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From the Publisher's Desk

Our Union Government is Quite Serious about Energy Storage

It is really pleasing to note that our country is progressing very fast towards the era of complete Green Power Generation. However, mere generation of Green Power is not enough, we have to ensure that no power (so generated) is wasted. Thus, on 6th October this year, the Ministry of Power invited suggestions with regard to formulation of a Comprehensive Policy Framework and recommended other interventions to promote Energy Storage in Power Sector. The last date for submission of the suggestions was October 31.

On 11th November, R. K. Singh, Union Minister of Power and New & Renewable Energy chaired a virtual meeting with senior officials from Central Government, Central PSUs, Renewable Energy Developers, PSP Developers and Battery Manufacturers for discussion on the 'Report on Comprehensive Policy Framework for promotion of Energy Storage in the Power Sector. Evidently, this reflects the serious intention of our government to accelerate the process of creating Energy Storage facilities in the country.

In the meeting, Singh has emphasized on the objective, which should be to ensure that no energy is lost and for that we need to be in a position to store all the energy, which is going to be surplus at any point of time. According to him, some storage needs to be added with the generation in order to ensure round the clock Renewable Energy. Beside directing to prepare separate Guidelines on Treatment of Energy Storage and Resource Adequacy, he has asked to work out the requirement of storage capacity year wise in keeping with the upcoming addition of Solar & Wind projects. Obviously, his prudent intention is praiseworthy.

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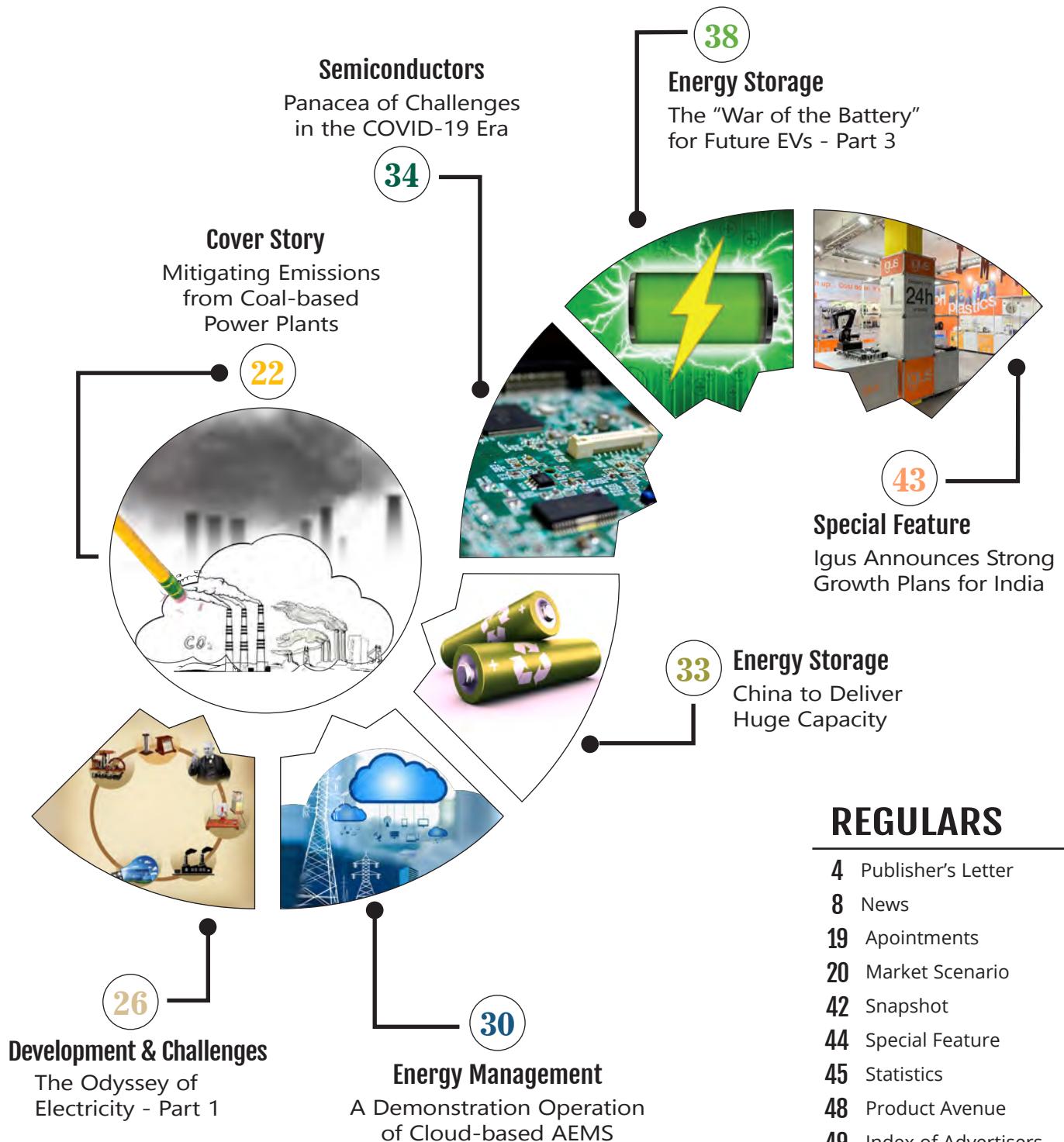
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RECPDCL HANDS OVER THE 'MP POWER TRANSMISSION PACKAGE – II LIMITED'

REC Power Development and Consultancy Limited (RECPDCL), a wholly owned subsidiary of REC Limited, the NBFC Navaratna CPSU under the aegis of Ministry of Power, has handed over the project specific SPV (Special Purpose Vehicle) formed for construction of Transmission Project viz., 'MP Power Transmission Package-II Limited' to M/s Adani Transmission Limited at Jabalpur on November 01, 2021.

M/s Adani Transmission Limited has been the successful bidder of the Intra State Transmission Project of Government of Madhya Pradesh and RECPDCL, the Bid Process Coordinator.

The SPV has been handed over by T.S.C. Bosh, ED & Jt. CEO, RECPDCL to Vivek Singla, President, M/s Adani Transmission Limited in the presence of Sunil Tiwari, Managing Director, MP Power Transmission



A glimpse of the ceremony of handing over the SPV...

Co Ltd; Kiran Gopal Vaska, IAS, Managing Director, MP Poorv Kshetra Vidyut Vitaran Co Ltd; Hariharan, Addl CEO RECPDCL and other Senior officials of RECPDCL, MPPTCL & M/s Adani Transmission Limited.

The selection of M/s Adani Transmission Limited was carried out through Tariff Based Competitive Bidding

(TBCB) for selection of Transmission Developers in line with the Standard Bidding Documents and Guidelines thereof as notified by Ministry of Power, Government of India.

The project comprises construction of around 870 km of 220 kV & 132 kV Transmission Lines along with associated 18 Power Sub-stations of cumulative transmission capacity of 2736 MVA. The project, to be implemented by M/s Adani Transmission Limited in 24 months, would facilitate overall improvement of power supply position in Madhya Pradesh. **EI**

INDIA TAKES ONE MORE STEP TO REDUCE CARBON EMISSION

This step by the Central Government will lead to a faster energy transition and will be beneficial for both the Generators and the Distribution Companies...

Under the guidance of Union Minister of Power and New & Renewable Energy, the Ministry of Power and New & Renewable Energy has issued revised guidelines providing for thermal generation companies to set up renewable energy generation capacity either by themselves through developers by open bids and supplying it to the consumers under the existing PPAs (Power Purchase Agreements).

This will enable the replacement of fossil fuel based energy by renewable energy under the existing PPAs. As the cost of renewable energy is less than the cost of thermal energy, the gains from the bundling of renewable energy with thermal will be shared between the generator and distribution companies or other procurers on a 50:50 basis.

As the renewable energy will be balanced with thermal energy, therefore, the DISCOMs will now not need to acquire any separate capacity for balancing of renewable energy. This is a very significant step towards achieving the goal of 500 GW of non-fossil fuel capacity by 2030.

The distribution companies will be able to count the renewable energy supplied under the scheme towards their renewable purchase obligation and this will be without the financial burden of separate PPA.

Under the direction of the Hon'ble Minister of Power and New & Renewable Energy, the Ministry of Power and New & Renewable Energy is poised to take some additional steps for achieving 500 GW of non-fossil power by 2030, for which orders are to be issued shortly. **EI**

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INDIA'S TRANSITION FROM FOSSIL-FUEL TO GREEN-ENERGY ON TRACK

Interacting with media in the India Pavilion at EXPO 2020, Dubai, India's Minister of Petroleum and Natural Gas & Housing and Urban Affairs, Hardeep Singh Puri said that India is on track with its transition from a fossil-fuel based to a green economy. He said, "What is happening in India is truly remarkable. In the coming decades,

the transition from a fossil-fuel based economy to a green economy will come from within the existing structure and the oil companies will facilitate that."

Puri also inaugurated the Ministry of Petroleum and Natural Gas section of the India pavilion at EXPO 2020, and invited the Gulf Cooperation Council (GCC) countries and others to invest and participate in this transition.



Inauguration of Petroleum and Natural Gas section of the India pavilion at EXPO 2020...

The minister said that the country's strategic relationship with the UAE is very important, adding that the real growth will now come from India. "If there is opportunity in the world, it is in India. We are extending an open invitation to everyone operating in the oil and gas sector to come to India. The transition from fossil-fuel to green

energy has to be organised in a way that, it is a win-win for all," he added.

The minister said that India is moving ahead with its plans on bio-fuel and green energy, and added, "In 2014, when Mr Narendra Modi became Prime Minister, only 1% or less than 1% of ethanol blending was taking place. Today we are already at 8.5%." 

POWERGRID UPGRADES NEW MARIANI SUB-STATION IN ASSAM

POWERGRID presently has 264 Sub-stations and 172,104 ckm (Circuit-Kilometre) and 464,292 MVA of transformation capacity...

Power Grid Corporation of India Limited (POWERGRID) has upgraded Assam's New Mariani Sub-station from 220 kV switching station to a 400/220 kV sub-station with 2x500 MegaVolt Ampere (MVA) transformation capacity, 2x125 Mega volt ampere (reactive) power compensation along with other associated bays under North Eastern Region Strengthening Scheme (NERSS-VI) project.

In March 2013, the New Mariani Sub-station had been commissioned in Jorhat District with 20 MVAR reactive power compensation capacity. With this upgradation, connectivity at 400 kV voltage level between 400 kV Misa Sub-station, 400 kV New Mariani Sub-station and 400 kV Kohima Sub-station has been established.

It has now become the first 400 kV Sub-station of upper Assam, which will serve as a key station for

catering to augmentation of power in upper Assam, Nagaland, Manipur and the entire North Eastern Region. This capacity addition will add efficiency and robustness, leading to supply of reliable power.

The project has been commissioned timely despite limitations in wake of COVID-19 pandemic, difficult soil and weather conditions. The bays & additional 400 kV D/C line section for upgradation of Misa-New Mariani line from 220 kV to 400 kV level are now under commercial operation. The project has been commissioned as part of 'Azadi Ka Amrit Mahotsav' marking 75 years of India's Independence. With the adoption of latest technological tools and techniques, enhanced use of automation and digital solutions, POWERGRID has been able to maintain average transmission system availability >99%. 



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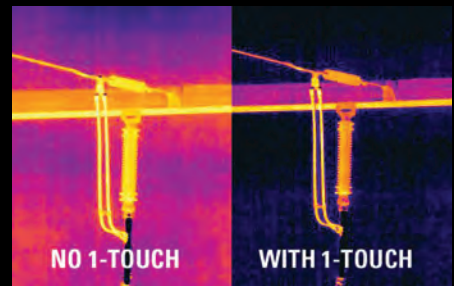
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CESL SIGNS MOU WITH MARRIOTT INTERNATIONAL TO DEVELOP EV CHARGING UNITS

With a view to boosting Electric Vehicles (EVs) adoption by strengthening charging infrastructure across the country, Convergence Energy Services Limited (CESL), a wholly-owned subsidiary of Energy Efficiency Services Limited (EESL), has signed a Memorandum of Understanding (MoU) with Marriott International to construct and operate EV charging infrastructure in the hotels managed, licensed and franchised by the Marriott

International and its affiliates in India. The MoU was signed in the presence of Bhaskar Gurunath, Area Director of Engineering, South Asia, Marriott International Inc., and Mahua Acharya and N Mohan of CESL.

