 5 GW of renewable energy projects.

Contextually, NTPC became a Maharatna company in May 2010. The company is ranked No. 2 Independent Power Producer (IPP) in Platts Top 250 Global Energy Company rankings.

PFC, JKPCL SIGN AND EXCHANGE AN AGREEMENT

JKPCL has taken up many projects, which are techno-economically viable, besides being eco-friendly and socially beneficial…

Government-owned Power Finance Corporation Ltd (PFC), India's leading NBFC, has sanctioned Rs 2790 crore to Jammu Kashmir Power Corporation ltd (JKPCL) for clearing its outstanding dues.

PFC and JKPCL have recently signed and exchanged an agreement for Liquidity Infusion Scheme under 'Aatmanirbhar Bharat Abhiyaan' for the Jammu and Kashmir Union Territory. The money sanctioned under the scheme will be used to clear the outstanding dues of CPSU, GENCOs & TRANSCOs, IPPs and RE Generators on 31st March 2020.

The exchange agreement was signed in presence of Rohit Kansal, Principal Secretary, PDD along with senior officers from JKPDD, KPDCL, JPDCL, PFC and REC. In May, the government announced a Rs 90,000 crore liquidity infusion for DISCOMs under which these utilities would get loans at economical rates from PFC and REC. This was an initiative of the government to help GENCOs remain afloat. Later, the liquidity infusion package was increased to Rs 1.2 lakh crore.

PFC is under the administrative control of the Ministry of Power. The corporation was conferred the title of a 'Navratna CPSE' in June,2007, and was classified as an Infrastructure Finance Company by the RBI on 28th July, 2010. It plays a crucial role in the rise of India as a global player. The state of Jammu and Kashmir is endowed with significant hydel potential which, when exploited fully, will provide a strong impetus for the growth of its economy.

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GE RENEWABLE ENERGY, SB ENERGY JOIN HANDS FOR NEW PROJECT

GE Renewable Energy has selected SB Energy (SoftBank Group) to supply, install and commission 121 sets of its 2.7-132 onshore wind turbines, cumulating 327 MW, to be installed at Pritam Nagar wind farm in Madhya Pradesh, India. The project was won by SB Energy during the tranche-VI auction of wind projects by Solar Energy Corporation of India and will produce enough green energy for 250,000 households in India.

GE 2MW low speed onshore wind turbine…

The supply for this project will leverage GE's significant local footprint in India with product design primarily at GE's Technology Centre in Bengaluru, blades manufactured in GE's plants in Vadodara and Bengaluru and assembly at the GE Multi-modal Manufacturing Facility in Pune.

Commenting on the development, Gilan Sabatier, Regional Leader for GE Renewable Energy's Onshore Wind business in South Asia and ASEAN said, "We are proud to be selected by SB Energy to execute this flagship project for the country. It is one of the largest wind projects ever awarded in India and will significantly contribute to the country's renewable aspirations. The project is a testament to GE's ability to not only offer state-of-the-art technology but also site development solutions to maximize customer returns. We sincerely thank SB Energy for its trust and look forward to furthering our partnership as it continues to build its renewable energy portfolio."

Tata Power to develop 100 MW Solar Project at Dholera Solar Park, Gujarat

Tata Power is steering the transformation of utilities to integrated solutions by exploring new business growth potentials…

Tata Power, India's largest integrated power company, has recently received a Letter of Award (LOA) from the Gujarat Urja Vikas Nigam Limited (GUVNL) to develop a 100 MW solar project in Dholera Solar Park of Gujarat. The energy will be supplied to GUVNL under a Power Purchase Agreement (PPA), valid for a period of 25 years from scheduled commercial operation date. The company has won this capacity in a bid announced by GUVNL in March 2020. The project has to be commissioned within 15 months from the date of execution of the PPA.

With this award, the cumulative capacity under development in Gujarat would be 620 MW, out of which 400 MW will be in Dholera Solar Park.

It is an important milestone in the company's endeavour to generate 35 - 40% of Tata Power's total generation capacity from clean energy sources – and will go a long way to meet the country's commitment towards green and clean energy.

The plant is expected to generate about 246 MUs of energy per year and will annually offset approximately 246 million kilograms of carbon dioxide. Tata Power's renewable capacity will increase to 3,936 MW, out of which 2637 MW is already operational and 1299 MW is under implementation including 100 MW won under this LOA.

Being a pioneer in the field, Tata Power has presence across the entire power value chain – generation of renewable as well as conventional power including hydro and thermal energy, transmission & distribution.

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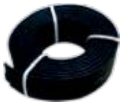
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INDIA'S FIRST LI-ION 3-WHEELER ACHIEVES 5,000 UNITS SALES MILESTONE

According to a recent communiqué from Mahindra Electric Mobility Ltd, a part of the USD 19.4 billion Mahindra Group, its lithium-ion battery powered electric 3-wheeler range, the Mahindra Treo, has crossed the 5,000 units sales milestone in India. The country's switch to EVs (Electric Vehicles) is being led by electric three-wheelers as they are economically, environmentally and socially sustainable.

Mahindra Group's Li-ion battery powered electric 3-wheeler…

Commenting on this significant milestone, Mahesh Babu, MD & CEO, Mahindra Electric said, "I would like to thank our customers for choosing and embracing e-mobility in the country. The Mahindra Treo range has crossed a remarkable sales milestone of 5,000 units and is currently being sold in over 400 districts across the country. Cumulatively, the Treo has travelled a distance of over 35 Million kms on Indian roads, saving 1,925 metric tonnes of CO_2 tailpipe emissions, equivalent to planting 87,500 trees to absorb the same emissions. Given its low running costs, our Treo customer has been able to save up to ₹ 45,000/ year (when compared to a traditional small body LPG auto). This electric 3-wheeler along with its unique styling, superior handling and top performance makes for a smart first and last mile mobility choice for both drivers and commuters."

The Treo range is powered by advanced Lithium-ion Battery Technology with a life of 1.50 lakh+ kilometres. The new Treo provides best-in-segment performance (maximum power of 8kW, peak torque of 42 Nm). It also has the longest wheelbase in its segment resultingin a very spacious cabin. EI

WORLD BANK GROUP SETTLE COMPLIANCE ISSUES WITH KPTL

KPTL has order book visibility for the next two years and the current sanctions will not impact the projects under execution…

World Bank Group on 6th October, 2020 has announced a settlement with Kalpataru Power Transmission Limited (KPTL or the company) pertaining to the World Bank's position that the company had failed to disclose intended payments to third parties when submitting bids in respect of two World Bank-financed projects in the years 2010 and 2012.

Under the settlement, KPTL and its controlled affiliates in transmission line business have agreed to sanctions due to which KPTL and its controlled affiliates in the transmission line business cannot participate in World Bank Group-financed projects and operations for a period of 12 months and 1 day, post which the World Bank will continue to monitor the compliance program for and the company's continued cooperation with the World Bank Group Integrity Vice Presidency for the next five months, during which period KPTL and its affiliates in transmission line business may participate in such projects and operations. The settlement does not entail monetary penalty on KPTL and its affiliates.

As per the terms of the settlement, the company has committed, among other things, to continue developing and enhancing an integrity compliance program consistent with the principles set out in the World Bank Group Integrity Compliance Guidelines.

The debarment of the company and its controlled transmission line affiliates qualifies for cross-debarment by a few other Multilateral Development Banks (MDBs) under the Agreement for Mutual Enforcement of Debarment Decisions. EI

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VIETNAM BAGS ITS FIRST CERTIFIED GREEN LOAN FOR SPV PLANT

The Asian Development Bank (ADB) and Phu Yen TTP Joint Stock Company (Phu Yen JSC) have recently signed a $186 million loan to develop and operate a 257 megawatt (MW) solar power plant in Hoa Hoi, Phu Yen Province, Vietnam, through the country's first certified green loan. Phu Yen JSC is owned by B. Grimm Power Public Company Limited and Truong Thanh Vietnam Group Joint Stock Company (TTVN).

The project is the largest single operating solar power plant in VietNam…

The project is the largest single operating solar power plant in Vietnam and one of the largest in Southeast Asia. It will help reduce 123,000 tons of carbon dioxide annually. The power plant will deliver electricity to Quang Ngai and Nha Trang cities, as well as surrounding areas in a region that is emerging as one of Viet Nam's key tourist centers.

The financing comprises a $27.9 million loan funded by ADB, a $148.8 million syndicated loan (B loan) funded by commercial banks with ADB as lender of record, and a $9.3 million loan from Leading Asia's Private Infrastructure Fund (LEAP). The syndicated loan is the first green B loan in Asia and the Pacific to be certified by the Climate Bonds Initiative, and one of the largest such loans yet mobilized in Viet Nam. Participating commercial banks include Bangkok Bank, Kasikorn Bank, Kiatnakin Bank, Industrial and Commercial Bank of China, and Standard Chartered Bank. Green loans are used to fund new or existing projects that deliver environmental or climate-related benefits.

POLAND'S PGE GROUP TO WORK ON ITS NEW STRATEGY

As the largest energy group in Poland, PGE will develop its experience and competence in the offshore sector, cooperating with the best…

Recently, the PGE Capital Group, which is Poland's largest energy sector company with respect to sales revenues and net profit, has declared its new strategy. According to the available information, one of the pillars of the Group's new strategy will be the construction of offshore wind farms in the Baltic Sea region that has a very high potential.

The PGE Group's Offshore Programme comprises the construction of three wind farms in the Baltic Sea with a total capacity of up to 3.5 GW, 2.5 GW of which will be built by 2030. Drawing attention on the significance of their decision, Wojciech Dąbrowski, President of the Management Board of PGE, said, "The PGE Group's Offshore Program is a huge investment, but it is not our last word either. We are planning further development in this direction in other concession areas, because offshore wind farms will be the driving force behind PGE's neutrality, which the PGE Group will achieve in 2050"

"PGE's investments in offshore wind energy will be accompanied by a complementary project, i.e., a programme to build large-scale energy storage facilities. We have been working on it since I became President of the Management Board of PGE in February 2020. Excess energy from RES, which we cannot use at the moment, should be stored in such large-scale installations," he added.

MITSUBISHI POWER INCREASES OUTPUT OF GEOTHERMAL PLANT AFTER RENOVATION

Mitsubishi Power, a major subsidiary of Mitsubishi Heavy Industries (MHI) Group, which was conducting a renovation project of the Otake Geothermal Power Station (Kokonoe-machi, Oita Prefecture) operated by Kyushu Electric Power Company, has declared completion of its work. Already, the commercial operation of the renovated facility has begun in October 2020. The stable electric power supply generated by the highly efficient and reliable steam turbine installed as part of this renovation project will curb CO_2 emissions, and contribute to a decarbonized economy.

Otake Geothermal Power Station...

This project was conducted under an Engineering, Procurement and Construction (EPC) contract by a joint venture comprising Mitsubishi Power, which supplied the steam turbine, Mitsubishi Power Industries Co., Ltd., which handled the supply and installation of auxiliary equipment, and Mitsubishi Electric Corporation, which supplied the generator and electrical facilities.

The uniqueness of the project is: the power generation system there utilizes a 'double flash and dual pressure' method, the first of its type in Japan. This allows for stable operation of the steam well and efficient use of geothermal resources. It has also increased the power output by two megawatts (MW) compared to the previous facility, to 14.5MW. The construction has been completed two months ahead of the schedule from the plan when work began in May 2019, allowing for the start of commercial operation in October.

Mitsubishi Power has fulfilled orders for more than 100 projects in the geothermal power field in 13 countries.

