Vol 60 No 10 October 2020 ₹100

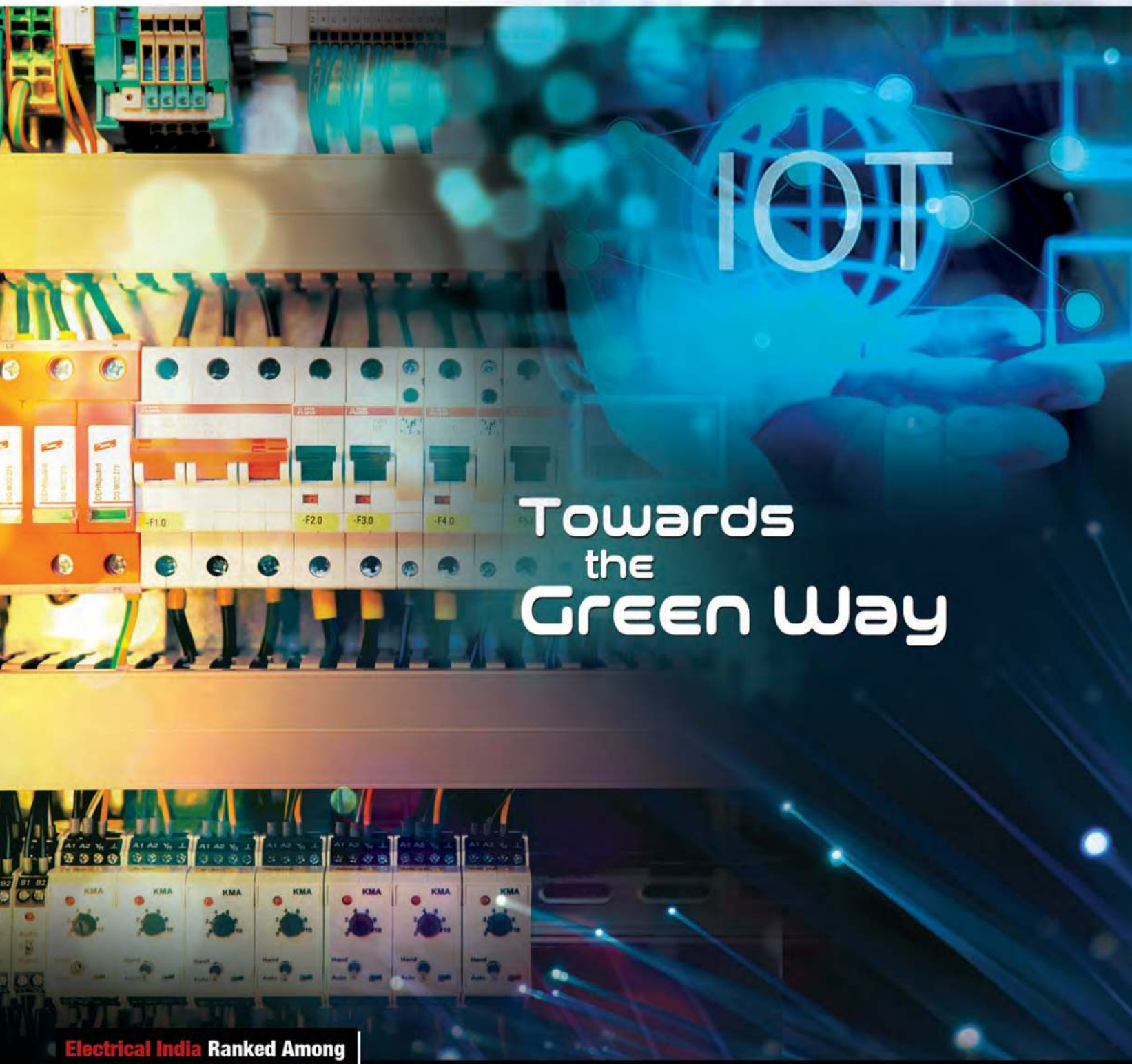
Since 1961

Electrical India

ISSN 0972-3277

India's oldest magazine on power and electrical products industry

60th Year of Service to the Industry



Electrical India Ranked Among World's Top 100 Publications in "The Future of Energy"