Under this partnership, CESL will be entrusted with planning and implementation of the project including all costs and performance of all tasks required for



LtoR: Bhaskar Gurunath of Marriott International; Mahua Acharya and N. Mohan of CESL during signing of the MoU...

procurement, installation, operation and maintenance of the charging units and related infrastructure. Over the next two months, CESL will be installing EV charging units across 37 Marriott International hotels and will gradually expand to 100 hotels within one year.

Talking about building a robust EV ecosystem, Mahua Acharya, MD, and CEO, CESL, said, "EVs are going to pave the way towards a green and sustainable future. Developing a sustainable landscape with

strong supporting EV infrastructure is the key to cultivating consumer confidence in electric vehicles and CESL is proud to be progressively spearheading initiatives to promote e-mobility in India. Our partnership will significantly enhance consumer convenience and we are expecting to reduce pollutants emission levels, leading to cleaner air and various public health benefits." **EI**

AMP ENERGY PARTNERS WITH SPA FOR THEIR ROOFTOP SOLAR PROJECT

In addition to economic savings, the plant will also help mitigate about 600 tons of CO₂ per annum...

School of Planning & Architecture (SPA), Vijayawada, has recently inaugurated a rooftop project developed by Amp Energy India. The 120kW solar rooftop plant has been developed under the rooftop scheme by Solar Energy Corporation of India (SECI) for government entities. SPA and Amp Energy India have signed a Power Purchase Agreement (PPA) under this scheme for procurement of solar power for 25 years.

This solar plant will generate about 1.68 lakh units per year, cater to around 50% of the school's energy consumption and save 18 to 20% on their electricity bill every year. By now Amp Energy has a total portfolio of about 1.5 GW+ spread across 15 states in the country.

This project is one of the several solar projects developed by Amp Energy India for educational

institutions in India. Amp India has already commissioned solar projects for Pondicherry University, National Law University (Bhopal) and Atal Bihari Vajpayee Indian Institute of Information Technology and Management, Gwalior among others.

Commenting on their philosophy, Pinaki Bhattacharyya, MD and CEO, Amp Energy India, said, "We believe solar power should be a part of most of real estate development projects across India. Partnering with educational institutions provide the right platform to demonstrate the upcoming generation about the benefits of renewables. India is at an inflection point in transitioning to renewables and this sector can play a key role in providing a key voice by adopting renewable energy for economic and environmental benefits." **EI**

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MAHINDRA ELECTRIC MOBILITY LAUNCHES ELECTRIC THREE-WHEELER TREO IN NEPAL

Mahindra Electric Mobility Limited has launched a Lithium-ion-powered electric three-wheeler auto called Treo in Nepal. The Mahindra Treo Auto 'Soft Top' variant has been introduced at the price of NPR 8,40,000, ex-showroom. Treo is not only spacious but is also comfortable on rough roads.

The three-wheeler has been introduced in Nepal with the Completely Build Unit (CBU) form. The vehicle is being manufactured at Mahindra's Bengaluru facility in India. Bookings for the ready to deliver Treo autos have started in select areas of southern Nepal's Terai region. Agni Energy, Mahindra's authorised EV distributor, will sell Treo in Nepal. With the Mahindra Treo, customers stand to save a significant NPR 2,00,000/year (when compared to petrol autos).



TREO has a maintenance-free, 1,50,000+ kilometre battery life...

The Mahindra Treo is India's largest selling Li-ion electric auto platform with sales of 10,000+ vehicles and has covered more than 63 million kilometres, since its launch in 2018.

Speaking on the launch, Suman Mishra, CEO of Mahindra Electric Mobility Limited said, "Nepal is a fast-developing economy, with eco-friendliness as well as long term sustainability on its agenda. With the Nepal

government promoting electric vehicles the time is just right for us to launch our range of electric three wheelers here. Last mile mobility products are a focus for Mahindra & Mahindra and the Treo auto is an embodiment of technology combined with sustainability, that will significantly enhance the livelihood of its owners with huge savings when compared with a conventional petrol auto."

EB

TATA POWER'S ENERGY AUDIT SERVICE HELPS FIRMS IMPROVE ENERGY EFFICIENCY

The company assists their commercial and industrial customers manage their energy consumption better...

Tata Power is offering energy audit service to its Commercial And Industrial (C&I) customers in Mumbai. The company has conducted more than 150 energy audits, enabling them to achieve high level of energy efficiency. This initiative is in line with the company's commitment towards conservation and efficient use of energy by its consumers.

These audits have benefitted Tata Power's C&I customers such as hospitals, malls, hotels, commercial complexes and factories by providing them an opportunity to save up to 10%-15% on energy bill as well as given them actionable recommendation to save up to 45 MUs.

The energy audit is provided to both large, small

& medium C&I customers. For large customers, the investment grade audits are carried out, whereas for small & medium customers, the brief walkthrough audit of their premises is being offered. For customers with large loads, specific thermal scanning and checks are carried out to identify hotspots and reduce probable faults whereas customers who have load that can distort wave forms, such as data centres, power quality audits are carried out.

This distinction is done because each facility is unique in nature and has a different load profile. The appliances, usage pattern and challenges faced by each facility is different and hence a thorough diagnostic of the energy consumption is necessary which is customised according to the needs.

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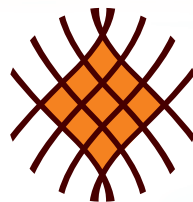
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ROLLS-ROYCE, CELLCENTRIC TO ROLL OUT FUEL CELLS FOR COMMERCIAL APPLICATIONS

Rolls-Royce and Cellcentric, a joint venture company set up by Daimler Truck AG and Volvo Group AB, are taking the next step in their strategic cooperation for the deployment of cellcentric hydrogen fuel cell modules. Rolls-Royce, through its Power Systems business unit, is to develop complete hydrogen fuel cell solutions based on cellcentric's fuel cell modules that emit nothing other than water vapour.

This will enable CO₂-free, climate-neutral generation of emergency power for data centres. Rolls-Royce is among the world's top three suppliers of emergency gensets for data centres. Both Rolls-Royce and Cellcentric are keen to play a part in driving the fuel cell breakthrough and are convinced that the technology – and time – are right for successfully



A view of the fuel cell module displayed on the Rolls-Royce stand at COP26 in Glasgow...

launching commercial fuel cell applications for the mass market.

Each fuel cell module will in the future deliver a net power output of around 150 kW – sufficient to power approximately 10 homes – and can be connected together into scalable fuel cell power plants with outputs in the megawatt range – capable of providing clean back-up power for large data centers.

Rolls-Royce commissioned a fuel cell demonstrator earlier this year and plans to bring one more demonstrator plant on line in 2022. The first pilot plants with customers will be installed in 2023, with Rolls-Royce launching standard production fuel cell systems in 2025. Recently a fuel cell module was displayed on the Rolls-Royce stand at COP26 in Glasgow, Scotland.

ET

PERTAMINA TO ENHANCE ITS GEOTHERMAL CAPACITY

PGE is expecting to gain an additional 375 MW from its current 672 MW in installed capacity from its geothermal power plant in the next four years...

Pertamina Geothermal Energy (PGE), aligned with the Indonesian Government's commitment to Paris Agreement, has planned to expand its installed capacity from geothermal power plant in order to provide higher contribution to the reduction of greenhouse gas emissions in Indonesia – as a support to achieve the Sustainable Development Goals (SDGs) on climate action by implementing Environmental, Social, and Governance (ESG) based programs.

Describing their view, recently during a discussion at the UN Global Compact on business ambition for climate action held virtually Nelwin Aldriansyah, Chief Financial Officer (CFO), said, "Our expansive plan will help Indonesia to achieve net zero emission target by 2060." The UN Global Compact is a voluntary initiative based on CEO commitments to implement universal

sustainability principles, and take steps to support UN goals.

Pertamina also reiterates the commitment to achieving the SDGs through the implementation of Environmental, Social, and Governance (ESG) based programs in their operational areas. According to Aldriansyah, PGE is planning to issue its own wind green bonds in the first half of next year (2022) beside its holding company – PT. Pertamina's plan from issuing green bonds in 2022.

"Proceedings of green bonds will be used to refinance our existing conventional loans and also to finance our CAPEX (Capital Expenditure) plan in developing new geothermal projects in Indonesia. We are aiming to have a total installed capacity to 1,500 megawatts by 2030," he further added.

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GEH, BWXT CANADA INK AGREEMENT TO SUPPORT BWRX-300 DESIGN AND COMMERCIALIZATION

GE Hitachi Nuclear Energy (GEH) and BWXT Canada Ltd. (BWXT Canada) have entered into a teaming agreement to cooperate on engineering and procurement to support the design, manufacturing and commercialization of the BWRX-300 Small Modular Reactor (SMR). The BWRX-300 is a 300 MWe water-cooled, natural circulation SMR with passive safety systems that leverages the design and licensing basis of GEH's U.S. NRC-certified ESBWR. Through dramatic and innovative design simplification, GEH projects the BWRX-300 will require significantly less capital cost per MW when compared to other SMR designs.

Through the agreement, if the BWRX-300 is selected for deployment at Ontario Power Generation's Darlington Nuclear Generation Station, BWXT Canada could provide detailed engineering and design for manufacturability



*BWRX – 300 small modular reactor...
Image credit: GE Hitachi Nuclear Energy*

for BWRX-300 equipment and components and ultimately could supply certain key reactor components for the deployment of the BWRX-300 in Canada.

Commenting on the agreement, Jay Wileman, President & CEO, GEH, said, "This agreement with BWXT Canada is a significant milestone in our efforts to build a Canadian supply chain to advance the

deployment of the BWRX-300 in Ontario. The ability of BWXT Canada to manufacture these key reactor components could help establish Ontario as a global manufacturing hub for our highly engineered equipment."

By leveraging the existing ESBWR design certification, utilizing the licensed and proven GNF2 fuel design, and incorporating proven components and supply chain expertise, GEH believes the BWRX-300 can become the lowest-risk, most cost-competitive and quickest to market SMR. E1

STANFORD'S SEMICONDUCTOR RESEARCHERS TO BE HONOURED

The (US) Semiconductor Industry Association (SIA) is the voice of the semiconductor industry, and the (US) Semiconductor Research Corporation (SRC) is a world-renowned, high technology-based consortium...

Two Stanford University professors; Dr. Subhasish Mitra, Professor of Electrical Engineering and of Computer Science, and Dr. Boris Murmann, Professor of Electrical Engineering; have been nominated for the 2021 recipients of SIA-SRC University Research Awards.

Commenting on their research works, John Neuffer, SIA President and CEO, said, "Research drives the innovation needed to advance semiconductor technology and strengthen America's economy and national security. Professors Mitra and Murmann have been instrumental in advancing chip technology, and we are pleased to recognize them for their outstanding achievements."

Neuffer also highlighted the urgent need for leaders in Washington to enact funding for the semiconductor research, manufacturing, and design provisions in

the CHIPS for America Act. SIA has also called on leaders in Congress to enact an investment tax credit for both semiconductor manufacturing and research. A combination of grants, tax credits, and research investments is needed to turbocharge U.S. semiconductor production and innovation.

The semiconductor industry is highly research-intensive. U.S. semiconductor companies invest nearly one-fifth of revenue into research and development, among the highest of any industry. But federal investment in semiconductor research has been flat as a share of GDP for years, while other governments have invested substantially in research initiatives to strengthen their own semiconductor capabilities. Increased investments in research, including semiconductor research, is vital to maintaining the US' technological edge. E1

Y. PARTHASARATHY HAS BEEN APPOINTED AS AMP'S DIRECTOR OF ENGINEERING IN INDIA



He will be instrumental in AMP's expansion drive for mass electrification across the world...

AMP, a company worldwide known for its connected battery management, charging and cloud technologies that power electric mobility, has recently appointed Yoga Parthasarathy as Director of Engineering in India. The company is led by a team of industry-leading experts – including Anil Paryani, a pioneer in energy management technology – with dozens of patents that have helped shape the modern energy, aerospace and automotive control landscape.