JERA DECLARES STEPS TO ACHIEVE NET ZERO EMISSIONS

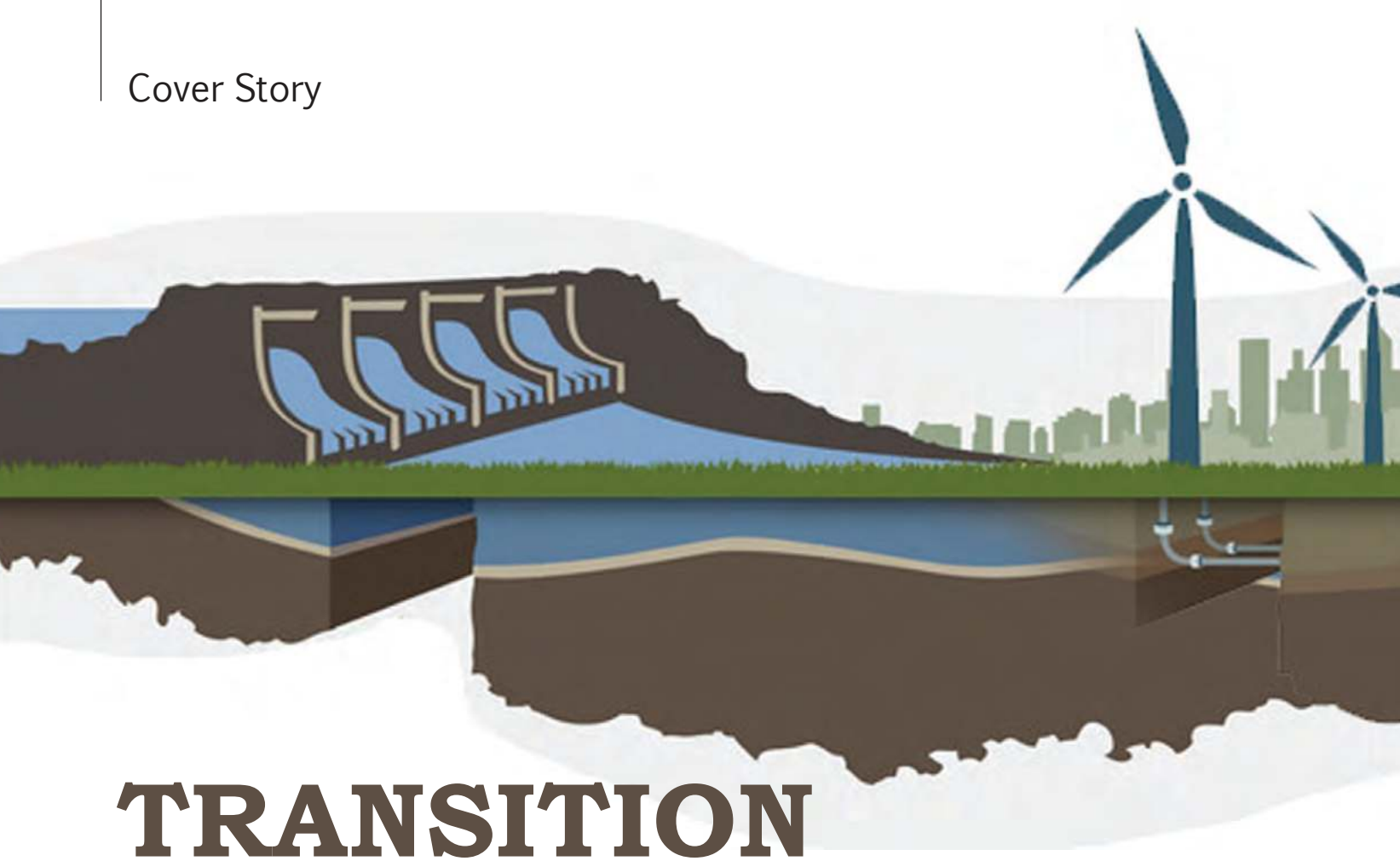
Besides inclusion of renewable power, JERA is also expecting to achieve 20% use of ammonia at its coal-fired power plants by 2035...

Targeting to achieve net zero emissions of carbon dioxide by 2050, the biggest power generator of Japan – JERA has communicated their decision to shut down all inefficient coal-fired power plants in Japan by 2030.

Although a panel formed by the Japan government has been verifying the pros and cons of defining standards of an inefficient coal-fired plant, JERA has provisionally stated that it has seen inefficient plants as ones that use 'supercritical or less' technology.

With a view to walking abreast with the companies across the globe that are speeding their initiatives to create a decarbonised society, JERA, a thermal power and fuel joint venture between Tokyo Electric Power Company Holdings and Chubu Electric Power, has set their ambitious 2050 target. Establishing the merit of the decision, Hisahide Okuda, Managing Executive Officer, JERA, said, "As a company operating globally and as a utility generating about one-third of domestic electricity, setting these goals is an essential qualification for remaining to be an energy company and an entry ticket for doing business in the global market."

JERA is now concentrating on enhancing their renewable energy generation capacity including the offshore wind-power plants. Their existing thermal plants will be charged with greener fuels like ammonia and hydrogen. It is planning to start a pilot programme to use ammonia with coal in mixed combustion at its Hekinan thermal power station in central Japan by 2030.



TRANSITION IS INEVITABLE

With rise in the use of renewable energy, its cost of installation is coming down very rapidly, the post-COVID19 development packages must be spent on building sustainable power systems with more renewable energy plants…

Before Abu Dhabi's global preparatory meeting for the United Nations Climate Action Summit in September (2019), a report from the International Renewable Energy Agency (IRENA) pointed out that Renewable Power is the cheapest source of electricity in many parts of the world. That report also provided that by 2020–2022, "All existing available renewable power generation options will compete-head-to-head with incumbents. As the share of variable renewables increases, the importance of looking beyond generation costs to total system costs becomes more important. Integration costs could be minimal if a systemic approach to the power system transformation is applied, but could rise if opportunities for flexibility options are confined narrowly to the electricity sector."

Commenting on the report, at that time, IRENA's Director-General Francesco La Camera said, "Renewable power is the backbone of any development that aims to be sustainable. We must do everything we can to accelerate renewables if we are to meet the climate objectives of the Paris Agreement. Today's report sends a clear signal to the international community:

Renewable energy provides countries with a low-cost climate solution that allows for scaling up action. To fully harness the economic opportunity of renewables, IRENA will work closely with our membership and key partners to facilitate on-the-ground solutions and concerted action that will result in renewable energy project."

Today's scenario

This year, a report titled 'Global Trends in Renewable Energy Investment 2020' has been jointly published by UN Environment Programme (UNEP), the Frankfurt School –UNEP Collaborating Centre and BloombergNEF (BNEF) – analysed investment trends and clean energy commitments (in 2019) made by countries and corporations for the next decade.

The report states that renewable energy is more cost-effective than ever – providing an opportunity to prioritize clean energy in economic recovery packages and bring the world closer to meeting the Paris Agreement goals. It traces commitments equivalent to 826 GW of new non-hydro renewable power capacity, at a likely cost of around USD 1 trillion, by 2030 (1GW is similar to the capacity of a nuclear reactor). Getting on track to limiting global temperature rise to under 2 degrees Celsius – the main goal of the Paris Agreement – would require the addition of around 3,000GW by 2030, the exact amount depending on the technology mix chosen. The planned investments also fall far below the USD 2.7 trillion committed to renewables during the last decade.

Falling cost is the trend

In their report titled, "Renewable Power Generation Costs in 2018," IRENA clearly mentioned that the costs for renewable energy technologies reached new lows again last year. Solar and wind power have emerged as the most affordable power source for many locations and markets, with cost reductions set to continue into the next decade. Cost declines across the board in 2018 have reconfirmed the status of renewable power as a highly cost-effective energy source. New solar photovoltaic (PV) and onshore wind power are on the verge of costing less than the marginal operating cost of existing coal-fired plants. Steadily improving competitiveness has made renewables the backbone of the world's energy transformation.

"Renewable power is the backbone of any development that aims to be sustainable. We must do everything we can to accelerate renewables ..."

- Francesco La Camera
Director-General, IRENA

Global electricity costs in 2018			
	Global Weighted-Average cost of Electricity (Usd/Kwh) 2018	Cost of Electricity: 5Th and 95Th Percentiles (Usd/Kwh) 2018	Change in the cost of Electricity 2017–2018
Bioenergy	0.062	0.048–0.243	−14%
Geothermal	0.072	0.060–0.143	−1%
Hydro	0.047	0.030–0.136	−11%
Solar photovoltaics	0.085	0.058–0.219	−13%
Concentrating solar power	0.185	0.109–0.272	−26%
Offshore wind	0.127	0.102–0.198	−1%
Onshore wind	0.056	0.044–0.100	−13%
Source: IRENA			

According to Camera, "The International Renewable Energy Agency (IRENA) has tracked and analysed the cost evolution of renewable power since 2012. Combining the latest data with global coverage and a transparent methodology has helped to shed light on the accelerating momentum of renewables, not only as a key climate solution but also as a strong business proposition. Within IRENA's database, for instance, over three-quarters of the onshore wind and four-fifths of the solar PV project capacity due to be commissioned in 2020 should produce cheaper electricity than any coal, oil or natural gas option. Crucially, they are set to do so without financial assistance. The competitiveness of renewable power generation options was not always widely recognised. However, the past decade has seen governments, industry, financing institutions, investors and project developers work together to drive down costs and improve performance. Solar and wind power – once seen as an expensive way to address economic, environmental and social-development goals – are now a cost-competitive way to meet energy demand. To fully harness the economic opportunity of renewables, IRENA will work closely with countries to develop concerted action on the ground. Electrification with renewables offers a low-cost decarbonisation solution to meet the climate goals set out in the Paris Agreement. Any development aiming to be sustainable needs to tap into renewable power."

"The chorus of voices calling on governments to use their COVID-19 recovery packages to create sustainable economies is growing..."

- Inger Andersen
Executive Director, UNEP

Reiteration with factual analysis

Although it may appear a bit irrelevant here still making a big sense to pinpoint the efficacy of combined solar and wind energy: A very recent (29th Oct, 2020) report from the Institute for Energy Economics and Financial Analysis (IEEFA) states, "Strong performance by Kosovo's first large-scale wind and solar farms show the coal-dominated, Western Balkan country can exploit falling renewables costs and green lending appetite to align better with a low-carbon European transition and reduce losses from stranded fossil fuel assets."

It cites a recent example too. "Kosovo has traditionally relied upon lignite, a low-grade form of coal, because of large reserves. But the World Bank and U.K.-listed Contour Global have withdrawn financial support for a new lignite power plant, citing its high cost compared with renewables. The withdrawal reflects how new coal plants are no longer economically viable in Europe,

and the $2 billion price tag for the proposed Kosova e Re Power Plant (KRPP) makes it highly unlikely that the project could proceed as a state-owned project." So, the message is clear… And whether Kosovo or Kashmir or Karnataka or Kerala, the changing cost structure is true everywhere…

The IRENA's report also categorically draws attention on the fact that – reductions, particularly for solar and wind power technologies, are set to continue into the next decade. According to IRENA's global database, over three-quarters of the onshore wind and four-fifths of the solar PV projects that are due to be commissioned next year will produce power at lower prices than the cheapest new coal, oil or natural gas options. Crucially, they are set to do so without financial assistance.

So what's coming next?

The latest Frankfurt School-UNEP Collaborating Centre and BNEF report states, "As COVID-19 hits the fossil fuel industry, renewable energy is more cost-effective than ever – providing an opportunity to prioritize clean energy in economic recovery packages and bring the world closer to meeting the Paris Agreement goals."

Also, the report shows that the cost of installing renewable energy has hit new lows, meaning future investments will deliver far more capacity. Renewable energy capacity, excluding large hydro-electric dams of more than 50 MW, grew by 184 GW in 2019. This highest-ever annual addition was 20 GW, or 12 per cent, more than the new capacity commissioned in 2018. Yet the dollar investment in 2019 was just 1 per cent higher than the previous year, at USD 282.2 billion.

Interestingly, the all-in or levelized, cost of electricity continues to fall for wind and solar, thanks to technology improvements, economies of scale and fierce competition in auctions. Costs for electricity from new solar photovoltaic plants in the second half of 2019 were 83 per cent lower than a decade earlier.

Commenting on the research, Inger Andersen, Executive Director of UNEP, said, "The chorus of voices calling on governments to use their COVID-19 recovery packages to create sustainable economies is growing. This research shows that renewable energy is one of the smartest, most cost-effective investments they can make in these packages. If governments take advantage of the ever-falling price tag of renewables to put clean energy at the heart of COVID-19 economic recovery, they can take a big step towards a healthy natural world, which is the best insurance policy against global pandemics."

"There is an unprecedented momentum for leaving the fossil fuel age behind us. And we must do it now…"

- Rana Adib
Executive Director, REN21

REN21 is the only global community of renewable energy actors from science, academia, governments, NGOs and industry across all renewable energy sectors. A recent REN 21 report shows that in the heating, cooling and transport sectors, the barriers are still nearly the same as they were 10 years ago. Commenting on that Rana Adib, Executive Director, REN21, says, "We must also stop heating our homes and driving our cars with fossil fuels."

Stressing on the need for sustainable power systems, in an apprehensive manner, Adib says, "Year after year, we report success after success in the renewable power sector. Indeed, renewable power has made fantastic progress. It beats all other fuels in growth and competitiveness. Many national and global organisations already cry victory. But our report sends a clear warning: The progress in the power sector is only a small part of the picture. And it is eaten up as the world's energy hunger continues to increase. If we do not change the entire energy system, we are deluding ourselves."

Renewable energy systems support energy sovereignty and democracy, empowering citizens and communities, instead of big fossil fuel producers and consumers. "When spending stimulus money, we have to decide: Do we want an energy system that serves some or a system that serves many?" says Adib. "But it's not only about money. We must end any kind of support to the fossil economy, particularly when it comes to heating, cooling and transport. Governments need to radically change the market conditions and rules and demonstrate the same leadership as during the COVID-19 pandemic," she adds further.