A Chary Publication®

Scan the QR Code to know more about EI Website

Follow us on

SUBSCRIBE/RENEW Online • Log on to www.electricalindia.in

From the Publisher's Desk

Effortless Charging of the EVs

Globally the automotive sector is transforming, I mean, all the IC engine driven vehicles will be gradually replaced by Electric Vehicles (EVs). So, advent of a new industry will slowly wipe out the existence of another industry, which is still dominating all kinds of transit. Every new technology had to establish itself through fighting. The case of EVs is also not an exception. World's first battery operated passenger car Reva was rolled out on Indian roads in 1994, however, even after 25 years, the confidence of the Indian users on electric cars is not so high. But, because of government's directive, we all know that things have to change to fulfil our environmental commitment.

Beside Range and Speed, at present the Indian user community is mostly worried about the availability of ubiquitous charging facility and the time taken for a complete round of charging. As far as the second point is concerned, in Electrical India, several times we have presented articles on fast charging technologies as well as battery swapping. So, today let me talk about an amazing technology, that will soon drive away all the apprehensions regarding charging. Yes, if electric cars could recharge while driving down a highway, it would virtually eliminate concerns about their range and lower their cost, perhaps making electricity the standard fuel for vehicles!

Scientists from Stanford University have already developed such a way to wirelessly deliver electricity to moving objects – it's a technology that will one day charge EVs and personal devices like cell phones on-the-go. Additionally, some transportation experts envision an automated highway system – where driverless electric vehicles will be wirelessly charged by solar power or other renewable energy sources.

Mahadevan

Publisher & Editor-In-Chief

Directors
Pravita Iyer
Mahadevan Iyer

Publisher & Editor-In-Chief
Mahadevan Iyer
miyer@charypublications.in

Commercial Director, Digital & Print
Pravita Iyer
pravita@charypublications.in

Editorial Department
P. K. Chatterjee (PK)
pkchatterjee@charypublications.in

Editorial Assistant
Abegail D'mello
abegail@charypublications.in

Advertising Department
Head - Marketing
Yasmeen Kazi
yasmeen@electricalindia.in

Design
Sachin Parbalkar
Jebas Thangadurai

Accounts Department
Dattakumar Barge
accounts@charypublications.in

electricalindiamagazine
electricalindia
ElectricalIndia
electricalindia1961

Chary Publications Pvt. Ltd.
906, The Corporate Park, Plot 14 & 15,
Sector 18, Vashi, Navi Mumbai 400703
Phone: 022 2777 7170 / 71
www.electricalindia.in

Single Issue: ₹ 100 / Annual Subscription: ₹ 1000

Printed, Published and owned by Mahadevan Iyer from 906, The Corporate Park, Plot 14 & 15, Sector 18, Vashi, Navi Mumbai 400703 and Printed at Print Tech., C-18, Royal Indl Estate, Naigaum Cross Road, Wadala, Mumbai - 400 031. **Editor: Mahadevan Iyer**

HIGH QUALITY FOR YOUR MACHINERY

MGM VARVEL
POWER TRANSMISSION

MGM brake motor main features

- TEFC 3-ph asynchronous brake motor (0.09kW-130kW)
- AC 3-ph brake (no rectifier) or DC brake on request
- Oversized brake disc for higher brake torque, longer life and reduced maintenance
- Fine and easy brake torque adjustment (as standard)
- Very quick brake reaction time
- Frequent START/STOP cycle applications
- Manual brake release (as standard)
- Hexagonal hole on non drive end of the shaft for manual rotation
- Single speed or two speeds motors
- All motors designed for inverter duty

VARVEL production lines

- RS-RT worm gearboxes: 28 to 150 mm centres. One stage worm, helical/worm and double worm.
- RD helical gearboxes: 50 to 2300 Nm. Two and three stages.
- RN parallel shaft gearboxes: 180 to 3300 Nm. Two and three stages.
- RO-RV bevel/helical gearboxes: 180 to 3300 Nm. Three stages.
- RG precision planetary gearboxes: 10 to 230 Nm. One and two stages.
- VR dry friction speed variators: IEC63 to IEC90 1 to 5 stepless speed range, 300 to 1500 rpm.
- VS planetary speed variators: IEC71 to IEC112 1 to 5 stepless speed range, 200 to 1000 rpm.