Yoga will take the reins of AMP's quickly

expanding engineering team in India after his most recent position as Vice President at Ather Energy, which created India's first smart and connected electric scooters. His leadership and engineering experience across the automotive and energy worlds will help AMP grow agile and impactful hardware/software development teams in the country. Yoga earned a bachelor's in engineering at Bangalore University before holding engineering roles at Coldwatt India, Cypress Semiconductor, Tejas Networks and Schneider Electric. E1

D. L. FARRELL WILL BE THE CHAIRPERSON OF CHEMOURS' BOARD OF DIRECTORS



She currently serves as the company's Lead Independent Director...

The Chemours Company has appointed Dawn L. Farrell as Chairperson of its Board of Directors, which will be effective from January 1, 2022. Farrell is a retired energy industry executive and the past President and CEO of TransAlta Corporation. She spent much of her 35-year career in various leadership positions with TransAlta and BC Hydro. She is a member of the Board of Directors of Canadian Natural Resources Limited, and past member of the Board of Directors

of the Business Council of Canada, Conference Board of Canada and Alberta Business Council.

Commenting on Dawn's new assignment, Mark Vergnano, Chairman of the Board of Directors at Chemours, said, "Dawn has been a champion for the best interests of Chemours and all its stakeholders. As I reflect on this transition, I'm confident Dawn will continue her relentless dedication as the next Chairperson of the Board." E1

D. HERMANC TO TAKE OVER AS PRESIDENT, ELECTROMECH. GROUP, AMETEK



He joined AMETEK in 1991 as a Marketing Analyst and Planner within their U.S. Gauge business...

AMETEK, Inc. has appointed Dave Hermance as President, Electromechanical Group. Hermance currently serves as Vice President and General Manager, AMETEK Measurement, Communications and Testing (MC&T) Division. He will be replacing Tim Jones, President, Electromechanical Group, who has announced his intention to retire at the end of 2021 following his 42-year tenure with the company.

Since joining, Hermance has continued to take on successfully larger leadership roles at AMETEK including

Business Unit Manager for their Industrial Products and for their Sensor Technologies businesses before taking on his current role as head of MC&T in 2016. He holds a Bachelor of Science degree in Business Administration and Management and a Master's degree in Business Administration from Oregon State University.

Commenting on Hermance's promotion, AMETEK Chairman and CEO, David A. Zapico has said, "Dave is a proven operating executive and has contributed greatly to AMETEK's success." E1

Indian EV Market Holds Great Potential



India's electric vehicle market size is expected to reach USD 152.21 billion by 2030. The market is expected to expand at a CAGR of 94.4% from 2021 to 2030...



India's electric vehicle market size is expected to reach USD 152.21 billion by 2030. The market is expected to expand at a CAGR of 94.4% from 2021 to 2030. The stringent regulations being drafted by the Indian government in response to the rising levels of vehicular emissions and the growing demand for environment-friendly vehicles are expected to drive the growth of the market over the forecast period. The efforts being pursued by the government to develop sustainable charging infrastructure in India also bodes well for the growth of the market.

Although the electric vehicle market in India is in its nascent stages at present, it is poised to emerge as one of the leading electric vehicle markets in the world. The Indian government has been pursuing consistent and committed efforts and has already drafted dedicated EV policies and rolled out various demand and supply incentives as part of the efforts to encourage the adoption of e-mobility across various market segments. For instance, India's Department of Heavy Industry (DHI), under the National Electric Mobility Mission Plan (NEMMP) 2020, has formulated the Faster Adoption and Manufacturing of Electric Vehicles (FAME) scheme to support the development of both Hybrid Vehicles (HV) and Electric Vehicle (EV) markets as well as that of their manufacturing eco-systems.

The growing popularity of electric vehicles is prompting the leading automotive manufacturers to launch electric vehicles in India. For instance, in October 2019, Maruti Suzuki, a leader in the conventional vehicle market, announced plans to launch electric vehicles for personal use for the Indian market in the following years. Similarly, in August 2021, Tata Motors launched the Tata Tigor EV in the Indian market. As the market continues to evolve and the consumer preference continues to shift from conventional vehicles to electric vehicles, more and more conventional vehicle manufacturers are expected to launch electric vehicles in the Indian market, thereby driving the growth of the market over the forecast period.

The outbreak of the COVID-19 pandemic triggered a global economic slowdown. The electric vehicle market is particularly vulnerable to any global economic slowdown owing to its reliance on global sourcing for the core battery technology. Moreover, the initial purchase price of electric vehicles tends to be higher than the gasoline-fired and hybrid vehicles, which particularly restrains the adoption of electric vehicles among price-sensitive customers. However, the Indian electric vehicle (EV) market was unaffected by the outbreak of the pandemic. In India, the registration of new electric passenger cars increased by 109% y/y in 2020, with 5,905 new vehicle registrations noted during the year. 

Source: Research and Markets

MITIGATING EMISSIONS

from
Coal-based Power Plants



In India around 60% of electricity is generated from fossil fuels. Out of that coal-based thermal power plants have a share of almost 52%. The obvious result is tremendous increase in pollution that leads to several diseases and death. Consequently, the Government of India has set to achieve 450 GW of renewable energy installed capacity by 2030. Till then other measures have been in force...

- P. K. Chatterjee (PK)



The World Health Organization (WHO) has recently pointed out that – “Ambient (outdoor) air pollution in both cities and rural areas was estimated to cause 4.2 million premature deaths worldwide per year in 2016; this mortality is due to exposure to fine particulate matters of 2.5 microns or

less in diameter (PM_{2.5}), which cause cardiovascular and respiratory disease, and cancers. People living in low- and middle-income countries disproportionately experience the burden of outdoor air pollution with 91% (of the 4.2 million premature deaths) occurring in low- and middle-income countries, and the greatest burden in the WHO South-East Asia and Western Pacific regions. The latest burden estimates reflect the very significant role air pollution plays in cardiovascular illness and death. More and more, evidence demonstrating the linkages between ambient air pollution and the cardiovascular disease risk is becoming available, including studies from highly polluted areas,” – there cannot be a second thought on the fact that today measuring, and arresting PM_{2.5} and mitigating its ill effects on human bodies is a matter of global concern.

WHO estimates that in 2016, some 58% of outdoor air pollution-related premature deaths were due to ischaemic heart disease and stroke, while 18% of deaths were due to chronic obstructive pulmonary disease and acute lower respiratory infections respectively, and 6% of deaths were due to lung cancer.

With this backdrop, at present, we cannot expect a dramatic change overnight, however, action at a highly accelerated pace could be taken to eliminate the root causes behind spread of these highly dangerous particles. This has not happened in one day. As the harmful trend was realised much earlier, ultimately the Paris Agreement (COP 21) in 2015 came into force. It was an international treaty through legal binding, which was adopted by 196 Parties at COP 21 in Paris, on December 12, 2015 and entered into force on November 4, 2016.

Air quality and climate change

It often stands as a query to many of us what the relation really is between air quality and climate change. EPA (United States Environmental Protection Agency) has very simply put it as: “Climate change can impact air quality and, conversely, air quality can impact climate change.”

What does that mean? EPA only gives the answer too. It states, “Changes in climate can result in impacts to local air quality. Atmospheric warming associated with climate change has the potential to increase ground-level ozone in many regions, which

may present challenges for compliance with the ozone standards in the future. The impact of climate change on other air pollutants, such as Particulate Matter (PM), is less certain, but research is underway to address these uncertainties.

Emissions of pollutants into the air can result in changes to the climate. Ozone in the atmosphere warms the climate, while different components of Particulate Matter (PM) can have either warming or cooling effects on the climate. For example, black carbon, a particulate pollutant from combustion, contributes to the warming of the earth, while particulate sulfates cool the earth's atmosphere."

Goals of Paris Agreement

Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels.

To achieve this long-term temperature goal, countries aim to reach global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century.

The Paris Agreement is a landmark in the multilateral climate change process, because, for the first time, a binding agreement brings all nations into a common cause to undertake ambitious efforts to combat climate change and adapt to its effects.

Researchers at work

As per EPA, considering the present situation, researchers across the globe are all focusing on works related to:

- Developing methods to apply possible global-scale changes in air temperature and precipitation patterns to local-scale conditions that affect air quality.
- Understanding the influence of climate change on fine particulate matter and other air pollutions.
- Identifying co-benefits of reducing air pollutants that also reduce the impacts of climate change.
- Understanding how mitigation options to reduce carbon dioxide, a greenhouse gas, can affect emissions of particulate matter, ozone, precursors and other air pollutants.

Effect of the steps taken so far

A recent survey report from UNEP (United Nations Environment Program) and IVL Swedish Environmental Research Institute states that efforts to tackle air pollution have stepped up in recent years and are

bringing dividends in many European countries, but extreme hotspots remain in Central Asia and the Balkans. Dangerous air quality levels continue to be recorded throughout Europe and Central Asia, and ammonia emissions are rising in all sub-regions.

It also states that "Air pollution is the world's biggest environmental killer, responsible for around seven million premature deaths each year through diseases such as lung cancer, acute respiratory infections and heart disease. Meanwhile, the main sources of air pollution and greenhouse gases are often the same. Most actions to improve air quality also therefore help to fight climate change".

Between 2010 and 2017, emissions of most monitored air pollutants decreased in Western, Central, Eastern and South Eastern Europe, the study finds.

For example, in Western and Central Europe, emissions linked to electricity, heat production and industry – a major source of air pollution – were found to have fallen by up to 20% in some countries. This is due to a greater uptake of renewable energy, improvements in energy efficiency and the use of environmental impact assessments.

Road transport emissions in Western and Central Europe were found to have fallen by 20-30% over the same period, partly due to enhanced efforts on vehicle inspections and the promotion of electric mobility. Meanwhile, stricter vehicle standards saw traffic emissions in South Eastern Europe plummet by 40%.

In Western and Central Europe, emissions linked to residential heating dropped by roughly 15%, thanks to an increased focus on energy efficiency and green technologies. Thirty-eight European countries now also ban the open burning of waste, up from 32 in 2016.

Such actions are being shown to benefit people's health. For example, in 2018, around 417,000 people are estimated to have died prematurely in the European Union due to exposure to fine particles (directly emitted as particles or formed from gaseous pollutants in the atmosphere, PM_{2.5}), which affects more people than any other air pollutant. By 2020, this figure had dropped to 240,000, and by 2030 the toll is expected to fall to 170,000.

However, PM_{2.5} levels still exceed World Health Organization guidelines at 70% of the stations located in all countries surveyed, the report underlines.

Furthermore, unlike for much of Europe, emissions are found to be on the rise in Central Asian countries. For example, PM_{2.5} emissions increased by 21% between 2010 and 2017 in Kazakhstan, while carbon monoxide emissions in the country jumped 34%, and road traffic emissions rose by 20%.

Meanwhile, emissions of ammonia increased across Europe and Central Asia during 2010-2017, with the biggest increase recorded in South Eastern Europe. Once emitted, almost entirely from farming, much of the ammonia forms into PM_{2.5} and can cause respiratory diseases. The rise in emissions occurred despite 75% of countries promoting sustainable agricultural practices.

Pollutants from power plants

As per EIA (US Energy Information Administration), in the United States, about 65% of total electricity generation in 2018 was produced from fossil fuels (coal, natural gas, and petroleum), materials that come from plants (biomass), and municipal and industrial wastes. The substances that occur in combustion gases when these fuels are burned include:

- Carbon dioxide (CO₂)
- Carbon monoxide (CO)
- Sulfur dioxide (SO₂)
- Nitrogen oxides (NO_x)
- Particulate matter (PM)
- Heavy metals such as mercury

Nearly all combustion by-products have negative effects on the environment and human health:

- CO₂ is a greenhouse gas, which contributes to the greenhouse effect.
- SO₂ causes acid rain, which is harmful to plants and to animals that live in water. It also worsens respiratory illnesses and heart diseases, particularly in children and the elderly.
- NO_x contribute to ground-level ozone, which irritates and damages the lungs.
- PM results in hazy conditions in cities and scenic areas and coupled with ozone, contributes to asthma and chronic bronchitis, especially in children and the elderly. Very small or fine PM, is also believed to cause emphysema and lung cancer.
- Heavy metals such as mercury are hazardous to human and animal health.