Image by Zeljko Ivic from Pixabay

NZ's invention may be the next power system maverick addressing long distance transmission blips…

A NOVEL WIRELESS TECHNOLOGY

Achieving cost-effectiveness in power transmission has been a major challenge to the global energy and utilities industry. In several regions where the generation cost could be minimized with induction of renewable resources, the levelized cost of energy (LCOE) increases due to the high cost of transmission. To address this, New Zealand based Emrod has developed a technology, which can deliver long-range, high-power, wireless power transmission (WPT) which can potentially replace the existing copper line infrastructure for transmission and distribution. The technology, if commercialized, can be lucrative for utilities across a number of regions globally, such as China and several countries in Europe, which have identified the right mix of energy generating resources to optimize the LCOE offered to the end users.

Emrod's march as an anti-copper firebrand: The Emrod technology leverages electromagnetic waves to safely and efficiently transmit energy wirelessly over significant distances. The technology is presently in the prototype stage, which would need to undergo considerable modifications to be scaled up. However, the prototype was successful in securing some public funding in New Zealand. The Emrod team designed and built the protype in Auckland in collaboration with Callaghan Innovation, an innovation agency driven by the New Zealand government. Emrod has been working with Powerco, New Zealand's second-largest power distributor, which has expressed interest in deploying a proof of concept of the technology. The exercise would be directed towards finding the level of compatibility of the technology with the existing distribution circuit operated by the utility.

Following stringent safety measures: Emrod leveraged a non-ionizing Industrial, Scientific and Medical frequency (ISM) band to execute the transmission in order to maintain high safety standards to be used around humans and animals. Furthermore, the technology has been equipped with a "low power laser safety curtain" which shuts down power transmission before any object, such as a bird or a drone can touch the main beam. The system also allows placing a meter anywhere to measure the usage of electricity.

High cost can stonewall adoption: The technology, once commercialized, would be appropriate for transmitting energy to remote locations with limited or no access to the grid. A full scale deployment would involve a one-time but a significant cost of several equipment including transmitting antennas, an array of relays and a receiving rectennas (i.e. a rectifying antenna which can convert microwave energy into electricity). Thus, the existing distribution grid infrastructure would remain unchanged. The transformers used in stepping down the transmission voltage (usually 110 KV) for directing it to the distribution grid would thus, be fed with the electricity converted directly from microwaves. A conventional rectenna can convert radio waves with low frequencies i.e. high wavelength to electricity. A sophisticated rectenna would thus, be required to obtain the necessary frequency, implying fabrication challenges. Also, the utility should have a series of such rectennas spread across the transmission path (typically, a couple of kilometers) which can bring down the financial viability of the technology.

Key Takeaway: The technology would be useful in case of unplanned outage events i.e., a truck equipped with a rectenna, driven to a visual range of a relay can establish a temporary wireless power connection. However, there are few segments of end-users who would not be influenced by the adoption of wireless power transmission. The zero-power home (where the house generates its own energy consumption and feeds the excess to the grid for monetary benefit) owners, for example, would require a very robust distribution network and would hardly be impacted by any change or disruption in the transmission lines. Also, end-users such as hospitals or military bases, which require high reliability in power supply are expected to continue with the traditional supplies, reinforced by appropriate energy storage systems as back-ups. The technology may replace small captive power plants for residential units in the years to come. Also, the technology promises potential for electric vehicle applications such as charging spots on highways.

Overall, the understanding of long-distance power transmission could be myopic. While the technology can obliterate the copper-based transmission, there are also associated costs to get the new technology aligned and integrated with the generation and distribution infrastructure. These ecosystems are quite hardwired into the overall power economy and thus, difficult to remove or replace. Thus, identifying key use cases would the key to profitability for any utility adopting this technology.

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Avimanyu Basu
Lead Analyst with Information Services Group (ISG)

"We have incorporated the highest forms of human safety..."

***Mitsubishi Electric** has launched a state-of-the-art **LV power switchgear and control gear** called **METTA. Sumeet Sharma, Assistant General Manager, LV Switchgear-Project Dept. of Automation & Industrial Division, Mitsubishi Electric India Pvt. Ltd.** is explaining the details of the product to **P. K. Chatterjee (PK)** online. Excerpts...*

What are the salient features of METTA LV power switchgear that help in saving cost?

METTA Low Voltage power switchgear and control gear assembly conforms to the latest IEC61439-1&2 standard and is designed and manufactured utilizing Mitsubishi Electric state-of-the-art technology, fully taking into account present and future power system requirements.

Its customer benefits with salient features and cost saving function includes the following:

- Build up to 5000A, 415 V AC Power control panel, and Motor control panel.
- Tested short-circuit current (lcw) value up to 100kA 1 sec
- Aluminium busbar design
- High levels of internal safety and tested up to Form 4b Type 7
- Build up to IP 54 degree of external protection
- No temperature derations up to 55 degree Celsius
- Design tested to IEC 61439- 1&2 with ASTA & ERDA certification.
- Weld-free modular bolted and flat pack enclosures
- Modular construction enables modification in panel shell on-site during or after execution as per site conditions.

Why are you using aluminium busbar instead of copper?

The Aluminium Busbar provides a special heat dissipation design.

It is twice as conductive as copper and can also be as much as 70% lighter than copper. The lightweight properties make aluminium bus bar installation so fast and easy that, a single operator can do it. Aluminium bus bar weight properties not only allow for ease and convenience but cost-savings as well. Thus, we are using aluminium bus bar instead of copper.

Please tell us about the extended safety aspects that you have included in METTA's design.

We have incorporated the highest forms of human safety as well as protection of materials and environment during the designing of METTA Panel.

The Internal Partition separation class is up to form 4b type 7 according to standard BS EN 61439-2, which completely isolates the live parts. It gives flexibility to work in one section of the panel while the rest of the panel is still live with power.

What are the site-specific advantages of its modular construction?

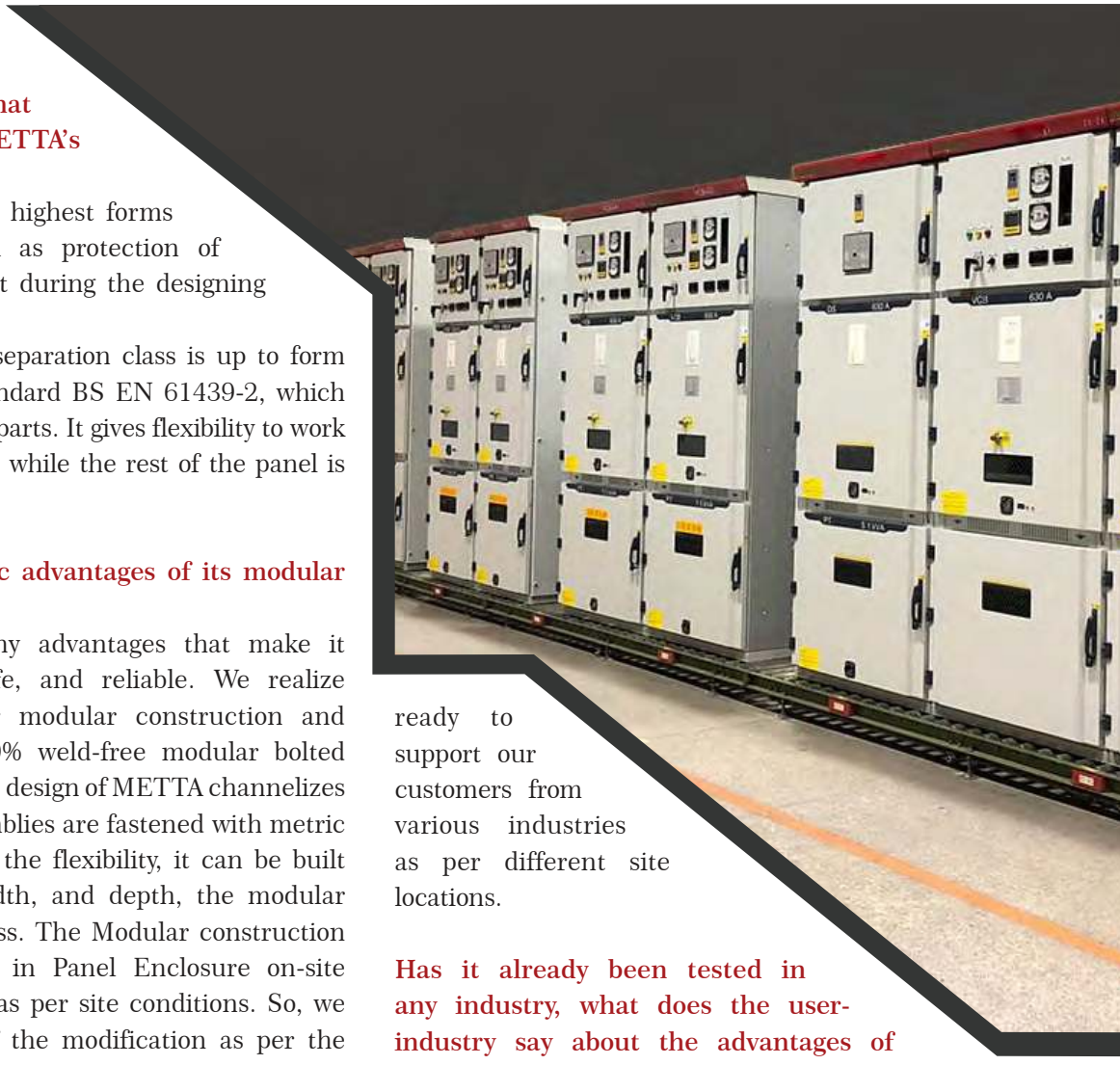
METTA comes with many advantages that make it flexible, user-friendly, safe, and reliable. We realize site-specific necessity for modular construction and therefore, METTA is 100% weld-free modular bolted design. The comprehensive design of METTA channelizes the structure so that assemblies are fastened with metric bolts and screws. To ease the flexibility, it can be built to any size in height, width, and depth, the modular component inventory is less. The Modular construction also enables modification in Panel Enclosure on-site during or after execution as per site conditions. So, we have covered the basis of the modification as per the requirement of our customer.

Can Metta Switchgear work efficiently in a highly corrosive environment?

Yes, METTA switchboard is tested and certified in the highly corrosive environment conditions by the International lab ASTA and domestic lab Electrical Research and Development Association (ERDA) in India. METTA switchboard offers no temperature deration up to 55-degree Celsius ambient temperature resulting in better thermal stability.

Is it possible to modify METTA's design as per individual customer's specification?

Yes, it is possible. METTA design is 100% weld-free, thus provides maximum flexibility to customers to utilize switchboard as per their site or application requirement without compromising on technical parameters. So, we are ready to support our customers from various industries as per different site locations.



Has it already been tested in any industry, what does the user-industry say about the advantages of using METTA?

We have tested it in the industry and METTA Panel is being used by customers from various industry segments. While designing, we were sure, and now it is proven that METTA design not only brings flexibility, but it also ensures safety and reliability for the convenience of its users.

Which industries are expected to be the best buyers for METTA?

The Modular design technology in Panels is the need of all Industry segment Users. Presently Airports, Residential and Commercial Buildings, Data centres, Government Utilities, Automobile Industry, various Process Industries, Shopping Malls, Hotels, and many more segments have already standardized on METTA Panel concepts and shall be our focused customer segments.

TESTING SMART METER

PART - II

The Smart Meter is an asset to the utilities that realises the revenue flow from the consumers to the power utilities and it is the revenue box for the utilities. The smart meter has two-way communication, which connects the consumer to utility. Smart meters are extremely critical components in the power network. Accuracy and reliable performance of smart meters and communication system between the smart meter and control centre are of vital importance. Also high accuracy measurement is required in Smart meter for accurate correct billing and to gain confidence of the customers. Testing of smart meters is a required activity to ascertain the quality and performance of the smart meters as per the relevant Standards. This article presents the test qualification requirements for Smart Meters...

In September issue of Electrical India, Part – I of this article was published. The remaining portion of the article has been cited here as Part II. The introduction to this part has been kept unchanged in order to give an instant cue to the reader.