A new generation of electric motors and gearboxes for power transmission quality from the alliance of two dynamic italian companies.
For those who want quality.

MGM-VARVEL Power Transmission Pvt Ltd

Ware House No. G3 and G4 • Ground floor • Indus Valley's Logistic Park
Unit 3 • Mel Ayanambakkam • Vellala Street • Chennai - 600 095 • Tamil Nadu, INDIA
Phone: +91 44 26533665 • 9629691777
info@mgmvarvelindia.com • www.mgmvarvelindia.com

REGIONAL OFFICE: KOHLI TOWERS • 4th Floor, Dapodi • Near Bharat Petrol Pump • Pune - 411012

Electrical India

Contents

Vol. 60 | No. 10 | October 2020

PROJECTION
18 Smart Grid Infrastructure In India To Witness High Growth

ELECTRIC VEHICLES
22 Latest Trends in EV in India

T&M
26 Testing Smart Meter Part – I

ENERGY CONSERVATION
30 Using Automatic Star-Delta-Star Starter

14
COVER STORY
Towards The Green Way

INTERVIEW
36 – C. P. Vyas, President – Electrification Business, ABB India

EXPERT INSIGHT
38 Moving Towards Better Indian Electricity Grid Discipline – Part 3

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

CONFERENCE
48 A transition to clean energy is about investing in the future

REGULARS

4 Publisher's Letter
8 News
44 Statistics
49 Index of Advertisers
50 Events

ESYLUX

For more details contact:

iTvis®
Lighting First

iTvis Innovations Pvt Ltd
t: +91 253 2236444
m: +91 94224 98376
info@itvisinnovations.com
www.itvisinnovations.com

HYGIENIC LIGHT SWITCHING. ESY!

CONTACTLESS ENERGY-EFFICIENCY WITH PRESENCE AND MOTION DETECTORS

FITTING PRODUCTS FOR APPLICATIONS

The higher the number of people who use a particular room, the greater the hygiene problem presented by the light switch – this applies to sanitary facilities, staircases and corridors in particular, but also in offices.

SANITARY FACILITIES

CORRIDORS

STAIRCASES

OFFICES

PERFORMANCE FOR SIMPLICITY

ESYLUX GmbH | www.esylux.com

You can find more informations on the ESYLUX website:

NTPC INVITES EoI FROM ENERGY INTENSIVE INDUSTRIES

With a view to promoting the 'Make in India' and give boost to the government's vision of Atmanirbhar Bharat, NTPC Ltd, India's largest power generation company and a PSU under Ministry of Power, has invited Expression of Interest (EoI) from Energy Intensive Industries for setting up manufacturing units within their plant premises.

As per a statement issued by NTPC Ltd., it has invited the EOI from MSMEs and Indian companies for setting up energy intensive manufacturing plants such as Bulk Chemicals - Ammonia, Urea, ChlorAlkali, Gypsum and Gypsum products, Geopolymer, Cooling & Heating Solutions, Aluminium, mineral processing (ceramics, tiles, pottery, brick, glass etc.), metallurgical and metal industries (foundries, forging, alloys, heat treatment, steel rerolling, etc.) in the industrial parks to be developed on a pilot basis in the NTPC Thermal Power plants at Solapur (Maharashtra), Kudgi (Karnataka) and Gadarwara (Madhya Pradesh). These industrial parks will be subjected to requisite approvals from respective State and Central Government. NTPC will process these approvals based on responses received in the EOI.

NTPC's power plants across the country have evolved into economic centres with robust infrastructure system in place. Capitalising on the economic ecosystem developed over a period of time, NTPC is exploring ideas to improve utilisation of land within its plant locations for enhancing economic activity and further contributing to economic growth of the country.