Mitigation measures taken in Indian thermal power segment

We must be proud of our progress in harnessing Renewable Energy (RE), the total installed renewable energy capacity in India, excluding large hydro, has crossed the mile-stone of 100 GW. Today India stands at 4th position in the world in terms of installed RE capacity, 5th in solar and 4th in wind in terms of installed capacity. While 100 GW has been installed, 50 GW is under installation and more are under tendering.

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

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

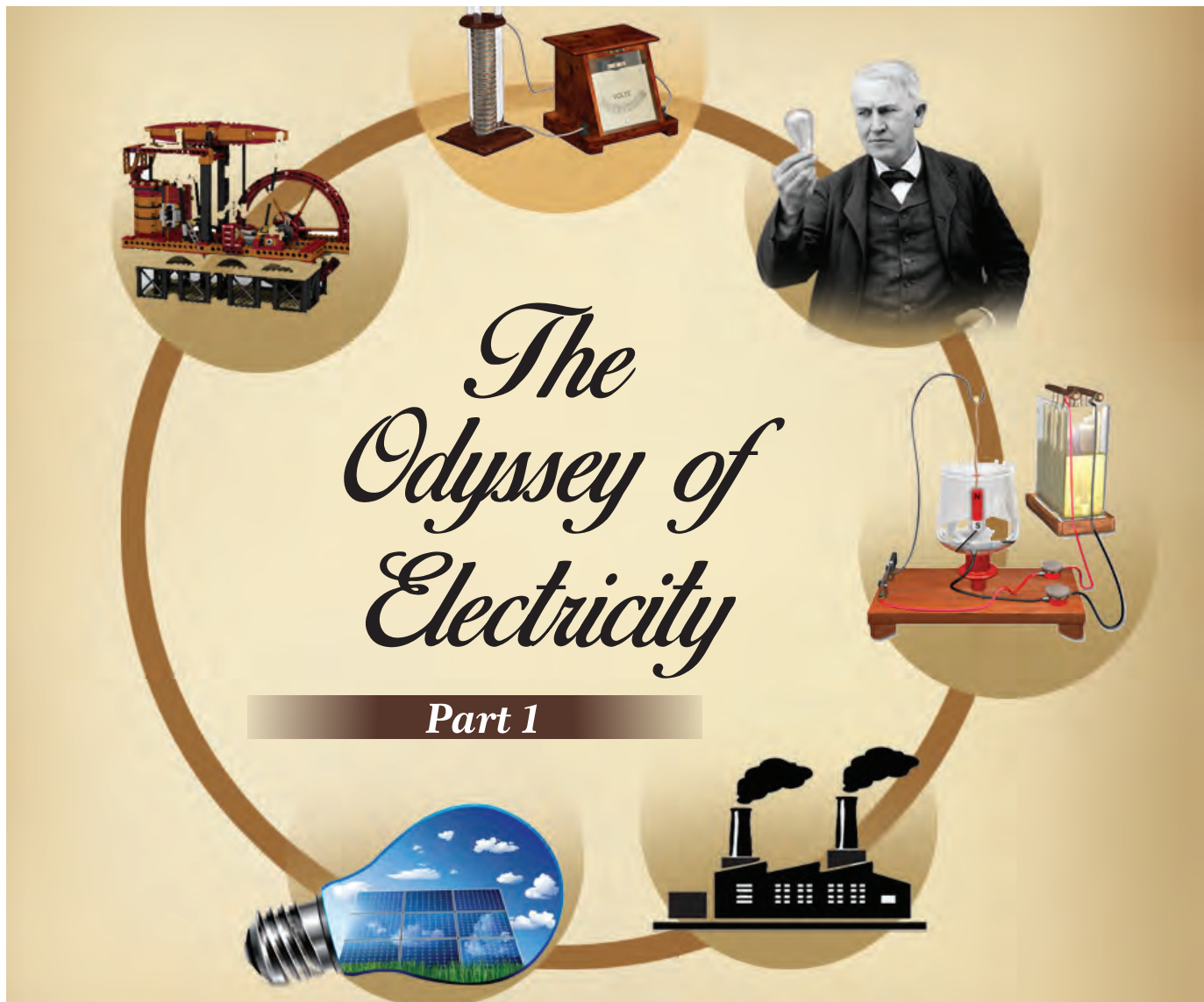
By now, we all are aware that the Perform, Achieve, Trade (PAT) scheme was introduced by the National Mission for Enhanced Energy Efficiency. It is a regulatory instrument to reduce specific energy consumption in energy intensive industries, with an associated market-based mechanism to enhance the cost effectiveness through certification of excess energy saving that can be traded. The first cycle of the PAT Scheme (2012-2015) managed to reduce the energy consumption of more than 400 energy-intensive enterprises (known as Designated Consumers -DCs) by 5.3%, above the initial target of 4.1%.

High efficiency Electrostatic Precipitators (ESPs) have been installed to capture Particulate Matters (Fly ash) from Flue gases.

Low NO_x burners have been installed for reducing NO_x emission from flue gases.

SO₂ emission control is achieved through dispersion of flue gases through tall stacks (275 metres) to reduce the concentration of polluting gases at ground level. 

Electrical India needs informative articles from working professionals.



Here is a brief history of development of electric power generation. The authors have very creatively sailed from the beginning to today's status quo – and highlighted the present-day challenges and hinted towards some possible solutions...

The violent spark accompanied by a loud sound across the clouds has always made humans feel overwhelmed and bedazzled. Lightning was given a similar fascinating status in mythologies all over the world as a weapon of gods like Zeus and Indra. Humans gradually started getting familiar with a miniaturized version of electric shocks from certain aquatic animals such as electric eels and electric catfish. Thales of Miletus was one of the earliest well known observers of the magnetic effect of static electricity and in 1600s in his book *De magnete*, William Gilbert wrote about his study on electricity and magnetism.

Certain discoveries on magnetic and electrical properties were made throughout the industrial era. The arrival of glass friction generators spurred a lot of interest in the field of electricity and is said to have stirred Benjamin Franklin who went on to conduct his famous kite experiment. Alongside these scientific developments, the world was already progressing through the strides of industrial revolution. The financial world was simultaneously

undergoing a major transformation with the emergence of private and state banks in the major continents. The arrival of James Watt's Steam Engine in the middle of the 18th century was one of the major turning points in the area of mechanisation and helped in bringing in further advancements.

These developments gave a major impetus to the growth of industries. Owing to division and specialisation of labour, a certain combination of labour and capital resulted in the most efficient and optimum level of production, which yielded large surplus. The industrial revolution in Europe and America changed the socio-economic milieu. It provided the population with a lot of new jobs in the industries, which caused a migration of labour from agriculture to factories, resulting in new urban regions. An upward surge in the birth rate and a fall in the mortality rate due to advent of vaccines and other developments in the medical field resulted in an unprecedented growth in population and ushered a new slab of educated middle class. These socio-economic developments led to an increase in employment and the creation of demand for capital in the form of infrastructural growth such as creation and maintenance of supply chains, railways and canals for the factories as the prospect of greater returns due to economies of scale was staring down from a yard which seemed achievable. A lot of funds was needed to finance these projects and it piqued a numerous entrepreneurs and bankers. Coal generated power for driving the factories, railways and the ship was already assuming its significance as a major driver of the economy. Coal and other forms of carbon such as coke were the drivers of the cogwheels and the area of mechanisation was constantly being upgraded by exploring methods of increasing efficiency and minimising human intervention.

A new vista

In 1800, Italian scientist Alessandro Volta created a more reliable source of electrical energy - his Voltaic pile- a battery made of alternating layers of zinc and copper disks. British chemist Humphry Davy invented the famous arc lamp in 1808, the first practical electric light Arc, which was utilised by cities to light their streets in the 1870s. They were lit up by large generators. It had certain limitations such as its overwhelming brightness, which prevented it from home usage and the dangerous high voltage it operated on making it hazardous for those who were in its proximity.

Electricity in India

India got its first electric light on January 7, 1879, in the city of Kolkata (erstwhile Calcutta) followed by Bombay in 1882. Arc lighting was superseded by Incandescent lightning which was invented by Thomas Alva Edison and Joseph Swan, with the former being more successful due to his usage of thinner filament. Edison's company manufactured a lot of bulbs and marketed it around the cities in the USA – as he grasped the potential of the market of electrifying the residence and businesses of customers. His utility worked with direct current which was also used for storing energy in batteries and running electric motors. However, the limited transmission distance due to its low voltage of 110 volts was proving to be an impediment for DC to gain further ground in urban areas as power stations had to be constructed right in the middle of the residential areas. The Pearl Street Station was set up in 1882 by Edison, which was a full scale Central power station powered by Coal. Central Power stations were also making their ways in UK from 1881 – and London got its first station in 1882. The West always had the requirement for heating in their nail biting winters. Boilers were installed to provide steam for residential heating purposes. With some innovations, part of the steam was later utilised for electricity generation

Birth of electrical machinery

A proper analysis on the conjoined feature of Electricity and Magnetism was finally demonstrated by Hans Christian Oersted in 1820 and in 1831, Michael Faraday and Joseph Henry invented the primitive electric motor, after documenting the generation of electric current by moving an metallic wire near a magnate, the basis of producing electricity in a generator. Z.T. Gramme designed the first practical generator. The Gramme machine was sold in large numbers in 1870. It had the potential to supply a steady direct current to power motors. The Hungarian ZBD team at Ganz works in 1884 designed the prototype of a high efficiency closed core shunt connection transformer – and it gave AC the advantage of being transmitted to larger distances relative to DC by the process of stepping up voltage for transmission over long distances and stepping down to a lower voltage upon reaching the end user for residential and business uses.

War of the currents

This subsequently brought the 'War Of Currents' in the USA between George Westinghouse's AC and Thomas Edison's DC business over capturing the American electrical power market. After a long tussle and endless controversies, the fifteen electric companies merged into two viz General Electric and Westinghouse with alternating current triumphing over direct current.

Generation & transmission

Development in the field of production and transmission of electricity was pacing up and coal assumed the significance of a national asset. Load factor was a cause of concern amongst the electrical companies as there were spikes of electricity demand in the early hours of work in the morning and in evening when electrical lights were turned on. As a result, the companies used to skip daytime service until the beginning of 20th century. Certain buildings such as large hotels, offices and factories had their own power generation source. To mitigate this issue, it was necessary for the load factor to increase, so that it becomes economically viable for the power companies to run their operations throughout the day.

The concept of electrical grid and their inter connectivity was experimented upon. The standardization of UK's electric supply and the creation of an integrated grid in the winter of 1938 due to an imbalance of power generating capacity between the northern and southern parts of the country proved to be helpful, especially during the wars and cold gales. Coal continued to assume and increase its importance. Use of pulverised coal improved coal combustion. The 40 MW Lakeside Power Plant in Wisconsin was the first plant to burn pulverised coal. Gradually a lot of achievements were seen throughout the early and middle part of 20th century. The Unit 6 at the Philo Power plant of Ohio was the first commercial super critical steam electricity generating unit in the world. However, the depleting coal stock caught attention in the 1950s and shortages were forecasted within a decade in the UK. Alternative sources of fuel were being explored. Gas power had taken off in the States after the second world war with GE installing its first commercial gas turbine for power generation in 1949. The advent of hydroelectricity in 1880s in the States and Switzerland's first pumped storage plant in 1909 exhibited the potential of alternative options for power generation. India had its first hydroelectric installation in 1897 at Sidrapong for

the Darjeeling municipality. In 1888, Charles Bush from Ohio constructed a 60 feet wind turbine, which spun a 12kW dynamo connected to some batteries in his basement and upon his success, numerous installations of such turbines spurred up in the Midwest. Further interest and development of the wind sector were stirred after the oil crisis of 1970s.