Test Requirements For Smart Meters

Type tests cover verification of the following requirements. Schedule of Type Tests as per IS 16444 (Part 1) & IS 16444 (Part 2)

- Test of Insulation properties:

i. Impulse voltage test
ii. AC High voltage test
iii. Insulation resistance test

- Test of Accuracy Requirements:

i. Test on limits of error
ii. Interpretation of test results
iii. Test of meter constant
iv. Test of starting condition
v. Test of no-load condition
vi. Test of ambient temperature influence
vii. Test of repeatability of error
viii. Test of influence quantities

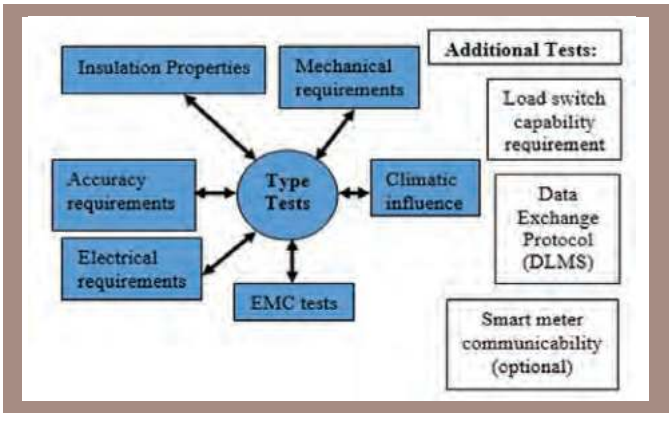
- Test of Electrical Requirement:

i. Test of power consumption test
ii. Test of influence of supply voltage
iii. Test of influence of short-time over currents
iv. Test of influence of self-heating
v. Test of influence of heating
vi. Test of influence of immunity to earth fault

- Test for Electromagnetic Compatibility:

i. Radio interference measurement
ii. Fast transient burst test
iii. Test of immunity to electrostatic discharges
iv. Test of immunity to electromagnetic HF field
v. Surge Immunity Test

- Test for Climatic Influences: i. Dry heat test, ii. Cold test and iii. Damp heat cyclic test
- Test for Mechanical Requirements: i. Vibration test, ii. Shock test. iii. Spring hammer test, iv. Protection against penetration of dust and water and v. Test of resistance to heat and fire



Additional tests:

- Test for Load Switch [Applicable only for A.C. Static Direct connected Watt-hour Smart Meter as per IS 16444 (Part 1)]

a. Performance requirements for load switching utilization category UC1 (Test requirements are mentioned in Clause 4.6.6.2.1 of IS 15884).

Category UC1 is applicable to smart meters rated at maximum current up to 100A.

b. Performance requirements for load switching utilization categories UC2 and UC3 (Test requirements are mentioned in Annex G of IS 15884): i. Normal operation, ii. Electrical Endurance, iii. Line to Load Voltage Surge withstand, iv. Fault current making capacity, v. Short-circuit current carrying capacity, vi. inimum Switched current, vii. Dielectric strength

- Test for Data Exchange Protocol
- Tests for Smart Meter Communicability and Smart meter functional requirements are cross referred to IS 15959 (Part 2) / IS 15959 (Part 3).

Significance Of Tests

- Test of Insulation properties: This test shall confirm the design and construction of meter for safety of personal and equipment in normal use and under normal conditions.

i. Impulse voltage test - This test determines the effect of voltage surge due to atmospheric disturbances of very short duration on electrical installation and their individual part. Lightning may produce over voltage on overhead transmission line by direct or indirect stroke.
ii. AC High voltage test - This test verifies the dielectric properties of smart meter.

This test verifies the dielectric properties of smart meter.

- Test of Accuracy Requirements: This tests will verify the metrological requirements of smart meters under normal conditions of use and under the influence of influencing quantities. This test in turn confirms the accurate billing.

i. Test on limits of error - This test ensures the smart meter class of accuracy due to variation of current and power factor.
ii. Interpretation of test results - During Test on limits of error, if the % error of smart meter obtained at various current and different power factors are within the limits, there is no need to displace the zero line to bring the errors within the limits.
iii. Test of meter constant - This test confirms the relation

between the test output and the indication in the display shall comply with the marking on the name plate of smart meter.

iv. Test of starting condition - The smart meter shall start and continue to register at the lowest value of current mentioned in the standard.

v. Test of no-load condition - During the test, the test output of the smart meter shall not produce more than one output pulse when 115% of reference voltage applied to the meter and current circuit in open circuit

vi. Test of ambient temperature influence - This test will verify the smart meter is capable of operating at higher or lower temperature without any change of characteristic of component and during this influence the % error of the meter is verified at different load current and power factor. The mean temperature coefficient is computed i.e., the ratio of the variation of the percentage errors to the change of temperature at the reference temperature shall be within the permissible limits.

vii. Test of repeatability of error - This test confirms the smart meter accuracy is repeatable or not at 5% Basic current, Basic current at UPF.

viii. Test of influence quantities - This test will confirm that the smart meter accuracy and variation in % error are within the specified limits under the following influence conditions: - a. Voltage variation, b. Frequency variation, c. Waveform: 10% of third harmonic in the current, d. Reversed phase sequence, e. Voltage unbalance, f. DC component in AC current circuit / DC and even harmonic test (applicable as per IS 13779), g. Auxiliary voltage (applicable as per IS 14697), h. Phase of auxiliary supply voltage by 120º (applicable as per IS 14697), i. Continuous magnetic induction (AC & DC) of external origin

- Test of Electrical Requirement: To verify the electric strength properties of the smart meter and withstand capacity of the smart meter under abnormal conditions.

i. Test of power consumption - To verify the power consumption of the smart meter in the voltage and current circuits are within the permissible limits as per standard.

ii. Test of influence of supply voltage - This test verifies when the smart meter is subjected to influence of supply voltage variations, the meter shall operate correctly and the accuracy and variation in % error shall be within the permissible limits.

iii. Test of influence of short-time over currents - The Short-time over currents may happen to be experienced by the smart meters due to short circuit faults occurred at the consumer premises. Short-time overcurrent shall not damage the meter and the switch shall remain operative. The surroundings of the meter shall not be endangered and protection against indirect contact shall be assured in all cases. After the test, variation of error shall not exceed the specified value as per standard.

iv. Test of influence of self-heating - This test will confirm that the current carrying capacity of cables, size of terminal block, screws used for cables are not over heated during full load condition for longer duration. The variation in error of the smart meter during twenty minutes shall not exceed the specified limits and variation between the minimum and maximum error of the meter shall be within the limit specified in the standard.

v. Test of influence of heating - This test is to confirm the proper operation of meter at different seasons. This test verifies the temperature rise of the meter due to excessive heating and restores the dielectric properties. Test of influence of immunity to earth fault - This test applies to three phase four wire meters. Earth fault condition is simulated in one of the 3 lines – all voltages increased to 1.1 times Vref during 4 hrs. Neutral of MUT is disconnected from Ground terminal of Meter Test Equipment (MTE) & is connected to line of MTE at which Earth fault has to be simulated. In this way 2 voltage terminals of MUT which are not affected by Earth fault are connected to 1.9 times Vref, Current= 0.5Ib & UPF. After the test, smart meter shall show no damage & shall operate correctly.

- Test for Electromagnetic Compatibility (EMC): The smart meter shall be designed in such a way the conducted or radiated electromagnetic disturbance shall not interfere functionally or metrologically with the operation of the meter.

To ensure that the smart meter is electromagnetically compatible, it shall comply with the two following test requirements: 1) Emission tests and 2) Immunity tests **Radio interference measurement (Emission):** This test ensures the RF emission disturbance (EMI) by conduction or by radiation shall not exceed the permissible limits mentioned in the standard.

Depending upon the way the EMI escapes from the equipment, there are two emission tests as per standards – the conducted emission (CE) test, which measures the

EMI that couples on to the other equipment via the power lead of the meter under test, and covers the frequency range from 150kHz to 30MHz; and the radiated emission (RE) test, that measures the EMI which escapes into the free space from the meter under test. It covers the emission over the frequency range 30 MHz to 1000 MHz.

Immunity tests: The immunity tests confirm that the meter is susceptible to both conducted and radiated RF electromagnetic disturbances. The conducted disturbances are - Fast transient burst, Electrostatic discharge and Surge and the radiated disturbances are Electromagnetic HF fields.

Fast transient burst test: The purpose of this test is to verify the immunity of the smart meters against Fast transient bursts of very short transients generated by the switching of small inductive loads, relay contact bouncing (conducted interference) or switching of HV switchgear – particularly SF_6 or vacuum switchgear (radiated interferences). This test ensures proper functioning and operation of the smart meter, when the Fast transient burst generated from source is coupled into the meter via power lines.

Test of immunity to electrostatic discharges: The Electrostatic Discharge (ESD) scenario is experienced when an operator is walking across a carpet of artificial fiber in a low humidity condition, a person can build up a charge of several thousand volts and also the ESD is generated from the moving objects. This disturbance simulates the type of high voltage interference that occurs when an operator touches the user accessible parts of smart meter after being charged to a high potential. This test ensures proper functioning and operation of the smart meter, when the ESD generated from one or another source is passed into the meter via user accessible parts.

Surge Immunity Test: The purpose of this test is to verify the immunity of the smart meter subjected to transient caused by over voltages from switching in the power network and lightning strokes (direct or indirect). This test ensures proper functioning and operation of the smart meter, in case Surges generated from the source and is passed into the meter via power lines.

Test of immunity to electromagnetic HF field: Electromagnetic (EM) radiations generated by sources like small handheld radio transceivers, fixed station radio and TV transmitters, vehicle radio transmitters etc.

This test ensures the proper operation and functioning of the smart meter under Electromagnetic HF fields present in the surrounding environment.

- Test for Climatic Influences: This test is to ensure proper functioning of the meters in different locations and under climatic conditions.

i. Dry heat test - This test determines the ability of components used in the meter at high temperature.
ii. Cold test - This test determines the ability of components used in the meter at low temperature.
iii. Damp heat cyclic test - This test determines the ability of components used in the meter under high humidity conditions when combined with cyclic temperature changes.

After each of the climatic tests, the meter shall show no damage and change of the information. These tests should not affect the functioning and operation of the smart meter.

- Test for Mechanical Requirements:

i. Vibration test - The smart meter is likely to be subjected to vibration environment during transportation and during operating condition. Hence the immunity of vibration is important to prove the reliability and performance of smart meter. The acceptance criteria for this test are that the smart meter shall show no change of information and variation in % error shall be within the permissible limits as per standard.
ii. Shock test - This test simulates the effects of relatively infrequent non-repetitive mechanical shocks likely to encounter by the smart meter in operating condition or during transportation. The acceptance criteria for this test are that the smart meter shall show no change of information and variation in % error shall be within the permissible limits as per standard.
iii. Spring hammer test - The purpose of this test is determine the ability of the meter to withstand a kinetic energy of 0.22 Nm on the outer surfaces of the meter cover (including windows) and on the terminal cover.
iv. Protection against penetration of dust and water - The smart meter shall have adequate degree of protection against ingress of dust and water. This test should not affect the functioning of the meter.
v. Test of resistance to heat and fire - The terminal block, the terminal cover and the meter case shall ensure reasonable safety against spread of fire. They should not be ignited by thermic overload of live parts in contact with them. The smart meter shall confirm to the requirements of the standard.

- Test for Load Switch [applicable only as per IS 16444 (Part 1)]

The load switch test ensures the performance of the load switch used for remote connect/disconnect. Load switch tests shall be carried out as per the utilisation category.

a. Performance requirements for load switching utilization category UC1 - This test verifies that the smart meter is capable of make and break at Vref, Imax with a linear resistive load for 3000 operations and at Vref, Ib, 0.4 inductive power factor for 3000 operations.
b. Performance requirements for load switching utilization categories UC2 and UC3 - The smart meter load switches shall be rated to carry maximum current continuously under normal operating conditions and to withstand the switching transients during make and break operations. The following tests on the smart meter shall be carried out as per the standard.
   i. Normal operation
   ii. Electrical Endurance
   iii. Line to Load Voltage Surge withstand
   iv. Fault current making capacity
   v. Short-circuit current carrying capacity
   vi. Minimum Switched current
   vii. Dielectric strength

The above said tests will confirm the following properties of load switch.

- Capable of making and breaking negligible currents of specified values - Capable of making, breaking and carrying rated currents of specified values;
- Capable of making into fault currents with specified value and under specified conditions;
- Capable of carrying short-circuit currents of specified value for a specified time period and under specified conditions;
- Not required to provide safety isolation properties in the open contact position. These are requirements for the installation mains isolation switch; and
- Not required to break overload currents or short-circuit currents. These are the requirements for fuses and circuit breakers that are normally used to protect the installation.
- Data exchange protocol

The DLMS data exchange protocol is chosen for smart meters including specific requirements for Smart Meters for the application layer as per IS 15959 (Part 1, 2 & 3). This helps in interoperability of meters with different makes of meters.

The purpose of DLMS protocol test is to ensure that the protocol is implemented in the meter and data from various object identification systems (OBIS) are as per standard. The data exchange protocol chosen for Smart Meter shall be as per IS 15959 (Part 2 for direct connected Smart meters & Part 3 for transformer operated Smart meters).