The initiative will create industrial parks within the power plants which, besides offering unique advantage of reliable electricity supply at competitive prices, will provide slew of other benefits of readily available infrastructural services like adequate water supply, accessibility through road and rail network, robust connectivity with internet lease lines, accessibility to township, medical facilities and local market along with various testing facilities, which will be co-opted on need basis. As part of the plan, NTPC will enter into separate agreement with prospective entities for allotment of spaces.

POWER MIN SPENT RS 11,000 CRORE FOR BIHAR

NTPC's recent construction of facilities and infrastructure in Bihar will make the life convenient for the locals...

Union power minister (IC) R. K. Singh has recently inaugurated a host of community focused facilities developed by NTPC in Bihar in the vicinity of NTPC Barh (1320 MW), Nabinagar Power Generation Company Pvt. Ltd. (NPGCL), Nabinagar (660 MW) and Kanti Bijlee Utpadan Nigam Limited (KBUNL), Kanti (610 MW).

Singh inaugurated two Community Centres- Sahari and Sahnaura at Barh, Patna. He also inaugurated 3 km long Meh-Indrapuri Barrage Road at Nabinagar, Aurangabad and the Main Gate Complex of Kanti Bijlee Utpadan Nigam Limited (KBUNL) in Bihar. While inaugurating the facilities from Patna, Singh informed that in the past 3-4 years, the Power Ministry has invested Rs 11,000 Crore worth of initiatives for electrification in Bihar, which includes substations, transmission and rural electrification projects. He revealed, "In the past 5 years, cost of coal and railway freight increased by 40%, but due to efficiency displayed by NTPC, they were able to limit power price hike by only 12%."

Singh further added, "The organisation has given Rs 257.5 Crore, the highest amongst Power PSUs to PM CARES fund. It has given over Rs 12 Crore to AIIMS, Patna. NTPC is diversifying its portfolio into other ways of generating power and we have a vision to transform it into a true multinational company. NTPC was also given the responsibility for electrification for the rural areas in Odisha, which they completed well before the deadline."

Global Monitoring for GIS

One System for Global GIS Condition Monitoring

- Partial Discharge Activity
- Open & Close Coil Currents: Profiles & Peaks
- I2T Sums & Maintenance Threshold
- Fault Currents
- Circuit Breaker Operation: Open/Close Time, Movement, Velocity
- Motor & Heater Currents
- SF6 Density & Leakage Monitoring
- Battery Voltage

ISA Advanced Instruments Pvt. Ltd. - ALTANOVA Group Company
www.altanova-group.com
info.asia@altanova-group.com

CABINET NODS FOR PGCIL SUBSIDIARIES' ASSET MONETIZATION

The Cabinet Committee on Economic Affairs, chaired by Prime Minister Narendra Modi, has approved monetisation of assets of Powergrid, a Public Sector Undertaking (PSU) under Ministry of Power, through Infrastructure Investment Trust (InvIT) model. This is the first time any PSU in Power Sector will undertake asset recycling by monetising its assets through the InvIT model. The proceeds from the asset monetization would be utilized by Powergrid for its CAPEX and the premium generated would augment the net worth of Powergrid.

Image by Scottslm from Pixabay

This approval will help Powergrid monetise in the first lot, assets with gross block value of more than 7,000 crores. These assets, which include mainly High Voltage Transmission lines and substations, are held by Powergrid in form of Special Purpose Vehicles (SPVs). The proceeds from the asset monetization would be deployed by Powergrid in their new and under-construction projects.

Based on the experience gained, further monetization shall be carried out in future. Asset recycling is a key strategy of the Government of India to release the capital invested in operational assets. The proposed InvIT of Powergrid would attract both domestic as well as global investors including Sovereign Wealth Funds. The CAPEX plan of Powergrid for next two years (2020-21 and 2021-22) is Rs. 20,500 cr. The Government of India has enacted an enabling regulatory and taxation framework for InvITs and the proposed InvIT by Powergrid would deepen this market.

The InvIT would provide an opportunity to the general public and institutional investors to benefit from this investment opportunity and participate in the growth of Indian Infrastructure Sector.