Development of atomic energy

The concept of harnessing energy contained in atoms was making rounds and some developments were taking place in labs by the end of 19th century and the world's first nuclear reactor was made in 1941 by Fermi in Chicago, although most of the research in atomic energy was initially utilised by the US govt for the most abominable purpose of creation and dropping of nuclear bombs over Hiroshima and Nagasaki. Only after the war did the US encourage nuclear energy development for peaceful civilian purposes. In Idaho, December 20, 1951, the first reactor to produce electricity was made. Soviet Union was also pursuing a massive and growing nuclear power program for heat and electricity generation. The nuclear industry grew rapidly in 1960s and 70s, although its history was blemished by the catastrophic events of Three Mile Islands and Chernobyl. In recent years, the Fukushima incident of 2011 due to a massive earthquake of 9.0 Magnitude on Richter scale caused a massive jolt radioactive contamination of the surrounding area.

Background of solar energy

Conversion of solar energy into electric is almost a 200 years' old practice. Edmond Becquerel discovered the photovoltaic cells in 1839. Subsequent developments took place throughout the 19th century with the discovery of the photoconductivity of Selenium in 1882. Solar cells made of Silicon were commercially produced after it was discovered that silicon had greater efficiency than Selenium and after 1970s, work on increasing efficiency of solar cells begun and the possibility of solar cells being a sensible and clean alternative of energy generation was realised.

Development of Indian power sector

India had a total installed capacity of 1,362 MW when it was free from the British rule in 1947. The country had its first coal power plant installed in Kolkata (erstwhile Calcutta) in 1899, which had a capacity of 1 MW. The Hydel installation at Sindrapong had a capacity of 0.13MW. The country had a concerning dearth

of infrastructure for the growth of power sector and providing electricity to the majority of the population, which was un-electrified was also a huge task and required immediate attention. Jawaharlal Nehru called Dams the temples of modern India and very rightly so, the potential of dams generating electricity while simultaneously ensuring irrigation to the surrounding areas proved to be the starting point of power sector development in India. The government invested heavily on creation of dams, geological survey for finding coal mines and other potential resources for energy creation and on the expansion of railways and roads. This also provided large employment opportunities, which assisted in cutting down the poverty level, creation of new urban places and driving the primary sector, which was the largest portion of the economy.

The country had isolated city-based electrical systems and eventually it adopted the grid system in 1961. The interconnected grid system of 5 regional grids for enabling transmission of surplus electricity between the states in each region. In 1975, the National Thermal Power Corporation Private Limited was founded by the then PM Indira Gandhi under the Companies act of 1956 and was renamed “National Thermal Power Corporation Limited.” It was engaged in power generation, transmission and distribution to SEBs in India. The company made magnificent strides in the sphere of power generation and by 1997, it achieved the milestone of generating 100 billion units of electricity in a year. The company changed its name to NTPC Limited in 2005 for its venture into hydro and wind power generation projects along with backward integration by coal mining.

The Power Grid Corporation of India Limited was created in 1989 – and it took over transmission assets of fellow power industry entities such as NTPC, NHPC, NEEPCO, NLD etc., and was tasked with maintaining and monitoring transmission of bulk power across different states of India. Since 1947, there has been a constant growth in the installed capacity of power generation with an average of around 12-15% annual growth up to 1980s – and at around 5% from 1990 to 2012. Growth in electrical consumption is also worth noting with the emergence of domestic and agricultural sector alongside industrial sector being the primary consumer till date.

The agricultural and industrial sector were the major consumers of electricity. The ascent of agriculture

sector’s share from around 3% in 1960 to 17.7% in the present indicates the progress in capital investment and mechanisation of agricultural practices, which resulted in greater yield of crops and better storage facilities. Similarly, the growing shares of domestic sector (around 24% currently) is a positive sign of economic development and human welfare. However, the distribution aspect of electricity is still a large leakage of money in the system. Most of the electricity services are provided through a regulatory system with controlled mechanisms through tariffs, cost plus pricing, long term PPAs etc – and have proved to be inefficient as there had been no incentive to encourage efficiency. The country has almost sufficient power generation capacity at present – but till date, a significant portion of population is yet to receive proper electrification and almost 0.07% of Indian household have no access to electricity.

Challenges in progress front

One of the largest obstacles of power sector is revenue collection, which has been plagued by irregular payments of dues by big industries, businesses and influential consumers due to unfair political and sociological advantages. Small consumers from both domestic, commercial and agricultural sector end up bearing the brunt through frequent power cuts and atrocious billing. A lot of operating inefficiencies result in an ever-growing aggregate technical and commercial losses. Power distributors often end up failing to fulfil the purchase agreements and the government has to step in to finance the debts.

...To be continued 



Rwitorshi Probho Roy is an under graduate student in Economics in Calcutta University, he has wide interest in Socio-Economic issues.



Dr. Bibhu Prasad Rath a graduate in Mechanical Engineering with Intermediate course work from ICWA and M.Tech from IIT Delhi. He has also done PhD (in Business Administration) from Aligarh Muslim University. He is currently holding the post of Additional General Manager in Engineering Division of NTPC Ltd.



A DEMONSTRATION OPERATION OF CLOUD-BASED AEMS

Based on the analysis and evaluation results of the demonstration project, the companies will consider the development of the business model in the form of a service, primarily in Europe, that provides cloud-based AEMS along with cloud-based DMS (completed in 2019)...

In Slovenia, a massive power outage caused by natural phenomena such as a severe cold wave occurred in 2014 – and measures to protect hospitals and other critical facilities from long blackouts became increasingly important. Also, countermeasures were needed especially for large-scale power consumers, such as factories, because voltage dips caused by lightning strikes etc., have a significant impact to own equipment.

In addition, the increasing demand for renewable energy and electric power had raised concerns about the need to secure flexibility of voltage and current to stabilize

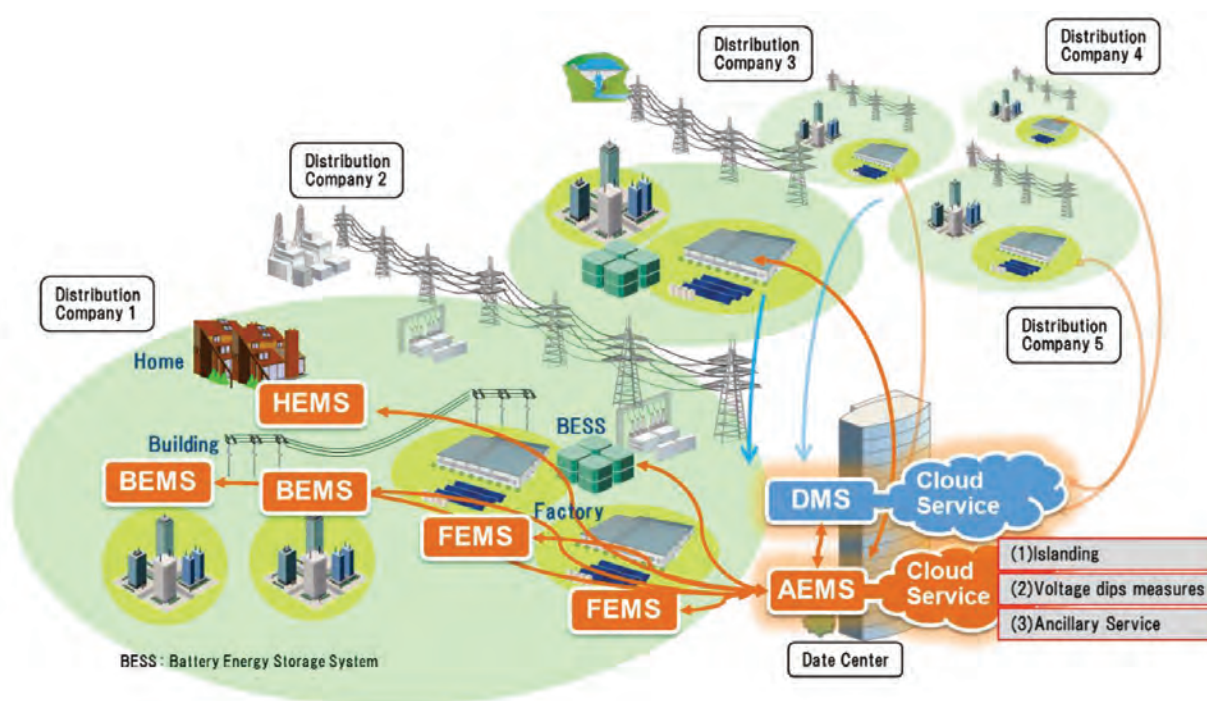


Image of Phase 2 of the demonstration project...

frequency, and there was a need for more advanced and economical power distribution grid systems and energy management technologies to solve these problems.

Under these circumstances, NEDO (New Energy and Industrial Technology Development Organization, Japan), Slovenia's Ministry of Economic Development and Technology, Ministry of Infrastructure, and ELES, d.o.o. (Elektro-Slovenija, d.o.o. – a state-owned electricity transmission company of Slovenia), had agreed to expand the scope of the demonstration project {the second phase of the smart community demonstration project in Slovenia decided to be conducted from October 2018 to March 2022 (with possibility of extension)} for

large-scale power consumers and electric power retailers and to start a demonstration project for a cloud-based Advanced Energy Management System (AEMS: Energy management system for large-scale power consumers and electric power retailers). The parties signed a revised version of Memorandum of Cooperation (MOC), Minutes of Meeting (MOM) and Memorandum of Understanding (MOU) respectively on September 24, 2018. At the same occasion, Hitachi, Ltd. and ELES, d.o.o. agreed to jointly implement this new demonstration scope and signed a revised version of the Implementation Document (ID). This demonstration project is the second phase following the first phase (the first phase of the demonstration project was aimed to

establish a business model for small to mid-sized distribution system operators solving problems such as maintaining appropriate voltage and shortening power outage time by developing cloud-based DMS for 2 Slovenian distribution system operators. On November 25, 2016, NEDO and Ministry of Development and Technology and Ministry of Infrastructure of Slovenia as well as ELES, d.o.o., agreed to carry out a smart community demonstration project. In addition, NEDO; Hitachi Ltd.; and ELES, d.o.o. had agreed to undertake a joint project. Hitachi, Ltd. and ELES, d.o.o. conducted demonstration operation after building the Distribution Management System (DMS) for electricity distribution companies and the first phase of the project



The storage batteries, which were installed in the power distribution grid in the Idrija district...

was completed in December 2019) of the demonstration project to construct a cloud-based integrated power Distribution Management System (DMS: a management system for distribution systems) for small- and medium-sized distribution companies.

Now, NEDO and Hitachi, Ltd. in cooperation with ELES, d.o.o., have completed an AEMS, which had been under construction since MOU as the second phase of the project and commenced its demonstration operation. Hitachi, Ltd. has completed the construction of a cloud-based AEMS, which enables the linkages between the storage batteries that were procured and installed by ELES, d.o.o., on the consumer's premises in the BTC district of Ljubljana – and the storage batteries that were procured and installed by Hitachi, Ltd. in the

power distribution grid in the Idrija district and to the xEMS {General term to describe energy management system for factories, buildings and homes. Factory Energy Management Systems (FEMS), Building Energy Management Systems (BEMS) and Home Energy Management Systems (HEMS)} of the consumers.

The demonstration project

In this demonstration operation, it was aimed to establish an energy service business for large-scale power consumers and electric power retailers by building a cloud-based AEMS in the data centre, which has several functions such as: Islanding (autonomous operation in the event of a power grid accident), Measures to prevent voltage dips, and Ancillary services (provision of flexibility to electricity transmission system operator).

Islanding (autonomous operation during grid failure)

In the event of power outages, the system will link up with the DMS to isolate the targeted areas including important facilities such as hospitals from the power grid and to supply power from the storage batteries to avoid a prolonged power outage. No islanding test has been conducted in an actual power distribution system in Japan, and this will also be the first demonstration case in Slovenia.

Voltage dips mitigation measures

The storage batteries installed in the targeted areas will be used to protect customers' important load facilities from voltage dips caused by natural phenomena such as snowfalls and lightning strikes at factories that require high-quality power supplies.

Ancillary services (provision of flexibility to electricity transmission system operator)

In cooperation with the storage batteries and xEMS such as BEMS and HEMS installed on the consumers' premises in the areas, the system provides electricity transmission system operator with the ability to adjust the frequency that contributes to grid stability.

Based on the analysis and evaluation results of the demonstration, Hitachi, Ltd. and ELES, d.o.o. will consider the development of the business model in the form of a service, primarily in Europe, that provides cloud-based AEMS along with cloud-based DMS that was developed in the first phase demonstration project.