- Tests for Smart Meter Communicability - The communication modules for WAN/NAN/IHD shall be approved by designated agency authorized by DoT and shall have Equipment Type Approval (ETA) as mentioned in the smart meter standards. The standard provides for use of suitable communication technologies in the design of smart meters. However, to assess the communication capability of smart meter a few tests including a test for end to end communication capability and functional requirements are identified and included in relevant standard of smart meter.

Necessity of Testing

Testing will ensure the following: i) Insulation properties, ii) Accuracy, iii) Reliability, iv) EMC, v) Environment hardness, vi) Mechanical durability and vii) Safety

Independent testing ensures that all Smart meters are subject to the same standards and requirements which gives confidence both to consumer and utility. Also allows the interoperability of the meters of different manufacturers.

CPRI Laboratory is accredited by NABL as per ISO/IEC 17025 and BIS recognised.

Conclusion

Considering the importance and necessity of Smart meters, it is required to install tested and proven meters in the field to carry out the required intended functions accurately, reliable operation, safety of personnel, equipment and also minimise the revenue losses to the utilities.

Acknowledgement

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Polymer Solutions for Electric Vehicles

The global plastic for the electric vehicle market is projected to reach around USD 2,620 million by 2025. The stringent emission norms and demand for weight reduction in electric vehicles requires polymer solutions meeting these customized performance requirements, especially for the interior application segment.

Customised Polymer Solutions

The main reason for high-performance polymer compounds is stringent emission standards to drive electrification as well as Weight Reduction. Another important aim is OEM preferences for thermally stable engineering plastics.

Reduced Weight and Cost

The main reason for OEMs to choose metal-to-plastic conversion and injection molded plastic components is weight reduction. Lighter-weight electric vehicles have a greater range between recharges, which is a major consideration for customers while making a new purchase. Also, light-weighting vehicles (both battery-powered and conventional) simplifies compliance with increasingly stringent governmental regulations surrounding fuel efficiency and reduced reliance on natural resources. Injection molded plastic parts are generally less expensive to produce than metal components, which allows OEMs and electric vehicle makers they serve to better control costs, maximizing profits.

High-Temperature Performance

Injection molded plastic parts can be made using materials with

characteristics that address certain, requirements unique to electric vehicles. Batteries, for example, must remain cool. The number of Formulated Polymers Limited engineering plastics compounds offer excellent heat resistance from which to construct battery compartments and cooling systems without sacrificing durability and safety.

Strength and Safety

There's sometimes pushback with regards to safety and mechanical performance. FPL's range of Formpoly reinforced FORMPOLY & STARFLAM compounds engineered to rival or exceed metal's tensile strength while also offering exceptional modulus, fatigue, creep

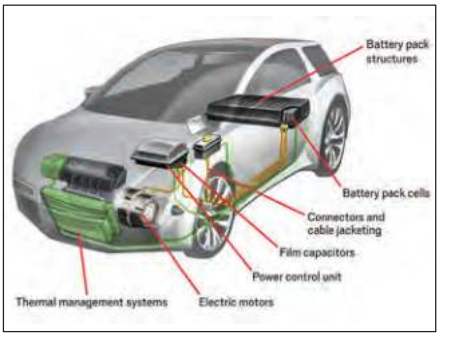
resistance and impact resistance while cutting weight by around 30%.

Engineering Plastics For Battery Applications

FPL has developed engineering thermoplastic, solutions for battery pack designs with its flame retardant low-density thermoplastic materials that target battery pack requirements, in particular:

- UL94 V0 flammability rating at a minimum thickness (0.8 mm)
- Chemical resistance testing to coolants and electrolytes
- Adhesive compatibility for ease of assembly and part integration
- High specific strength, stiffness, and superior impact properties for outer housings applications.

FPL is drawing upon its expertise in engineering compounds and has designed polymer solution to produce lighter Flame Retardant reinforced grades with superior impact performance. FPL is also developing solutions in Polyamides, ABS blends, PPE compounds and polypropylene (PP) grades from its portfolio, which show promising applicability.



Use of FORMPOLY mPPE COMPOUNDS resin can also help automakers avoid the use of chlorinated and brominated FR materials, providing a potential environmental benefit. FORMPOLY & STARFLAM flame retardant compounds in PA6, PA66, PPS, ABS compounds are used in EV battery applications due to their superior mechanical performance at lower thicknesses and shorter cycle times.

Power system automation is the act of automatically controlling the power system via I&C devices…

POWER SYSTEM AUTOMATION

Automation is the use of various control systems for operating equipment such as machinery, processes in factories, heat treating ovens, aircrafts and other applications that reduce human intervention.

Power system automation controls the power plant operations through optimization against the variation of parameters to provide high efficiency and reliability depending upon the demand of operation. The power system automation has become increasingly sophisticated on the back of major advancement in computer hardware and software. However, the advancement in sensors, amplifiers, recorders, control elements, valves and measurement technologies has enabled many power operating parameters to be measured and monitored that provides a detailed picture of the state of a plant in real time.

Large power plants are typically supervised and controlled by production and maintenance staff – that uses the process control system as a tool to automate process functions and gather & present information to be used by short and long term staff decision-maker. It is preferable that an organization behaving as a community be engaged to solve short-term problems and to develop evolving procedures for optimizing performance. Thus, the role of the control system is to automate, inform, network and store data.

Advancements in power system automation are available for all types of power plants. For renewable sources, such as wind and solar, optimization strategies are being developed although the potential of renewables sources are very limited. In case of steam tubine-based combustion plant, automation provides a great advantage. A good automation system will allow control of the combustion process in boiler by controlling the combustion process, which is important for plant emission performance as well as efficiency. It will control the temperature of steam and pressure – and allow the best efficiency to be achieved.

It can also be used to control the process of gas-turbine. However, the modern gas-turbines often operate at the limits of their materials' capabilities – and already closely controlled to ensure that they do not exceed their

limits. Thus, there is often less scope. Within the realm of the nuclear power plant, automation helps in easing some of the burdens on the operator during normal operations and it also assists in the event of an emergency.

Power system automation is the act of automatically controlling the power system via Instrumentation and Controlling (I&C) devices. Substation automation refers to use of IED data, control and automation capabilities with the substation, and control commands from remote users to control power system devices. PSA also includes processes associated with generation and distribution levels, which is power delivery automation. Together monitoring and controlling of power delivery reduces the occurrence of outages. The IEDs, communication protocols and communication methods work together as a system to perform power system automation.

- **Data Acquisition:-** Data acquisition refers to acquiring data. This data is in the form of measured analog voltage or current. This acquisition can be used locally or sent to another device in a substation or from the substation

to other several databases for use by operators and administrators.

- **Power system supervision:-** Operators monitor the information remotely on computer displays and graphical wall displays.
- **Power system control:-** Control refers to send command messages to a device to operator the I&Cs and power system devices. Field personnel can also control devices using front- panel push buttons or a laptop computer.
- **Power system automation:-** System automation is the act of automatically controlling the power system via automated processes within computers and I&C devices. The processes rely on data acquisition, power system supervision and power system control – all work together. The commands are generated and then transmitted in the same way as operator initiated commands.
- **I&C system:-** I&C devices are built using microprocessors as microprocessors are single chip computers that allow the devices to process data, accept commands and communicate information.
- **Instrument transformer:-** They are used to sense power system current and voltage values. They are connected to power system apparatus and convert the actual power signals.
- **Transducer:-** transducer converts the analog output of an instrumental transformer from one magnitude to another.
- **Remote Terminal Unit (RTU):-** Remote terminal unit is and IED that can be installed in the remote location and acts as a termination point for field contacts. A pair of copper conductors are used to sense every contact and transducer values. These terminals originated at the power system device and then terminated on panel within the RTU. The RTU can transfer collected data to other devices and control commands from other devices through a serial port.
- **Communication port switch:-** A communication switch, switches between several serial ports. The remote user can communicate with a port switch via a connection to the substation. Once the user connects, that can route their communication through the port switch to one of the connected substation IEDs.
- **Meter:-** A meter is an IED that is used to create accurate measurements of power system current, voltage and power values. Metering values such as demand and peak are saved within the meter to create information about the activity of the power system.
- **Digital Fault Recorder:-** DFR is an IED that records information about power system disturbances. Harmonics, frequency and voltage are examples of data captured by DFRs.
- **Time Synchronization Source:-** A time synchronization source is an IED that creates a time-of-day value, which is then broadcast to the IEDs in order to set all their clock to the same time.
- **Human Machine Interface (HMI):-** The front panel display or a personal computer act as an interface to system data and controls for personnel in the substation.
- **Future Scope:-** In future the control system will supervise the systems, rather to control it. The system will incorporate the latest technologies and use multiple communication channels. The operator interface will become the human computer interface – allowing collaboration between interested parties enabling them to participate in optimization and operation of plant. In the future, computers will be at the power plant – but the operator will be somewhere else. Data will be available through portals to the outside world with the aim to optimize the process, and operation costs will be reduced.

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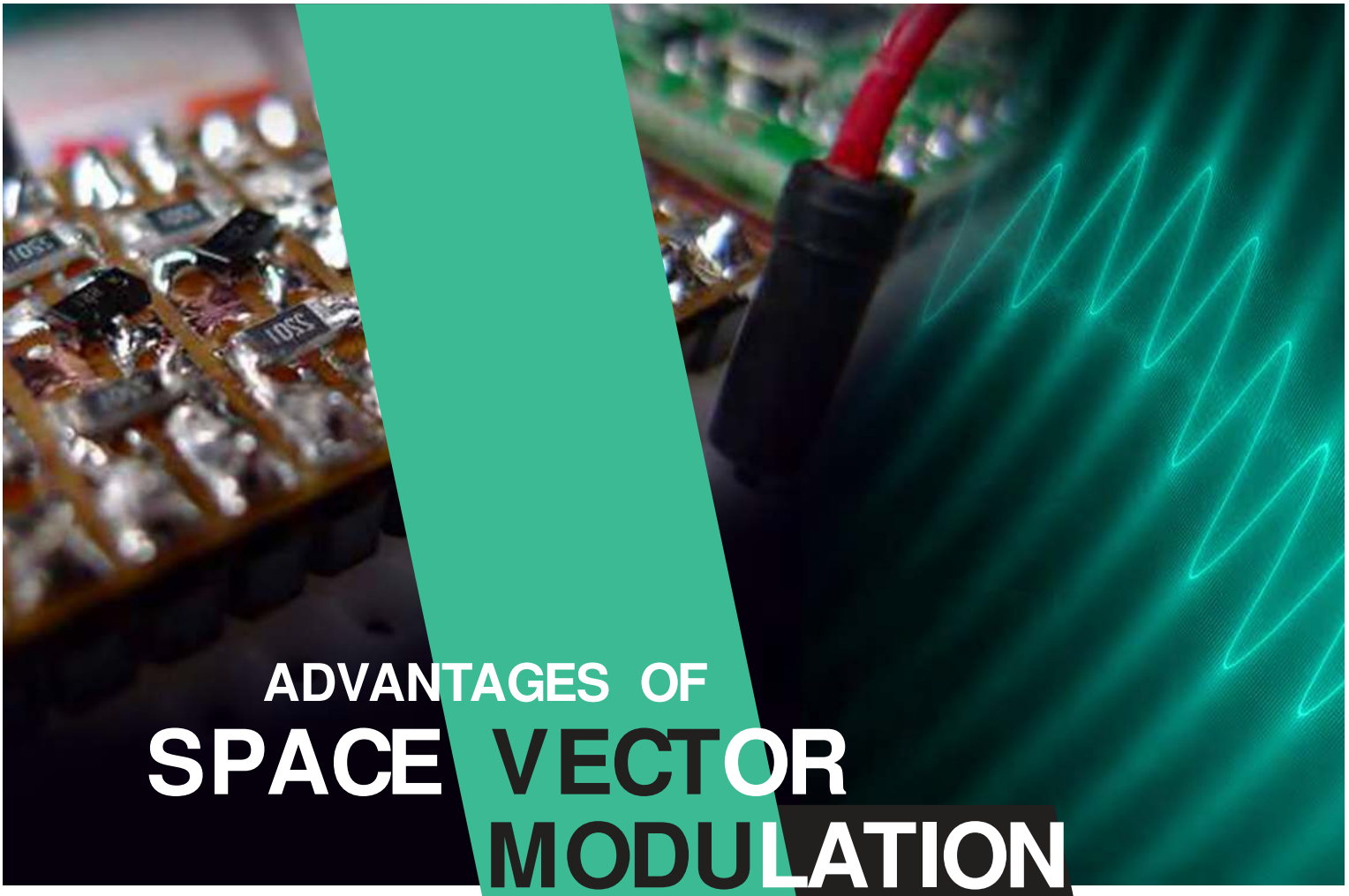

ADVANTAGES OF SPACE VECTOR MODULATION

The most commonly used modulation techniques employed are the Sinusoidal Pulse-Width Modulation (SPWM) technique and the Space Vector Modulation (SVM) technique. Which one is really better?