RAIGARH-PUGALUR HVDC LINE PUT INTO COMMERCIAL OPERATION

With the use of state-of-the-art maintenance techniques, automation and digitization, Powergrid has been maintaining average transmission system availability above 99%...

Powergrid has commissioned Pole-1 of the Raigarh Pugalur HVDC Transmission system comprising {1,500 Mega Watt (MW)} +800 kilovolt (kV), Raigarh HVDC Terminal Station (Chhattisgarh) & Pugalur HVDC Terminal Station (Tamil Nadu) along with 1,765 kms long ±800 kV, HVDC line from Raigarh to Pugalur and 2 nos. of HVAC lines in Tamil Nadu. As per the statement of Power Grid Corporation of India Limited (Powergrid), 'Maharatna' Enterprise under Ministry of Power, this system will facilitate power flow of 1,500 MW from Western Region to Southern Region ensuring reliable and quality power supply.

Powergrid has completed this gigantic system despite many challenges and lockdown restrictions – encountered during COVID19 pandemic applying its professional expertise and project management capabilities.

The pole-I having a 1,500 MW capacity, is the first leg of the 6,000 MW Raigarh – Pugalur HVDC Project, between Western and Southern Region, which is envisaged for evacuation of bulk power generated by Independent Power Producers (IPPs) in the state of Chhattisgarh using the state-of-the-art HVDC technology. Implementation of balance portion of this project is in its advanced stage and will be integrated in a phased manner during FY 2020-21.

Power Grid Corporation of India Limited (Powergrid), is a 'Maharatna' Enterprise under Ministry of Power, Government of India. As on August 31, 2020, the total transmission assets of Powergrid and its subsidiaries stood at 164,511 ckm of transmission lines, 249 Sub-stations and more than 414,774 MVA of transformation capacity.

TATA POWER SIGNS A PPA WITH APOLLO GLENEAGLES HOSPITAL

As on date, the India's largest integrated power company, together with its subsidiaries and jointly controlled entities, has an installed or managed capacity of 12,742 MW...

Tata Power, India's largest power company, has signed a Power Purchase Agreement (PPA) with Apollo Gleneagles Hospital to commission the biggest carport in Indian Health Sector. This will be the biggest carport in the state of West Bengal. With 335Kwp capacity, the project is expected to generate approximately 4.26 lakhs units for the hospital and reduce 80,000 gms of carbon emission per annum.

The project requires a complex level of EPC expertise and customised plan layout for which Tata Power has created high level engineered design enabling the team to efficiently assemble the structure. Additionally, state-of-the-art technologies and ingenious planning by Tata Power will help in the smooth project execution.

The company has commissioned many prestigious projects that stand proud as a benchmark in the industry. Few such installations are carport project at the Cochin International Airport, rooftop installation in a Cricket Stadium at CCI in Mumbai, vertical solar farm project for Dell India, and rooftop installation at India International Centre, New Delhi. Each project installed by Tata Power endorses green and clean energy, along with enhancing the horizon of happy customer of Tata Power.

SPINNING OF TURBINES STARTS FOR SINGOLI–BHATWARI HEP PLANT

Larsen & Toubro has announced 100% completion & readiness for commissioning of the 99-MW Singoli–Bhatwari Hydroelectric Power (HEP) Plant. The commissioning of this run-of-the-river plant along the iconic Char Dham route will be a major boost to the state of Uttarakhand, with the plant's capability of providing over 400 million units of renewable energy per annum.

Situated about 25 kms from Rudraprayag, the plant features a barrage, with a medium-sized intake pond near Ukhimath, a 12 km long headrace tunnel and a surge shaft over 180 m in-depth and is devoid of any rehabilitation and resettlement issues. The plant houses 3 units of Voith Turbine generators of 33 MW each, equipped with a state-of-the-art switchyard and controlled via the latest Supervisory Control and Data Acquisition (SCADA) technology.

The SCADA systems are designed to automatically monitor and control plant and its equipment such as telecommunications, water and waste control to take timely decisions and actions. This provides uninterrupted power supply at minimum generation cost. Besides, the plant will cater to peak demand loads of 2½ hours each in both halves of the day, bringing relief even during non–monsoon months and meeting peak electricity demand.