CHINA TO DELIVER HUGE CAPACITY

In support of global demand expansion, a recent research report from global natural resources consultancy Wood Mackenzie points out that global lithium-ion battery capacity will double in the next two years, with NMC and LFP demand forecast to reach 2.30 TWh in 2030, accounting for 89% of global battery cell capacity...



Across the world, economic recovery is at top of mind for politicians, with renewable energy integration taking centre stage. Despite disruptions from the Covid-19 pandemic, Wood Mackenzie's Global Energy Storage Outlook forecasts nearly 1 TWh of total demand from 2021-2030.

Pointing at the market share, Xu Le, Senior Research Analyst from the company states, "The US and China will dominate the global storage market, together commanding over 70% of total global installed capacity through 2030."

Deployment in the FTM segment

Deployments in the Front-Of-The-Meter (FTM) segment will crest 700 GWh – or 73% of total global deployment - by 2030. According to Xu, "Moves to accelerate the decarbonisation of the US and Chinese power sectors are gaining pace and provide the foundation of our global market forecast. China is driving our H₂ outlook market upgrade, doubling our previous forecast. China's newly instituted 30 GW of energy storage by 2025 target has an outsized impact on the regional FTM market."

China FTM storage annual installations will be more than triple in 2021 and deliver 260 GWh of new capacity for 2021-2030. Wood Mackenzie sees the Asia Pacific market growing 20-fold, reaching 400 GWh of total storage capacity by 2030, with the FTM sector accounting for 82% of that demand.

In North America, the current U. Investment Tax Credit (ITC) for storage plus solar applications has supercharged demand, with a 4.5x increase in annual FTM deployments on tap for 2021. Budget reconciliation and energy tax reform resulting in a new ITC for standalone storage applications would provide upside to the current 10-year market outlook.

Europe's storage market is also set to surge, with Wood Mackenzie expecting cumulative installs to exceed 100 GWh by 2030, led by Germany and Italy. High power prices will push the European non-residential segment from 11% in 2020 to 19% in 2030, while the residential market will exceed 27 GWh by 2030.

Expansion of the BTM markets

Behind-The-Meter (BTM) markets are expanding worldwide, with 57 GWh of new deployments forecast through to 2030. The residential sector is being driven by cost reductions and consumer awareness, coupled with solar hybridisation and electric vehicle adoption.

While annual deployments in the non-residential market will also expand, the sector will experience a sluggish start as public policy support cannot overcome challenging project economics in most markets.

Australia will lead the non-residential sector this year, driven by higher project IRRs through revenue stacking, while Japan tops the residential market in 2021 due to availability of customer PPA contracts.

In Latin America, non-residential storage will reach 9.7 GWh by 2030 with storage supporting grid resilience amidst continued variable renewable energy expansion. Storage auctions began this year and will support increases in regional capacity. Corporate PPAs further regional drive BTM market growth, with two already-contracted projects under development in Chile.

South African investments for both FTM and BTM storage are driving regional forecast upgrades. The recent tenders in South Africa will bring 873 MW of energy storage into the market. On top of this, a traceable non-residential storage project pipeline is forming in South Africa, Kenya and Nigeria, increasing Wood Mackenzie's confidence level in the future growth. 

PANACEA OF CHALLENGES IN THE **COVID-19 ERA**

Semiconductors are a marvel of modern technology and the foundation of modern life. Packed with up to tens of billions of transistors on a piece of silicon the size of a quarter, semiconductors enable everything from cars to coffee makers, not to mention new, potentially game-changing applications such as artificial intelligence, quantum computing, advanced wireless networks, and more...



Over the last year, with the world still gripped by the COVID-19 pandemic, semiconductor-enabled technologies allowed us to remotely work, study, treat illness, order goods online, and stay connected. As much of the world shut down, semiconductors enabled the gears of the global economy, healthcare, and society writ large to continue spinning.

And, critically, semiconductors helped doctors and scientists develop treatments and vaccines to begin making the world healthy again. Without the semiconductors that power the world's most advanced supercomputers, for example, the

historically rapid development of COVID-19 vaccines would not have been possible.

While the semiconductor industry has achieved great successes in 2021, it also faces significant challenges. Chief among them is a widespread global semiconductor shortage. Unanticipated rising demand for semiconductors needed during the pandemic response, coupled with significant fluctuations in chip demand for other products such as cars, triggered a rippling supply-demand imbalance felt across the world. The semiconductor industry has worked diligently to increase production to address high demand, shipping more semiconductors on a monthly basis than ever before by the middle of 2021, but most industry analysts expect the shortage to linger into 2022.

The shortage increased awareness of the importance of America's semiconductor supply chains. Although geographic specialization in the global chip supply chain has enabled tremendous growth and innovation in the industry, vulnerabilities in the supply chain have emerged in recent years. For example, in 2019, 100% of the world's most advanced logic semiconductors (< 10 nm) were produced overseas.

The U.S. government has taken notice of the need to fortify America's semiconductor supply chains through robust investments in U.S. chip production and innovation. In June 2021, the U.S. Senate passed the United States Innovation and Competition Act (USICA), broad competitiveness legislation that includes \$52 billion to bolster domestic chip manufacturing, research, and design. The semiconductor industry has urged the U.S. House of Representatives to follow suit and send legislation to the President's desk to be signed into law.

In 2021, semiconductors helped steady a world wobbled by COVID-19, and the industry's future has never been brighter. As semiconductor innovation and global chip demand continue their inextricable rise, government and industry must work together to maintain America's leadership in this foundational, indispensable technology.

Chips fighting Covid-19

As the "brains" of electronic devices, semiconductors have been crucial to the pandemic response and recovery of the global economy. They have provided display, wireless connectivity, processing, storage, power management, and other essential functions to a wide

array of essential products, life-saving equipment and critical infrastructure. This includes healthcare and medical devices, telecommunications, energy, finance, transportation, agriculture, manufacturing, aerospace, and defence. Semiconductors also underpin the IT systems that have made remote work and school possible and have provided access to essential services across every domain, including medicine, finance, education, government, food distribution, and more.

Throughout this global pandemic, semiconductor-rich devices have become increasingly prevalent in developing solutions for numerous problems in the economic and public health sphere. The ability of semiconductors to drive performance in these critical sectors is tied to "Moore's Law," the observation that the capabilities of semiconductor chips will double roughly every two years, while the price goes down. Today, the most advanced microprocessors contain nearly 40 billion transistors.

Supporting the world through the pandemic in different ways

Medical devices

Semiconductors are an integral component of many medical devices used in hospitals and doctors' offices today, including many devices that are critical to treating COVID-19 patients. Any medical device that can be plugged into an electric socket or has batteries depends on semiconductors to operate. Semiconductors provide functions such as operations control, data processing and storage, input and output management, sensing, wireless connectivity and power management. By enabling functions previously performed by non-semiconductor devices, semiconductors have often lowered costs and improved performance at the same time. This has proved critical to the COVID-19 response and improving health care in general. Two specific examples of semiconductors in medical devices helping in the COVID-19 fight are below.

- **Portable ultrasound devices:** In a hospital setting, the first line of detection for COVID-19 is identifying recognizable symptoms of the virus such as lung lesions. Quickly identifying this trait of the severe acute pneumonia associated with the virus has allowed doctors to treat afflicted patients without having to wait for tests on viral infection. This rapid response is possible with handheld ultrasound devices and temperature screening. These portable

ultrasound devices have transitioned from utilizing piezoelectric crystals to semiconductors, greatly reducing the cost and improving performance. Now, due to the utilization of semiconductors, hospitals have access to vastly more affordable and efficient technologies to assess internal injuries in patients.

- **Ventilators:** These are utilized to treat patients with severe lung damage by assisting breathing and are controlled by semiconductor chips. The ventilator system uses semiconductor sensors and processors to monitor vital signals; determine the rate, volume, and amount of oxygen per breath; and accurately adjust oxygen levels according to the needs of the patient. These signals are read and interpreted by the machine's semiconductor processors, which control the speed of the motor that translates to mechanized breathing to support a patient.

Public testing & tracing

Accurate and timely testing for COVID-19 was a vital part of assessing risk and determining treatment needs for the public, and semiconductor-enabled medical instruments helped advance testing efforts. Temperature screenings have become common for many workplaces and public facilities hoping to reopen their spaces to large amounts of people. This has been done using thermal cameras or non-contact forehead infrared thermometers that are enabled by semiconductors such as sensors and analog chips that translate real world phenomena such as temperature into digital readings.

Accelerating vaccine development

The pandemic rapidly generated data that researchers could use to develop a COVID-19 vaccine, but the sheer volume of this data made it difficult for scientists to find the specific data they needed. Fortunately, cutting-edge semiconductor-enabled technologies are streamlining the research process for present-day developers. For example, an engineer from a U.S. semiconductor company developed a platform called Deep Search, which uses natural language processing to mark-up research papers for more accurate discovery by search engines. Such technologies have helped scientists more rapidly develop vaccines to combat illness and disease such as COVID-19.

In addition to the work of individual technologists, cooperative research organizations have maximized

vaccine development capacity by leveraging economies of scale. The COVID-19 High-Performance Computing (HPC) Consortium is a cooperative network designed to join the computing capacities and data collection of groups including industry, academia, federal agencies, and international government agencies. Early in the pandemic, semiconductor-enabled AI technology was deployed to help universities, companies, and clinics lower the time required to model and run different potential treatments from weeks to minutes. This significantly saved time and resources needed to develop hypothetical solutions in wetlabs.

Virtual everything

Semiconductors underpin the IT infrastructure necessary for maintaining communication networks between colleagues and classmates outside of a traditional office and school setting. Firms that could conduct business remotely quickly reacted to the pandemic by shifting resources to digital communication, and the trend may be here to stay. With network usage growing between 30 to 50% for top providers, chip-enabled communication infrastructure has provided a lifeline to businesses and schools to carry on with remote work and school for many throughout the pandemic.

Delivery and transportation services are heavily dependent upon rapid communication capabilities. Some examples are the large fleets of truck drivers that operate long shifts and require coordinated support from fleet managers. Both pick-up and delivery options for store items, groceries, and restaurant food have been popular during the pandemic because mobile phone apps have made the transactions easy and safe. Grocery delivery companies utilize the ubiquity of smartphones to connect shoppers and customers, and these semiconductor-enabled services have seen a massive increase in application downloads and order quantities.

Remote healthcare and vulnerable populations

A critical aspect of safely reopening economic sectors has been protecting vulnerable populations such as the elderly, diabetic, and hard of hearing. Managing contact with these populations is the first step, but real-time monitoring systems have allowed physicians access to information regarding the daily status of their patients both in-house and remotely. Semiconductors have played an important role in this.

Remote healthcare, or telemedicine, has been necessary and highly beneficial during the COVID-19 crisis, and semiconductors are vital to IT infrastructure and to wearable medical technology for patient monitoring. This technology is especially helpful to the elderly population and patients with underlying health conditions.

People with diabetes are also at higher risk from the coronavirus. This risk can be mitigated with new semiconductor-rich technologies that make use of advanced sensors such as Continuous Glucose Monitoring (CGM) and wearable insulin pumps. CGM works by placing a sensor on your skin that transmits information to a device that will alert you if your blood sugar fluctuates greatly. Similarly, insulin pumps manage your glucose levels by releasing small doses of insulin according to your programmed schedule. For diabetic COVID-19 patients, access to such technologies has helped to prevent life-endangering complications.

Semiconductors have also improved COVID-19 care for underserved and vulnerable populations in less well-known ways. Hard of hearing patients have been at a distinct disadvantage during the COVID-19 crisis, as medical masks degrade speech quality, making it difficult for hearing impaired patients to understand the advice given by health care professionals. A study in Hearing Review concluded, "Many of the people who have fallen victim to the virus have hearing loss, are unaccompanied by family members, are frail, have multiple chronic conditions and are likely without hearing assistance." Hearing aids use semiconductors to filter, process, and amplify sound, all in a small package that fits discretely on or in the ear. To help patients acquire hearing aids, several hearing care firms have launched platforms to allow remote patient care. Other telemedicine platforms have seen a more than 700% increase in users in areas highly affected by the virus. ⁽¹⁾

Source: Compiled from the report of Semiconductor Industry Association, U. S.