DC to AC converters or inverters find wide applications in industry for AC motor drives. They are also widely used in FACTS devices, HVDC transmission, Uninterruptible Power Supplies, ship propulsion systems, etc. The most basic and still prominently used inverter configuration is the two-level Voltage Source Inverter (VSI), shown in Fig. 1. A number of modulation techniques have been developed over the years for the two-level VSI. However, the most commonly used modulation techniques employed are

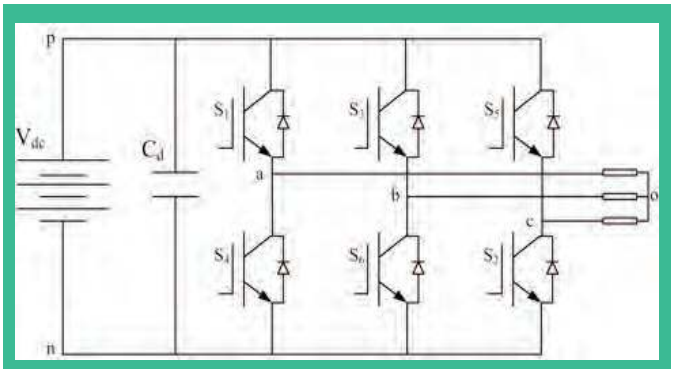

Figure 1: Two-level voltage source inverter...

the Sinusoidal Pulse-Width Modulation (SPWM) and the Space Vector Modulation (SVM) technique. In this article, we attempt to compare the two techniques and illustrate the advantages that the SVM technique has over the SPWM technique.

Sinusoidal Pulse-Width Modulation (SPWM)

The wide popularity of the SPWM technique for the modulation of the two-level VSI can be attributed to its simplicity. It is a carrier-based technique in which each phase leg of the inverter is independently controlled. SPWM can be unipolar as well as bipolar. Since Space Vector Modulation is a bipolar modulation technique, so to maintain consistency in the comparison, bipolar SPWM is considered here. It employs a common carrier wave for all the three phases whose frequency fcr is much higher than the inverter output frequency. It also employs three modulating waves, one for each phase. The modulating wave for each successive phase leg of the inverter is phase displaced by 120°, as shown in Fig. 2. The frequency f of the modulating waves is same as the desired inverter output frequency. The amplitudes of the carrier and modulating waves are Am and Acr respectively. The ratio fcr/f is called the frequency modulation index mf of the inverter; while the ratio Am/Acr is called the amplitude modulation index ma. The value of ma ranges from zero to one for the linear modulation range and decides the amplitude of the fundamental component of the output voltage of the inverter. On the other hand, mf decides the harmonic spectrum of the inverter output voltage. It also decides the device switching frequency as well as the inverter switching frequency (which is same for bipolar SPWM).

The implementation of the SPWM technique is pretty simple. For each inverter phase leg, the modulating

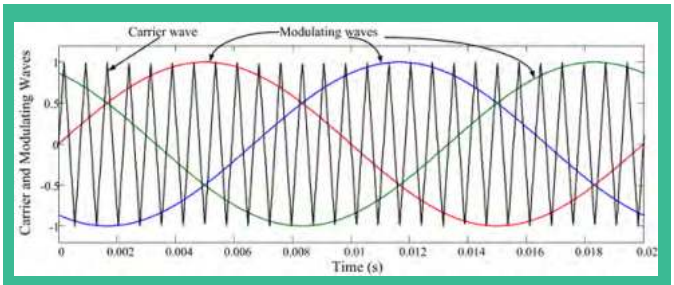

Figure 2: Carrier and modulating waves for SPWM...

wave is compared with the carrier wave. Whenever the modulating wave is greater than the carrier wave, the upper switch of that inverter leg is turned on; otherwise the lower switch is turned on. The inverter output line-line voltage and its frequency spectrum for mf = 23 and ma = 1 with a DC link voltage Vdc = 200 V are shown in Fig. 3. Note that these results are obtained without any output filter. In practice, the inverter will employ an output filter to limit the harmonics and the Total Harmonic Distortion (THD) within permissible limits.

Space Vector Modulation (SVM)

Space Vector Modulation is another popular scheme for the modulation of voltage source inverters. The modulation scheme is notable for its ease of digital implementation, especially in the case of multilevel inverters since the number of carriers does not increase with the number of inverter levels.

The operating status of the switches in each inverter leg of Fig. 1 can be represented by switching states.

Figure 3a: Inverter output line-line voltage waveform...

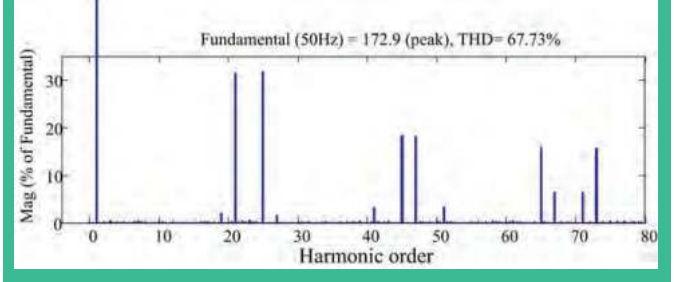

Figure 3b: Inverter output frequency spectrum...

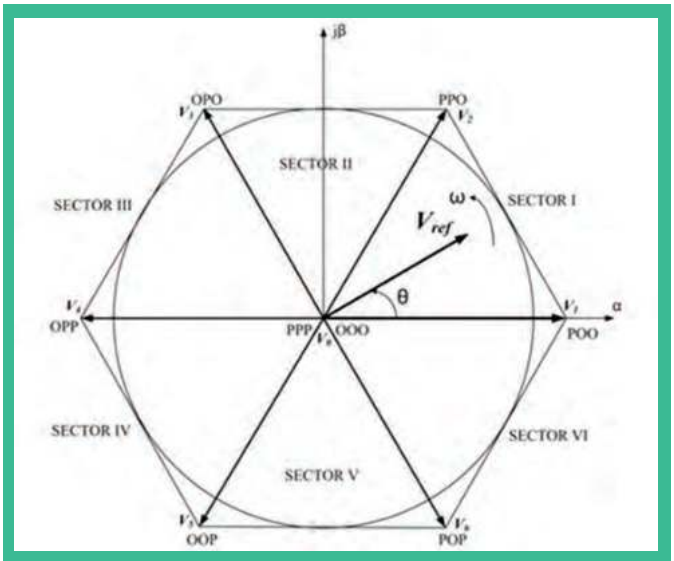

Figure 4: Space vector diagram of a wo-Level Inverter...

Switching state P indicates that the upper switch of that particular inverter leg is on and the voltage of that phase leg with respect to terminal n of the DC rail is Vdc. Conversely, the state O indicates that the lower switch is on and the corresponding voltage is zero. Since no two switches of the same inverter leg can be on at the same time, we can have eight possible combinations of switching states for a two-level VSI. These are [POO], [PPO], [OPO], [OPP], [OOP], [POP, [PPP] and [OOO]. Among the eight switching states, [PPP] and [OOO] are zero states, while the others are active states.

Conceptually, a set of three-phase waveforms can be represented by a single rotating vector, often called a Park's vector. This concept can be applied to the three-phase output voltages of the two-level inverter. The active and zero switching states can then be represented by active and zero space vectors, respectively. These space vectors, when drawn graphically, result in a regular hexagon with the active space vectors (V1 to V6) as its vertices, and the zero vectors (Vo) as its centre. This regular hexagon is called the Space Vector Diagram (SVD) of a two-level inverter, and is shown in Fig. 4. The SVD also shows a reference vector Vref, which represents the reference sinusoidal wave desired to be generated by the inverter. The basis of SVM is to generate Vref as closely as possible using the Nearest Three Vectors (NTVs) to the reference vector. Note that the active and zero vectors are stationery vectors whereas Vref is rotating continuously in space at a frequency ω rad/s and subtends an angle θ with respect to the reference axis. Here ω is the desired output frequency of the inverter in rad/s.

The amplitude of Vref decides the amplitude of the fundamental component of the output voltage. It can be expressed as a function of the amplitude modulation index ma, where ma corresponds to the radius of the largest inscribed circle of the space vector hexagon and ranges from zero to one for the linear modulation range. The reference vector is sampled at regular intervals of time. During a sampling interval Ts, Vref and θ are held constant and Vref is synthesized using the NTVs to Vref. The reciprocal of Ts is called the sampling frequency fs (≡ fcr). The ratio fs/f, where f is the inverter output frequency, is called the frequency modulation index mf and decides the inverter output voltage harmonic spectrum as well as the device switching frequency.

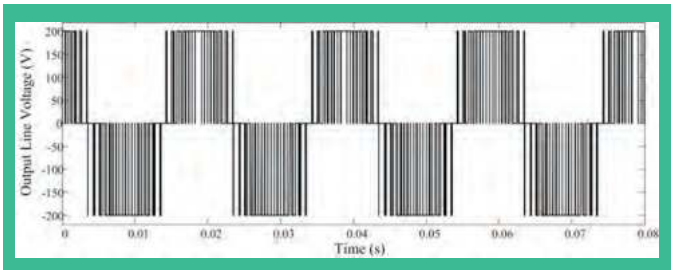

Figure 5a: Inverter output line-line voltage waveform...

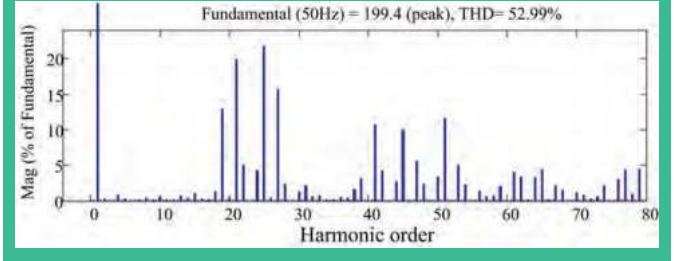

Figure 5b: Inverter output frequency spectrum...

The inverter output line-line voltage and its frequency spectrum for mf = 23 and ma = 1 with a DC link voltage Vdc = 200 V with Space Vector Modulation are shown in Fig. 5. Note again that these results are obtained without any output filter. Since the lower order harmonics are eliminated in both the modulation schemes, the output filter size is considerably reduced. The THD of the output current waveform would be even lower on account of the load inductance.

Key Points of Comparison

- **Utilization of DC link voltage:** In case of sinusoidal PWM, the amplitude of the fundamental component of the output line voltage is found to be 172.9 V (peak value) or 122.2 V (rms). Thus, the amplitude of the

fundamental component for SPWM is 122.2/200 = 0.612 or 61.2% of Vdc. In case of Space Vector Modulation, the amplitude of the fundamental component of the output line voltage is 199.4 (peak value) or 141 V (rms). Thus, for the case of SVM, the amplitude of the fundamental component is 141/200 = 0.707 or 70.7% of Vdc. Thus, the SVM scheme is able to extract more fundamental component of the output line voltage as compared to SPWM. Specifically, for the same DC link voltage, the output line voltage magnitude for SVM is 0.707 Vdc /0.612 Vdc = 1.155 or 15.5% greater than that obtained with SPWM.

- **Output line voltage THD:** The output line voltage THD values obtained for the two-level inverter without any output filter are 67.73% and 52.99% for SPWM and SVM respectively. Thus, the THD is significantly lower in case of Space Vector Modulation, which is to be expected since the amplitude of the fundamental component of the output line voltage has increased.
- **Output current THD:** Considering a 0.8 lagging power factor load, the output line current THD values are obtained as 3.53% and 2.85% for SPWM and SVM respectively. For the same load, these values correspond to the output line voltage values and are significantly within limits in both the cases. Note that these values are obtained for a frequency modulation index of 23.
- **Device switching frequency:** The number of switchings of each power electronic device in one cycle of the inverter output voltage is equal to the frequency modulation index for both the techniques. Thus, there is no difference between the two techniques as far as device switching frequency is concerned.
- **Frequency spectrum:** Comparison of Figs. 3(b) and 5(b) shows that the SPWM gives a much cleaner frequency spectrum as compared to SVM, even though the THD is greater. This is because the output line voltage in case of SVM is inherently half-wave asymmetric, as a result of which even-order harmonics are also present in the output voltage. However, the harmonics can be eliminated by making some changes in the switching sequence design.
- **Ease of implementation:** SPWM is much easier to implement as compared to SVM as the concept behind it is pretty simple. However, it must be noted that the sinusoidal modulating waves and the carrier wave cannot be generated using digital processors; instead look-up tables have to be used. The accuracy of the generated waves depends on the number of data points in the look-up tables. Also, if carrier-based PWM schemes are used for multilevel inverters, the number of such look-up tables goes on increasing. No such look-up tables are required for SVM implementation. In fact, it is possible to have algorithm based all-digital SVM implementation even for multilevel inverters using techniques such as the g-h coordinate transformation technique.
- **Design flexibility:** There is no flexibility in design afforded by the SPWM technique. However, this flexibility is available in case of SVM wherein it is possible to design the switching sequence as per the requirements of the implementing personnel. There is the option to use which switching states to use, how many segments to have in one sampling period Ts etc. The design options increase significantly in case of multilevel inverters. As such, SVM has been, and continues to be, a favourite for researchers.