The wet commissioning process starts with machine spinning of the turbines initially without generation of electricity and upon due testing, eventual synchronization with the grid for supply of electricity. Grid synchronization and charging of the transmission lines is expected in approximately a month, and is timed during the inauguration of the plant.

MOJO POWER CHOOSES CARBONTRACK'S EM TOOLS FOR ITS CUSTOMERS

Sydney-based Mojo Power has signed a memorandum of understanding with CarbonTRACK to deploy CarbonTRACK's technology in a live deployment with targeted customers. CarbonTRACK's system will equip Mojo customers to automatically turn off or defer intense energy usage during peak price periods. Once the benefits are proven, Mojo will deploy the system more widely for customers.

Spiros Livadaras, Managing Director, carbonTRACK

Mojo Power's Executive Director Commercial Adam MacDonald said, "This is an exciting move for Mojo Power in building out our offerings of smart tools for residential and business customers. We want our customers to enjoy simple plans, clear and accurate bills and access their electricity usage data – if they choose to. CarbonTRACK provides us with smart tools that give our customers the visibility to track and automatically manage their electricity usage," he said.

CarbonTRACK Managing Director Spiros Livadaras said Mojo Power's decision demonstrated the benefits offered by carbonTRACK's technology for innovative energy companies. "We are extremely pleased to be working with Mojo. Mojo is an innovative Australian electricity retailer that's disrupting the status quo, so we are proud that our technology will help their customers both improve their quality of life and save money," he said.

Benefits of carbonTRACK's Intelligent Energy Management systems include demand-side management; peak shaving; storage integration; and Virtual Power Plants. carbonTRACK's Demand Response, Frequency Regulation, Virtual Energy Trading and Grid Resiliency solutions deliver the full Virtual Power Plant (VPP) value chain to Utilities & Transmission System Operators, System Operators & Energy Traders, Financiers, Solar Sales Teams and Solar Hardware Manufacturers.

ECOLUTION KWH TO HARNESS KINETIC ENERGY TO POWER REFRIGERATED TRAILERS

In industries, people are so much used to traditional ways of doing things, that they hardly can speculate the enormous benefits that can be derived by slightly changing the method of doing the things, which is popularly termed as innovation. Those who can innovate, they create new milestones. Exactly the same thing has happened in Ecolution KWH, LLC (Ecolution), an e-mobility and power company from Naples. The company has received a U.S. patent for reusing wasted kinetic energy in refrigerated trailers used to distribute food and medicine. When combined with an electric or hydrogen-fueled truck, such as those being developed by Tesla and others, the Ecolution trailer accomplishes a total elimination of carbon emissions plaguing the multi-billion dollar global industry.

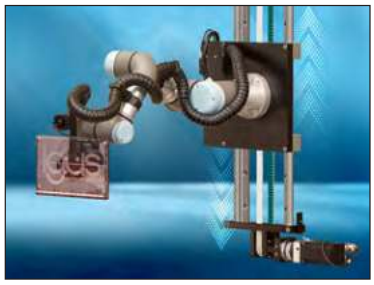
Ecolution's 'green perfect cycle', MARS system, replaces the diesel gas tank and TRU Genset units typically used in 'reefer' trailers to refrigerate produce and medicine on the way to retail stores and outlets with swappable batteries. As a result, it can reduce the average weight of a refrigerated trailer by 1,200 pounds, increasing the hauling capacity of the trailer, while delivering greater battery life for the electric truck.

The key MARS-patented innovation is the use of alternators connected to disc brakes in the trailer, sending power through a converter to a battery storage unit for on-demand energy, all within the reefer trailer. The company now has four patents pending in Germany, Japan, China and South Korea. The invention, under research and development for five years, now goes into a prototype in the US, Europe, Latin America and Asia.