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The “War of the BATTERY” for Future EVs

Part - 3

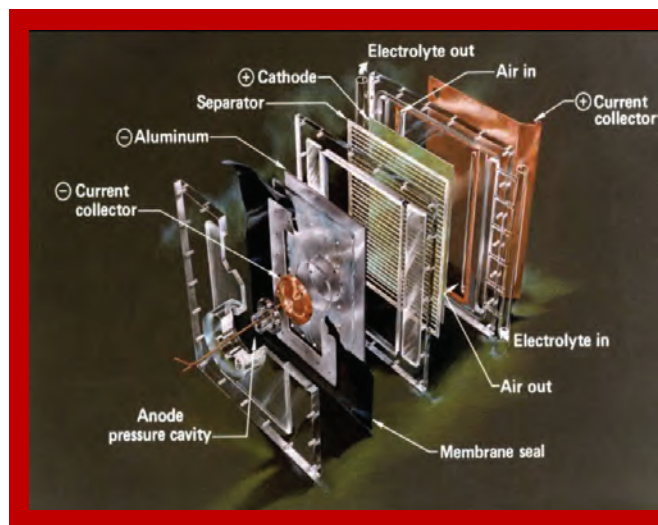
*In the “War of
The Batteries”,
many technologies would
fall and many underdogs
would rise in coming times before
few winners take their righteous
place. Here is a description of the
development of the batteries and
the present day status with the
future potential...*

Primary Batteries – Non Chargeable/ Mechanically Rechargeable Metal Air Battery (MAB) or Al-Air Battery (AAB)

Another category of aqueous battery systems is the MAB, which is an electrochemical cell with high specific energy, utilizing ambient air as the positive active material, and light metals (Li, Ca, Mg, Al, Zn or Fe), most commonly Al or Zn, as the negative active material, typically with an aqueous or aprotic electrolyte. The first Metal-Air battery was designed by Maiche in 1878 (Zn-Air) yet its commercial products started to appear in the market only in 1932. Following this development, other aqueous Fe-Air, Al-Air, and

Mg-Air batteries were developed in the 1960s. It took another two decades for the first non-aqueous metal-air batteries to emerge (initially for Li-air and more recently Na-Air, K-Air & Al-Air). The specific capacity and energy density of MAB/ AAB cells are higher than that of LIB, making them a prime candidate for use in EVs. It has the potential of providing up to eight times the range of a LIB with a significantly lower total weight. Also aluminum is the most abundant metallic element (8.23% by mass in Earth's crust and the third most abundant of all elements after oxygen and silicon). Since India ranks 5th in the world Aluminium reserves, the AlBs seem to be the most suitable for the Indian EV market.

Many efforts are underway to develop a “mechanically” rechargeable AIB where the discharged Al-electrode is physically removed and replaced with a fresh one, however, the recycling of removed discharged Al-electrode has to be done in dedicated plants where Aluminium is recovered from it, which is an energy-intensive process.



Work on EV powered by Al-Air battery has also been going on since 1989 when road tests of a hybrid Al-Air/LAB EV were reported while another Al-Air/plug-in hybrid minivan was demonstrated in Ontario in 1990. Phinergy9 in March 2013 released a video demonstration of an EV using an Al-Air battery being driven for 330 km while on May 27, 2013, the Israeli channel claimed that a car with a Phinergy battery in the back, traveled for 2,000 km before replacement of the Al anodes.

In India, while Log9 is a Bangalore-based company that has roots in the IIT Roorkee incubation center, is indigenously working on Al-Air batteries since 2015, Indian Oil Corporation (IOC) and Phinergy have recently formed a JV (in 2021) to build these ultra-lightweight Al-Air batteries for Electric Vehicles (EVs).

Advantages

- High Energy Density
- Higher Voltage
- Safer & Better
- By-Product Of Battery, $\text{Al}(\text{OH})_3$ Can Be Harvested & Recycled
- Aluminium Is Hydrophilic (Water-Attracting) Thus Battery Reaction Remains Stable
- Al-Air Batteries Are Cheaper Than LIB
- Environmentally Friendly
- Abundance Of Al In India-Reduced Dependency On Any Import For EV Battery

Disadvantages

- Sluggish Discharge Kinetics
- They Cannot Be Recharged Like LIB
- Recycling Of Its By Product $\text{Al}(\text{OH})_3$ Is Highly Energy Intensive
- Possibility Of Corrosion Of Al Metal With O_2 & CO_2 When Not In Use
- Availability Of Battery Swapping Stations & Al Charging Sharing Would Be Required

Fuel Cell (FC)

The concept of the FC was first demonstrated by Humphrey Davy in 1801, but the invention of the first working FC is credited to William Grove, a chemist, lawyer, and physicist who in 1842 called it a “gas voltaic battery”. More work followed between 1939 and 1949 to create various Alkaline FCs. FCs are similar to batteries except that the active materials are not the integral part of the cell (as in a battery), but they are fed into the cell from storage whenever power needs to be generated by

Energy Storage

FCs, and Oxygen or air is the predominant oxidant and is fed into the cathode side of the FC.

However, the FCs differ from the battery in one way i.e. it can produce electrical energy as long as the active materials are fed to the electrodes or the electrodes do not fail. The electrode materials of the FCs are inert in that they are not consumed during the cell reaction, but have catalytic properties which enhance the electro reduction or electro-oxidation of the reactants (the active materials). The anode active materials used in FCs are generally gaseous or liquid and are fed into the anode side of the FC. As these anode materials are more like the conventional fuels used in heat engines, the term “Fuel Cells” has become popular to describe these devices.



A Fuel Cell Electric Vehicle (FCEV) is an EV that uses a FC, sometimes in combination with a small battery to power its on-board electric motor. FCs of these FCEVs generate electricity generally using oxygen from the air and compressed hydrogen stored in tanks mounted on a vehicle. Most FCEVs are classified as zero-emissions vehicles that emit only water and heat.

FCs have been used in various kinds of vehicles including forklifts, especially in indoor applications where their clean emissions are important to air quality, and in space applications. However, the first commercially produced hydrogen FC automobile, the Hyundai Tucson FCEV, was introduced in 2013, Toyota Mirai followed in 2015 and then Honda entered the market. The new generation of FCs are being developed and tested in trucks, buses, boats, motorcycles, and bicycles, among other kinds of vehicles.

Advantages

- High Efficiency
- Power Quality Does Not Degrade Over Time.
- More Silent And Smooth
- Environmental Friendly As No Harmful Emissions Are There
- FCs Are Lighter And Compact

Disadvantages

- Expensive To Manufacture Due To The High Cost Of Catalysts (Platinum)
- Considering The Explosive Nature Of Hydrogen, Creating Supply Chain Would Be A Challenge
- Current FC Technologies Still Have Scalability Challenge
- Highly Explosive Gas And Its Handling Would Always Be A Safety Concern
- Hydrogen Is Expensive To Produce And Not Widely Available

Some Other Battery Technologies Currently Evolving

Graphene Aluminium Battery: Graphene-based batteries have exciting potential but they are not fully commercially available yet. Many companies are already working on it with the combination as Metal-Air Battery or to improve LIB performance (Log 9 Materials, Samsung & Huawei) while in June 2014, US-based Vorbeck Materials announced the Vor-Power battery providing 7,200 mAh and is probably the world's first graphene-enhanced battery.

Cobalt-Free Lithium-Ion Battery: Researchers at the University of Texas have developed a LIB that doesn't use cobalt for its cathode.

Silicon Anode Lithium-Ion Batteries In 2015, Tesla founder Elon Musk claimed that silicon in Model S batteries increased the car's range by 6%.

Lithium-sulfur Batteries: The invention dates back to the 1960s, when Herbert and Ulam patented in 1962, a primary battery employing lithium or lithium alloys as anodic material, sulfur as cathodic material, and an electrolyte composed of aliphatic saturated amines.

Sand Battery: This alternative type of lithium-ion battery uses silicon to achieve three times better performance than current graphite Li-ion batteries.

Vertically Aligned Carbon Nanotube Electrode: NAWA Technologies has designed and patented an Ultra-Fast Carbon Electrode, which can be a game-changer in the battery market. It uses a Vertically-Aligned Carbon Nanotube (VACNT) design which can boost battery power (10X), energy storage (3X), and the lifecycle of a battery (5X). The technology could be in production by 2023.

Gold Nanowire Batteries: Researchers at the University of California Irvine have cracked nanowire batteries that can withstand plenty of recharging.

Battery As EV's Structural Component: Research at the Chalmers University of Technology are working on new batteries not as a power source, but also as a structural component & once developed would be making batteries strong enough to get integrated into vehicle's structure to become an integral part of vehicles serving a dual purpose, weight reduction, and power supply.

Batteries Free From Heavy Metals like nickel and cobalt (IBM is developing a product and that can potentially out-perform lithium-ion)

Foam Batteries: Prieto11 is a company that has managed to make 3-D batteries, using copper foam substrate. This means these batteries will not only be safer, but they will also offer longer life, faster charging, five times higher density, be cheaper to make, and be smaller than current offerings. New Foam Batteries Promise Fast Charging, Higher Capacity in an almost limitless variety of shapes, they could offer energy storage applications previously unimaginable.

Ryden Dual Carbon Battery: Power Japan Plus has already announced this new battery technology called Ryden dual carbon. Not only will it last longer and charge faster than lithium but it can be made using the same factories where lithium batteries are built.

Sodium-Ion Batteries: Scientists in Japan are working on new types of batteries that don't need lithium like your smartphone battery. These new batteries will use sodium, one of the most common materials on the planet rather than rare lithium – and they'll be up to seven times more efficient than conventional batteries.

Epilogue

With so many players in the battery market eying for future EVs, it would be interesting to watch as to in whose favour this "War of The Battery" tilts finally to capture the Global Market as well as the Indian EV market. Though in current times we do not have legends like Edison & Westinghouse/ Nikola Tesla, still in present times we do have Elon Musk, China, and the rest of the world to fight this "War of The Battery". This may take many years before the dust settles down and one/few winners emerge, which may not be with the best of technology but a technology with is environment friendly, has mass acceptance, ease of operation, longevity range, reliable and is low cost, reliable & safe. We need to wait and watch for the ends result of this WAR keeping in mind following key learnings from all the previous technology/ standards wars:

- First-Mover Advantage Is No Guarantee Of Success
- Multiple Technologies Can Coexist And Supplement Each Other
- These Standards Wars Are Often More Than The Superiority Of Technology
- Framing The Challenges & Issues Are Critical For Success.

...concluded 📌



Prabhat Khare possesses a BE (Electrical) degree from IIT Roorkee (Gold Medalist). Now, he is the Director of KK Consultants. He is also a BEE Certified Energy Manager and a Lead Assessor for ISO 9K, 14K, 45K & 50K.

The Saga of Steep Improvement

This has been made possible by massive policy and infrastructure interventions through schemes of the government: Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Integrated Power Development Scheme (IPDS), Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya)...