Conclusion

Sinusoidal Pulse-Width Modulation is conceptually simpler to understand as well as implement as compared to Space Vector Modulation for DC to AC converters. However, the advantages offered by SVM are significant as compared to SPWM. Even though SVM requires some effort to master it, its advantages in the long run over SPWM make it worthwhile to do so. To an engineer, the design flexibility offered by SVM is also very encouraging and interesting.

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"India will chart its own course of energy transition..."

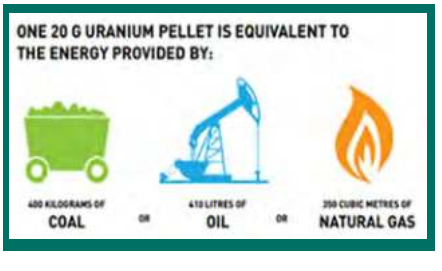
(Continuation from the October 2020 issue)

Recently, in a free-wheeling interaction with Electrical India (EI) team, Dr Vivek Soni, Faculty of Management, PhD & MTech (IIT Delhi), and a Certified Independent Director -MoCA, Govt of India, revealed his observations and expectations from the ongoing developments in the Indian Power Sector. Here is the Part 2 of the interaction; remaining parts will appear in the next issues of EI…

India is blessed with huge potentials of solar as well as wind (onshore and offshore) energies, then down the line in next (say) five years what should be the ideal power mix for us?

This is true that India has very high potential of solar as well as wind for converting into energy. Our country receives solar radiation of 5 to 7 kWh/m^2 for 300 to 330 days in a year, power generation potential using solar PV technology is estimated to be around 20MW/sq. km and using solar thermal generation is estimated to be around 35MW/sq. km.

The Indian energy sector has lately witnessed a rapid growth in an effort to meet the demands of a developing nation. However, continued use of fossil fuels is set to face multiple challenges like depletion of fossil fuel reserves, global warming and other environmental concerns, geopolitical and military conflicts and of late, continued and significant increase in fuel price. Renewable energy source like solar and wind are the solutions to the growing energy challenges as they are abundant, inexhaustible and environment friendly.



If you look at considering all the aspects, solar Energy in India is one of the most exciting and thriving industries in the world right now. Main reason is that source's unique confluence of favourable Supply and Demand factors. On cost fronts, we have also optimized the fabrication of modules that have been declining rapidly in recent years and is near to achieve grid parity.

India is now trying to expand its green energy portfolio by harnessing the entirely unexploited offshore wind energy potential along its 7,600 kms coastline. The focus on offshore has increased in recent years partly due to its global rise and partly due to the ongoing lull in the onshore wind energy segment.

Offshore wind energy has multiple benefits over onshore. "The biggest advantage of offshore observed worldwide is that the generation profile is much flatter compared to onshore farm.

As far the as wind energy is concerned, the basic framework for offshore project development in India is provided by the National Offshore Wind Policy 2015. So far, sites have been running many wind projects near coasts of Gujarat and Tamil Nadu through a programme called Facilitating Offshore Wind in India (FOWIND). The FOWIND project came up with eight potential zones in the two states that are most suitable for offshore wind development.

India is also planning to install five more LiDAR (Light Detection and Ranging) systems, including two in Gujarat and three in Tamil Nadu soon.

In terms of way forward to India efforts on development of on and offshore projects, it is evidenced from the LiDAR data collected in Gujarat, generation from installations will be more evenly distributed across the year, while 60 per cent of the generation from onshore projects tends to be concentrated in three to four months. Despite suitable conditions, the pace of development has been slow and the 5 GW target is out of reach given project gestation is 6-7 years. While the government is busy preparing the tenders, supply chain issues have been left unaddressed.

In this case of wind, again cost has become another parameter to challenge. The capital cost of offshore wind projects is roughly five-seven times higher than onshore projects. While turbines account for 60-80 per cent of the capital cost of an onshore project, they are only 30-50 per cent of the cost in case of an offshore project. Instead, the share of grid connection costs is higher at 15-30 per cent in case of offshore wind due to the requirement of laying sub-sea cables.

However, even though offshore wind capacity development is more expensive, the economics can work out if VGF is provided along with tax breaks and technology benefits. Further cost reductions will need to be achieved through turbine designs customised for low-wind conditions, low labour cost as well as tax waivers.

At present, tax burden on the industry is estimated to be 30-31 per cent. Developers have been requesting the government to waive off the custom duties and impose only the 5 per cent goods and services tax (GST), in line with the concessions being provided to oil and gas industry. This is crucial considering that most of the projects are, at present, dependent on foreign technology.

Based on the above, it can be said that optimal energy mix make the energy sector transition a powerful driver for the government's reform plans to increase the robustness and sustainability of power supplies while expanding affordable energy access. These goals are behind the government's "24×7 Power for All" initiative to provide access to 245 million people without power by 2019.

This has been possible with the downward trend of cost of solar panels and newer technology options like battery energy storage systems. In fact, the reduction in cost projections is very aggressive for battery energy storage technology so as to render them financially viable.

To achieve the mix, a horizon of 10-12 years is sufficient to gear up the systems and policies in the right direction. We must keep focus on today's energy mix and plan for optimal generation capacity mix which is primarily aimed at finding out the least cost optimal generation capacity mix, further which may also be required to meet the peak electricity demand and electrical energy requirement of the next few decades. In this context, planning for optimal generation capacity mix for India gains tremendous importance so as the future generation capacity mix will be cost effective as well as environmental friendly.

Can we manufacture better solar arrays at a cheaper rate than that Chinese manufacturers offer?

This is fact that Indian solar companies have been highly dependent on China in terms of importing components. Modules account for nearly 60% of a solar power project's total cost.

It was estimated that over 80 per cent of solar cells and modules are imported from that country because of its competitive pricing compared to domestic manufactures.

Many sources reported that India's solar industry is largely dependent on procurement of raw materials from China. The same is not the case for wind equipment but for solar about 85 per cent of cells and modules are still imported, mostly from China. "India's current domestic manufacturing capacity stands at around 11 GW for panels and 3GW for cells, although some capacity remains unutilised due to price and quality concerns. Since the world in entirety and India specifically is looking at diversification of trade markets, this is an opportunity to dramatically improve our capabilities in domestic manufacturing of solar equipment.

On this front, India is also looking to play a larger role in global energy supply chains in the backdrop of the disruption caused by the pandemic and with the Self –reliance progarmme, India currently has considered in scaling up a domestic manufacturing capacity beyond 3 GW for solar cells and recently awarded a manufacturing-linked solar contract that will help in establishing additional solar cell and module manufacturing capacity. Here, clean energy projects now account for more than a fifth of India's installed power generation capacity, with the country becoming one of the top renewable energy producers globally with ambitious capacity expansion

plans. In this context, China remains India's second largest trading partner after the US. India's exports to China rose 3.8% to $17.1 billion in 2019 while imports contracted 7.5% to $68.3 billion during the same year.

We must, however, keep in mind that near-term development and execution of Renewable Energy (RE) projects is not hampered with our plant set under self –reliance manufacturing. A dedicated strategy the need of the hour and to scale up local manufacturing, Indian manufacturing industry look forward to put in place a long-term policy, coupled with infrastructure and the right incentives to support the same. Another factor of investment into R&D, which is imperative, and policy makers and top thinker need to think about complete vertical integration if we want to attempt self-sufficiency in solar equipment manufacturing. It is not enough to just set up units to make cells, modules or wafers. It should also need to gear up production of ancillaries including inverters, glass, back sheets etc.

Besides boosting domestic manufacturing, our country should also need to take a forward-looking approach to the manufacturing of equipments for renewable. No doubt battery technology is all set to be a gamechanger, as it addresses the intermittency of renewables and can transform electric mobility. Many initiative of Energy Effcieincy Services Limited (EESL) are praise worthy. We believe that this segment will become critical for the growth of RE in the coming years.

Are we (as a country) self-sufficient to design and produce all power electronics products to store, integrate and control mainly the renewable energies (with variable generation outputs)?

My answer is yes, we are.

However, that said in the solar segment though a few companies in India are doing local manufacturing they have not been able to keep up with the paramount quality one gets from trade from other part of the world. It is sometimes at a cheaper rate than what the vendors here in India provide. On this front, quality in manufacturing needs to occupy the central point of attention.

Besides solar, even the lithium batteries for Electric Vehicles (EVs) are sourced from outside India due to the non-availability of Lithium in India. Hence, many manufacturers feel that it would not be appropriate to boycott trade relations with other countries. Other than electronics parts in the EV industry, Indian electronic industry is mainly depending upon for Lithium-based batteries for EVs.

As a massive and game changer initiative, India has taken step to become self-sufficient to design and produce all power electronics products to store, integrate and control mainly the renewable energies. Here, one of our main products, EV battery-swapping stations for two and three-wheelers is going to be set up in different parts of the country. It will use four different type Lithium-based batteries out of which two are sourced from other world by our battery partners. A disruption will directly impact our end-user choice and price parity. In the meantime, we are also working in alternative electronics equipments and battery technologies to minimize the dependency on any other country.

Are we still dependent on the import of passive electronic components that increase the cost of our power electronic devices?

Let's understand perspectives of electronics that include passive, active, electro-mechanical and associated components.

Passive electronic components are components that consume energy and do not produce energy. A typical example of passive electronic components would be resistors and capacitors, they are not active components like diodes, transistors, ICs and LEDs. Note that, the current growth drivers of Indian electronics market for domestic manufacturing are LED lighting, automotive electronics, energy meters, solar energy, mobile phones and IT products such as tablets. Local mobile phone makers are also expected to drive demand for their components.

When it comes to energy sector, the electronics industry is going through an exciting phase. Demand for electronic products is on the rise, electronics is playing a major role in energy sector, and innovations are happening with increased efficiency and frequency. With the new setting of vision of self – reliance India program, Manufacturers of electronic products need to focus on continuous improvement in order to stay ahead of the pack.

A few tech trends that will impact the electronic components industry are convergence of technologies that allows a single device to use multiple

technologies and provide varied services, followed by miniaturisation which is expected to increase and will impact the traditional components market, as most of these components will be replaced by chip components and integrated circuits. Artificial intelligence is another one, which has moved beyond consumer products and is also available in several industrial electronic products and lastly going green where manufacturers will need to shift focus from discrete components to integrated components in order to benefit from the changing tech landscape in the country.

One should note in the mid that upon massive move to self-reliance India program, the Indian Electronic Systems Design and Manufacturing (ESDM) industry is on its way to achieving its full potential in terms of both production and design capabilities. India's domestic electronics production had exceeded imports in last couple of years. This indicates that the 'Make in India' initiative is beginning to have a positive impact on domestic manufacturing. Favourable business policies for the domestic electronics sector have undoubtedly played their part, particularly in facilitating the setting up of manufacturing facilities for smart phones, set-top boxes, televisions and other appliances. This presents an opportunity to the electronic components manufacturing industry of the country. Over the next five years, accelerated local manufacturing of electronic products to cater to growing domestic demand will drive the market for electronic components in India.

However, this will only be possible if the Indian electronic components industry can transform itself into the best-in-class manufacturing hub as few of issues related to passive components are high capital costs, inefficient supply chain for raw materials, non-availability of advanced manufacturing equipment, logistics inefficiencies and infrastructural bottlenecks and lack of skilled labour, need focused approach.

What is your take on India's initiative to produce big indigenous energy storage facilities and components required for that?

India has a great ability to get into sunset industries rather than sunrise industries and the future belongs to only two things and the country needs to put its entire scientific community behind two aspects storage and batteries. Without storage and batteries India has no future.

Secondly, the future lies in electric mobility. This is going to happen worldwide and if India is able to take the lead in these two things it will take lead globally. In every other sector, we have got in too late in the game but in these two sectors we are exactly where the world is. People may say whatever but we are exactly where the world is. If we are able to make technological breakthroughs in the areas of storage and batteries, if we can make a massive break-through in electric mobility, India will leap-frog the world.