India had a massive power deficit of -16.6% in 2007-08. Even in 2011-12, it was -10.6 %. Through the multi-pronged, comprehensive and aggressive interventions of the government, this deficit is near about wiped out, consistently over the last 3 years: -.4% In 2020-21, -.7% in 2019-20 and -.8% in 2018-19. The current year, up

The Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY), was brought in on 25th July, 2015 for infrastructure push in the rural sector – setting up of transmission and sub transmission systems. The Integrated Power Development Scheme (IPDS), was brought in on 20th November, 2014 for to fill in power

Power Supply Position Since 2007-08

Year	Energy Requirement / Availability				Peak Demand / Peak Met			
	Energy Requirement	Energy Availability	Surplus (+) / Deficit (-)		Peak Demand	Peak Met	Surplus (+) / Deficit (-)	
	MU	MU	MU	%	MW	MW	MW	%
2007-08	7,39,343	6,66,007	-73,336	-9.9	1,08,866	90,793	-18,073	-16.6
2008-09	7,77,039	6,91,038	-86,001	-11.1	1,09,809	96,785	-13,024	-11.9
2009-10	8,30,593	7,46,644	-83,949	-10.1	1,19,166	1,04,009	-15,175	-12.7
2010-11	8,61,591	7,88,355	-73,236	-8.5	1,22,287	1,10,256	-12,031	-9.8
2011-12	9,37,199	8,57,886	-79,313	-8.5	1,30,006	1,16,191	-13,815	-10.6
2012-13	9,95,557	9,08,652	-86,905	-8.7	1,35,453	1,23,294	-12,159	-9.0
2013-14	10,02,257	9,59,829	-42,428	-4.2	1,35,918	1,29,815	-6,103	-4.5
2014-15	10,68,923	10,30,785	-38,138	-3.6	1,48,166	1,41,160	-7,006	-4.7
2015-16	11,14,408	10,90,850	-23,558	-2.1	1,53,366	1,48,463	-4,903	-3.2
2016-17	11,42,928	11,35,332	-7,596	-0.7	1,59,542	1,56,934	-2,608	-1.6
2017-18	12,13,326	12,04,697	-8,629	-0.7	1,64,066	1,60,752	-3,314	-2.0
2018-19	12,74,595	12,67,526	-7,070	-0.6	1,77,022	1,75,528	-1,494	-0.8
2019-20	12,91,010	12,84,444	-6,566	-0.5	1,83,804	1,82,533	-1,271	-0.7
2020-21	12,75,534	12,70,663	-4,871	-0.4	1,90,198	1,89,395	-802	-0.4
2021-22 (Upto Oct.)	824348	820706	-3,642	-0.4%	2,03,014	2,00,539	-2,475	-1.2

till October, it has been -1.2%; the marginal spike being attributable to the annual post monsoon pressure on power output. This is also likely to normalize by the end of the year.

This transformation from an acutely power deficit country, to a situation of demand being met, except for an extremely marginal shortfall of less than 1%, has been made possible by the following schemes brought in by the current Government to address the unhappy situation.

infrastructure gaps in urban areas. The Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya) scheme launched on 25th September, 2017, had the vision to take electricity to every household (willing), and has been able to supply electricity connections to 2.8 to crore households that were hither to in darkness.

The augmentation to the installed power capacity in the country, consequent to these efforts, has been 1,55,377 megawatts in last approximately 7 years. 

Igus Announces Strong Growth Plans for India

The company has launched over 180 new products from its innovative 'virtual' show booth to support growth...

Igus, the global leader in Motion Plastics, has recently announced an aggressive growth plan and strategy in the backdrop of 20 successful years of operations in India. As the 9th largest market globally and the 3rd largest market in the APAC region, igus India has consistently been recording double digit growth over the last many years (except the pandemic year) and in the current year is growing at 30% above the previous record year on average. igus India hopes to double its revenues to INR 300 crores in the next 3-4 years. Among a host of plans to drive growth in the next phase, igus India has announced the introduction of a 'virtual show booth' replete with its entire set of products that is available for customers to be viewed, tried and tested both via virtually and physically.

The innovative virtual booth aims to give customers an immersive experience similar to a face-to-face expo with an option to interact with product experts. The first such innovative virtual trade show was set up at igus' global headquarters in Cologne, Germany. After the great success of the virtual expo spanning 400 sq.m in Germany, which hosted more than 100,000 visitors from across the globe, igus India has created its own IMPS virtual show booth exclusively for its customers in the Indian Sub-continent.

Announcing the launch of the virtual product expo titled Igus Motion Plastic Show (IMPS), Deepak Paul, Managing Director, igus (India) said, "India is one of the key markets in the world for igus, occupying one among the top 10 positions, globally. Having achieved an impressive double-digit growth for the last 20 years in India, igus India's range of motion plastics with its motto 'tech up; cost down' has been widely accepted across all manufacturing industries. With businesses chugging back to normalcy and the buoyancy in the economy on its way to returning it to the hey days, the path ahead looks promising as manufacturers look for cost effective ways to drive their businesses. To support them, Igus India has chalked out a multi-pronged strategy to drive growth and support businesses achieve their growth objectives, one of them being an immediate addition of 10,000 sq.ft with the intention of starting injection



Igus Motion Plastic Show (IMPS)...

moulding in India, which has been a longstanding wish from the Indian customers."

Santhosh Jacob, Country Manager and Director, Igus India said, "As a technology focused organization, innovation has always been igus' cornerstone and prime focus. Igus India's investment of nearly 2 Million INR into The Igus Motion Plastic Show (IMPS) is yet another innovative offering to enable customers visiting the virtual stall to not only witness new products, product extensions and new service offerings, but also interact with igus' product experts who can share more insights, global experience and also directly discuss their relevant applications of interest virtually. Coupled with the possibility of on-line lifetime calculations and option to order and pay on-line and get delivery starting from 24 hours, igus truly would like to work towards being the easiest company to work with."

Stephen Moreno Simpson, International Group Development, Igus GmbH added, "igus products are manufactured in accordance with its guiding principle – plastics for longer life. Our products are designed with passion to extend the service life of machines and applications, eliminate maintenance and reduce costs. Our investment in the virtual trade show comes at a time when buoyancy to the manufacturing segment is returning and augurs well with the plans that we have envisioned for India."

18

Managing the Menace of Voltage Variations

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

Effects of high or low voltage

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

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

Automatic Voltage Controller (AVC)

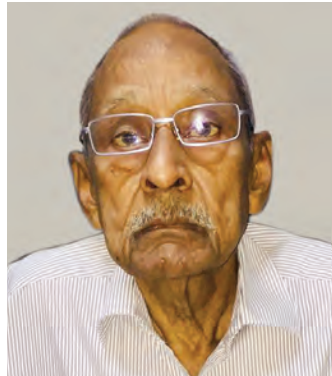
To solve the challenge of voltage variation, Automatic Voltage Controller (AVC) is required. The main part of AVC is the Voltage Regulator.

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

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

In 1990 we developed the linear regulator

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



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

Energy Audit

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

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

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

The payback period

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

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

For more information:

contact at E-Mail: jemc@jindalelectric.com

ALL INDIA INSTALLED CAPACITY (IN MW) OF POWER STATIONS
(As on 31.10.2021)

Region	Ownership/ Sector	Mode wise breakup								Grand Total
		Thermal					Nuclear	Hydro	RES * NRE)	
		Coal	Lignite	Gas	Diesel	Total				
Northern Region	State	17319.00	250.00	2879.20	0.00	20448.20	0.00	5888.25	725.51	27061.96
	Private	22425.83	1080.00	558.00	0.00	24063.83	0.00	3061.00	21819.76	48944.59
	Central	15662.48	250.00	2344.06	0.00	18256.54	1620.00	11484.52	379.00	31740.06
	Sub Total	55407.31	1580.00	5781.26	0.00	62768.57	1620.00	20433.77	22924.27	107746.61
Western Region	State	21290.00	900.00	2849.82	0.00	25039.82	0.00	5446.50	569.28	31055.60
	Private	31947.17	500.00	4676.00	0.00	37123.17	0.00	481.00	30897.67	68501.84
	Central	20479.10	0.00	3280.67	0.00	23759.77	1840.00	1635.00	666.30	27901.07
	Sub Total	73716.27	1400.00	10806.49	0.00	85922.76	1840.00	7562.50	32133.25	127458.51
Southern Region	State	20322.50	0.00	791.98	159.96	21274.44	0.00	11819.83	594.88	33689.15
	Private	12747.00	250.00	5340.24	273.70	18610.95	0.00	0.00	44686.53	63297.48
	Central	11835.02	3390.00	359.58	0.00	15584.60	3320.00	0.00	541.90	19446.50
	Sub Total	44904.52	3640.00	6491.80	433.66	55469.99	3320.00	11819.83	45823.31	116433.13
Eastern Region	State	7450.00	0.00	100.00	0.00	7550.00	0.00	3537.92	275.11	11363.03
	Private	5553.00	0.00	0.00	0.00	5553.00	0.00	209.00	1427.35	7189.35
	Central	14613.38	0.00	0.00	0.00	14613.38	0.00	1005.20	10.00	15628.58
	Sub Total	27616.38	0.00	100.00	0.00	27716.38	0.00	4752.12	1712.46	34180.96
North Eastern Region	State	0.00	0.00	466.36	36.00	502.36	0.00	422.00	233.25	1157.60
	Private	0.00	0.00	0.00	0.00	0.00	0.00	0.00	160.70	160.70
	Central	770.02	0.00	1253.60	0.00	2023.62	0.00	1522.00	30.00	3575.62
	Sub Total	770.02	0.00	1719.96	36.00	2525.98	0.00	1944.00	423.95	4893.92
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	27.66	27.66
	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	38.01	78.06
ALL INDIA	State	66381.50	1150.00	7087.36	236.01	74854.86	0.00	27114.50	2403.27	104372.64
	Private	72673.00	1830.00	10574.24	273.70	85350.95	0.00	3751.00	99019.67	188121.62
	Central	63360.00	3640.00	7237.91	0.00	74237.91	6780.00	15646.72	1632.30	98296.93
	Total	202414.50	6620.00	24899.51	509.71	234443.72	6780.00	46512.22	103055.25	390791.18

Figures at decimal may not tally due to rounding off

Source: CEA



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5 YEARS	30	3000.00	4500.00	5500.00	3000.00	6000.00	7000.00
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3 YEARS	18	2000.00	2900.00	3500.00	2000.00	3900.00	4500.00
5 YEARS	30	3000.00	4500.00	5500.00	3000.00	6000.00	7000.00
AUTOMATION & ROBOTICS WORLD							
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3 YEARS	18	3200.00	4100.00	4700.00	3200.00	5100.00	5700.00
5 YEARS	30	4800.00	6300.00	7300.00	4800.00	7800.00	8800.00



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AC current, AC + DC Current, AC Voltage, AC + DC Voltage, DC Current, Resistance, Capacitance, Frequency,

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A software CD & USB cable is supplied along with the instrument, in addition to a pair of test leads. Two K-type thermocouple probe, one temperature connector, Carrying Case & Operational Manual are also supplied. 

For further information, Email: sales@kusam-meco.co.in, Website: www.kusamelectrical.com

igus launches ‘cable guide’ for SCARA robot

Scara robots are ideal to perform pick-and-place or assembly tasks in the industry. However, these dynamics has a limited lifespan due to the corrugated hoses wearing out within a very short time. Therefore, igus has now developed an alternative, which can be retrofitted with the SCARA Cable Solution, which significantly increases the service life.



The horizontal articulated-arm robots work fast over four axes. The inner and outer arms pivot horizontally. The component for gripping objects, the ball screw, moves rotationally and linearly. This allows the robot arm to reach almost any point in its working radius. This is fast and precise, but it means that the externally routed cables and hoses have to be replaced or serviced frequently due to the high loads. This was also the case for a manufacturer in the automotive industry who wants to optimise its energy supply - both the corrugated tube and the rotary bearing.

“Inspired by this challenge in the market, we looked at the weak points of the hoses and connectors and

developed the SCARA Cable Solution in a two-year research and testing process,” explains Matthias Meyer, Head of Business Unit ECS triflex & Robotics at igus GmbH. The new development is a customised cable guide that safely guides the energy from axis 1 to the ball screw and prevents the cables from kinking even in continuous operation.

The SCARA Cable Solution consists of three components: the rotary bearing for the moving end and the fixed end, as well as the corrugated hose with the e-rib. The special feature lies in the new rotary connection, which absorbs the torsional forces. Here, integrated ball bearings ensure a smooth-running energy supply system that is resistant even to high accelerations. The corrugated hose is reinforced with an e-rib, so that it can only move in one spatial direction. The guide elements on the sides give the hose unsupported length. 

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

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NOTE : We can provide you the computerized printout of voltage variation at your premises by installing the Data Loggers

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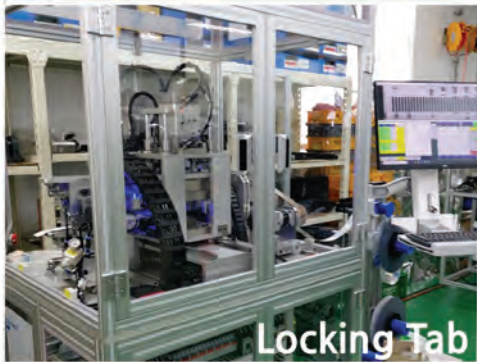


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