Just think of Renewable Energy, India's biggest asset, is its sun and its renewable energy but this renewable energy cannot be tapped fully without storage and without a huge and massive break-through in our ability to link it with transmission and distribution and make massive improvements.

In my views, it is a major push in EVs across India will naturally help to spur the stationary storage industry

given the synchronicities across lithium-ion batteries at present and the likely reduction in battery costs for both sectors as a result.

Recently, Solar Energy Corporation of India (SECI) has now released two major tenders including 1.2GW of solar PV combined with 3,600MWh of energy storage connected to the national grid.

The country needs energy transformation and we need to look at four objectives access to energy at rational prices, improved security and independence, greater sustainability and economic growth. We need to completely re-frame our oil policy to look at this. If we need to clean up India and provide better life for our citizens, we need to focus on these areas.

With appropriate policy support through this mission, Indian companies will be able to diversify into energy storage business. I also have opinion that through Make In India initiative, India will able to compete with the countries like China, Australia, Germany, USA, Taiwan, South Korea other Li-Ion manufacturing countries. In my views, such focused program will not only boost production, improve air quality in cities along with reducing India's oil import dependence, enhance the uptake of renewable energy and storage solutions but also expand dimensions of products across the entire Energy storage value chain.

ALL INDIA INSTALLED CAPACITY (IN MW) OF POWER STATIONS
(As on 30.09.2020)

Region	Ownership/ Sector	Mode wise breakup								Grand Total
		Thermal					Nuclear	Hydro	RES * NRE)	
		Coal	Lignite	Gas	Diesel	Total				
Northern Region	State	16659.00	250.00	2879.20	0.00	19788.20	0.00	5777.25	725.01	26290.46
	Private	22425.83	1080.00	558.00	0.00	24063.83	0.00	2817.00	16288.51	43169.34
	Central	14354.96	250.00	2344.06	0.00	16949.02	1620.00	11450.52	379.00	30398.54
	Sub Total	53439.79	1580.00	5781.26	0.00	60801.05	1620.00	20044.77	17392.52	99858.34
Western Region	State	21740.00	1040.00	2849.82	0.00	25629.82	0.00	5446.50	555.54	31631.86
	Private	32847.17	500.00	4676.00	0.00	38023.17	0.00	481.00	25570.04	64074.21
	Central	19147.95	0.00	3280.67	0.00	22428.62	1840.00	1627.50	666.30	26562.42
	Sub Total	73735.12	1540.00	10806.49	0.00	86081.61	1840.00	7555.00	26791.88	122268.49
Southern Region	State	19782.50	0.00	791.98	159.96	20734.44	0.00	11774.83	586.88	33096.15
	Private	12747.00	250.00	5340.24	273.70	18610.95	0.00	0.00	41960.28	60571.23
	Central	11835.02	2890.00	359.58	0.00	15084.60	3320.00	0.00	541.90	18946.50
	Sub Total	44364.52	3140.00	6491.80	433.66	54429.99	3320.00	11774.83	43089.06	112613.88
Eastern Region	State	7450.00	0.00	100.00	0.00	7550.00	0.00	3537.92	275.11	11363.03
	Private	6153.00	0.00	0.00	0.00	6153.00	0.00	96.00	1267.10	7516.10
	Central	13682.05	0.00	0.00	0.00	13682.05	0.00	1005.20	10.00	14697.25
	Sub Total	27285.05	0.00	100.00	0.00	27385.05	0.00	4639.12	1552.21	33576.38
North Eastern Region	State	0.00	0.00	498.86	36.00	534.86	0.00	422.00	233.25	1190.10
	Private	0.00	0.00	24.50	0.00	24.50	0.00	0.00	105.28	129.78
	Central	770.02	0.00	1253.60	0.00	2023.62	0.00	1263.50	30.00	3317.12
	Sub Total	770.02	0.00	1776.96	36.00	2582.98	0.00	1685.50	368.53	4637.00
Islands	State	0.00	0.00	0.00	40.05	40.05	0.00	0.00	5.25	45.30
	Private	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.87	24.87
	Central	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.10	5.10
	Sub Total	0.00	0.00	0.00	40.05	40.05	0.00	0.00	35.22	75.27
ALL INDIA	State	65631.50	1290.00	7119.86	236.01	74277.36	0.00	26958.50	2381.03	103616.90
	Private	74173.00	1830.00	10598.74	273.70	86875.45	0.00	3394.00	85216.08	175485.53
	Central	59790.00	3140.00	7237.91	0.00	70167.91	6780.00	15346.72	1632.30	93926.93
	Total	199594.50	6260.00	24956.51	509.71	231320.72	6780.00	45699.22	89229.42	373029.35

Figures at decimal may not tally due to rounding off

Source: CEA

Energy Supply Position Report (Revised)

Figures in MU net

States	September, 2020				April, 2020 to September, 2020			
	Energy Requirement	Energy Supplied	Energy not Supplied		Energy Requirement	Energy Supplied	Energy not Supplied	
	(MU)	(MU)	(MU)	%	(MU)	(MU)	(MU)	%
Chandigarh	170	170	0	0.0	879	879	0	0.0
Delhi	3,343	3,343	0	0.0	17,126	17,124	3	0.0
Haryana	6,005	5,999	6	0.1	29,239	29,213	26	0.1
Himachal Pradesh	893	882	11	1.2	4,554	4,522	32	0.7
UT of J&K and Ladakh	1,431	1,431	0	0.0	8,917	8,008	909	10.2
Punjab	7,264	7,264	0	0.0	35,177	35,177	0	0.0
Rajasthan	7,094	7,093	1	0.0	40,480	40,449	30	0.1
Uttar Pradesh	13,411	13,325	86	0.6	69,478	68,887	590	0.8
Uttarakhand	1,347	1,347	**0**	0.0	6,922	6,922	0	0.0
Northern Region	**40,958**	**40,854**	**104**	**0.3**	**212,771**	**211,181**	**1,589**	**0.7**
Chhattisgarh	2,745	2,745	0	0.0	14,974	14,974	0	0.0
Gujarat	8,928	8,928	0	0.0	50,786	50,786	0	0.0
Madhya Pradesh	6,492	6,492	0	0.0	35,768	35,768	0	0.0
Maharashtra	11,553	11,553	0	0.0	68,750	68,750	0	0.0
Daman & Diu	213	213	0	0.0	907	907	0	0.0
DNH	527	527	0	0.0	2,098	2,098	0	0.0
Goa	322	322	0	0.0	1,905	1,905	0	0.0
Western Region	**30,780**	**30,780**	**0**	**0.0**	**175,187**	**175,187**	**0**	**0.0**
Andhra Pradesh	4,997	4,996	1	0.0	30,271	30,268	3	0.0
Telangana	5,177	5,177	0	0.0	30,581	30,579	3	0.0
Karnataka	4,539	4,538	0	0.0	31,862	31,860	3	0.0
Kerala	1,904	1,904	0	0.0	11,939	11,936	3	0.0
Tamil Nadu	8,354	8,354	0	0.0	50,017	50,013	4	0.0
Puducherry	232	232	0	0.0	1,316	1,315	0	0.0
Lakshadweep #	4	4	0	0	28	28	0	0
Southern Region	**25,203**	**25,201**	**2**	**0.0**	**155,986**	**155,971**	**15**	**0.0**
Bihar	3,313	3,304	9	0.3	18,118	18,017	101	0.6
DVC	1,876	1,876	0	0.0	9,696	9,696	0	0.0
Jharkhand	872	866	6	0.7	4,780	4,712	68	1.4
Odisha	2,746	2,746	0	0.0	15,027	15,027	0	0.0
West Bengal	5,015	5,008	7	0.1	27,050	26,961	89	0.3
Sikkim	41	41	0	0.0	240	240	0	0.0
Andaman-Nicobar #	29	27	2	6.7	173	162	12	6.7
Eastern Region	**13,863**	**13,841**	**22**	**0.2**	**74,911**	**74,653**	**258**	**0.3**
Arunachal Pradesh	63	63	0	0.4	311	308	3	0.8
Assam	1,034	996	37	3.6	5,400	5,152	248	4.6
Manipur	77	76	0	0.4	440	437	3	0.7
Meghalaya	163	163	0	0.0	905	897	7	0.8
Mizoram	47	46	0	0.9	328	325	3	0.8
Nagaland	77	77	0	0.4	426	424	2	0.5
Tripura*	144	144	0	0.1	797	794	2	0.3
North-Eastern	1,604	1,565	39	2.4	8,605	8,338	268	3.1
All India	**112,407**	**112,241**	**166**	**0.1**	**627,460**	**625,330**	**2,130**	**0.3**

Lakshadweep and Andaman & Nicobar Islands are stand- alone systems, power supply position of these,does not form part of regional requirement and energy supplied. * Excludes energy exported to Bangladesh.

Note: Power Supply Position Report has been compiled based on the data furnished by StateUtilities/ Electricity Departments.

Source: CEA

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Heavy cables guided by quickly mounted igus energy chain

Harnessed and tested e-loop energy supply system increases safety and reduces procurement and installation time…

igus now offers the e-loop with special connectors and cables as a tested and ready-to-connect readychain...

It guides cables safely at a defined bend radius and even withstands shocks and impacts: the e-loop. The energy chain system is specifically designed for hanging applications, such as in deep drilling rigs and is already replacing service loops worldwide. In order to offer users a complete ready-to-connect system from a single source that operates safely even in extreme application scenarios, such as in explosion zones, igus now offers its energy chains with special connectors and cables as tested readychains.

The development

To guide cables safely in hanging applications, igus has developed the e-loop as an alternative to the service loop. This is because the service loop often causes a number of problems: the cables have no guide, have no defined bend radius, cannot move and, in the worst case, break. When servicing or repairing the service loop, the complete system must be replaced, as the cables are sealed together. "With the e-loop we have developed an alternative to the service loop. The three-dimensional energy supply system combines the advantages of a polymer energy chain with a high strength pull rope. The rope absorbs the tensile forces inside the chain and transmits them to the mounting brackets. This means that the cables remain completely strain-relieved", says Tim Schneebeck, Industry Manager Oil & Gas at igus GmbH. The modular e-chain made of high-performance polymer offers a defined bend radius at all times and withstands vibrations and shocks thanks to PU protectors.

Save procurement time and costs

The e-loop successfully replaces the service loop, especially in deep drilling rigs. But the e-loop is also used in shore power supply or open-cast mining: "We have already won many projects. Customers often wanted a complete energy supply system with the appropriate essential tests in accordance with VDE and IEC", says Schneebeck. "For low voltage cables, for example for top drive systems, we were able to supply a completely tested readychain system with chainflex cables right from the start. We now have the right partners on board for high-voltage cables and special connectors", says Markus Hüffel, Product Manager readychain & readycable at igus GmbH. All e-loops can now also be provided by igus with special cables and special connectors for shore power supply and explosive zones as a finished system. The energy supply system is harnessed by igus and tested with a Megger VLF Sinus 34kV. The readychain system saves the user almost 90% procurement time and 68% of the assembly time. In addition, igus gives a guarantee of up to 36 months depending on the configuration of the e-loop.

e-loop series also expanded for stationary applications

Due to the success of the system, igus has now expanded the e-loop series to include a version with crossbars every 2nd link. The new version has been specifically developed for stationary applications, for example in shore power supply, for the energy supply from the mast to the power container; it is lightweight and cost-effective. The e-loop is also available with rollers and handle modules so that it can be easily moved from A to B over the floor at quay facilities. When the machine and system reaches the end of their service life and is no longer in use, igus will take it back and guarantee pure recycling. In return, the user receives a credit note based on the net weight. EI

For further information:
https://www.igus.eu/info/e-loop?L=en

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Date: 18 - 20 November 2020
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Date: 03 - 05 December 2020
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INTERNATIONAL ELECTRONICS CIRCUIT EXHIBITION (SHENZHEN)

Date: 04 - 05 December 2020
Location: China
Email: mandawong@hkpca.org / amandali@hkpca.org

POWER2DRIVE INDIA

Date: 15 - 17 December 2020
Location: India
Email: info@mm-india.in

WIRE INDIA

Date: 25 - 27 March 2021
Location: India
Email: info@md-india.com

WEBINAR

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Date: 12th November 2020
Time: 10:00 AM ET
Organizer: IEEE Power Electronics Society

Webinar Name: Reliability of Modern Power Electronic based Power Systems
Date: 17th November'2020
Time: 10:00 AM ET
Organizer: IEEE Power Electronics Society

Webinar Name: New Advances in State-Space Based Control of Power Converters
Date: 1st December'2020
Time: 11:00 AM ET
Organizer: IEEE Power Electronics Society

Webinar Name: Introduction to ITRD, the Technology Roadmap of Power Electronics for DERs
Date: 16th December'2020
Time: 11:00 AM ET
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