A ROBOT'S RANGE QUICKLY EXTENDED WITH 7TH AXIS FROM IGUS

UR (Universal Robots) and robolink robots acquire a 5-times larger action radius...

igus now offers a directly ready-to-connect 7th axis, so that a robot can move over a distance for several metres. The new complete system consists of a maintenance-free drylin ZLW toothed belt axis with corresponding adapter plate, switch cabinet, cables and software integration. For easy integration of the axis of the robot, igus has developed two adapter kits for robolink and UR robots. They enable fast and, above all, cost-effective low-cost automation.



With the help of a 7th axis from igus, UR robots can move flexibly over for distance of several metres...

Robots insert workpieces into a milling machine, dispense chocolate bars from vending machines and place crates on pallets, which are then stacked. But how can they move vertically, horizontally or overhead in a flexible manner? The answer is a 7th axis. Specifically, for linear adjustment, igus has developed a lubrication-free, lightweight flat axis with a stroke of up to 6m and a positioning accuracy of 0.5mm with the help of its drylin linear construction kit. To ensure that the axis can be easily combined with a robot, igus now offers overall solutions for UR3, UR5 and UR10 robots (Universal Robots), robolink DP robots and DCi robots. "A customer who acquires the new complete system receives, on the one hand, an adapter plate for easy attachment of the robot and the energy chain to the axis and, on the other, the corresponding integration solution, in other words the switch cabinet with cables, motor controller and the respective software solution", explains Alexander Mühlens, Head of Automation Technology at igus GmbH. "If a robolink robot is used, the 7th axis can be easily controlled by means of the igus robot control software. For UR robots, we supply an UR-CAP as a direct integration solution, including all the electrical modules needed." This means that the robot can be installed and put to work within just a few minutes. The 7th axis is supplied by igus as a complete system that is ready to connect immediately, consisting of a drylin ZLW-20 toothed belt axis in the desired length exactly to the millimetre, plus the connecting cables, the switch cabinet, the power electronics, the software integration and the corresponding adapter set. Alternatively, the adapter set is separately available consisting of adapter plate and control system.

NEW CONSORTIUM FORMED TO DEVELOP OFFSHORE WIND POWER PROJECTS

J-Power, JERA and Equinor have developed, constructed, and operated large-scale power generation projects around the world for a long time...

Electric Power Development Co., Ltd. (J-Power), JERA Co., Inc. (JERA) and Equinor ASA (Equinor) have formed a consortium to jointly evaluate and work towards submitting a bid for offshore wind power projects in Akita Prefecture off Noshiro City, Mitane Town, Oga City and off Yurihonjo City. Going forward, the consortium will work towards bidding for the Projects based on the "Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities." J-Power is the second largest wind power producer in Japan with approx.530MW of the net wind power generation capacity. J-Power has been operating onshore wind power generation projects in Nikaho city and Yurihonjo city, Akita Prefecture for long years. Regarding offshore wind projects, it has expertise in the development, construction, operation, and decommissioning of offshore wind power demo-project off Kita-Kyushu City and it was successfully awarded the Kitakyushu Hibikinada offshore wind power project through the auction. JERA supports sustainable deployment of ocean-based renewable energy as a sole member from Japan of Ocean Renewable Energy Action Coalition, which is formed by global companies and organizations who lead offshore wind power industries, and as it aims to become a global leader in renewable energy, it is driving the development of large-scale offshore wind power projects in the world. Equinoris is the world's leading floating offshore wind developer and has a firm ambition of becoming a global offshore wind major.

TOWARDS THE GREEN WAY

Although several years ago, the European Commission banned the use of SF_6 gas in almost all sectors, only in switchgear industry it is still being used in a big way owing to the advantage that the gas ensures that any arcs that may occur during switching are quickly extinguished. However, the environmental impact of SF_6 gas is around 23,500 times more than that of CO_2 and once leaked it can remain in the atmosphere for up to 3,200 years. Thus, introduction of SF_6 alternatives should be given topmost priority today… - P. K. Chatterjee (PK)

Green Power is a very popular phrase in today's world. However, from generation to distribution through transmission, electricity offers many opportunities to adopt green practices – and literally the scope is increasing with growing penetration of our understanding. However, in this article, we will restrict ourselves to delve into the green ways of energizing and de-energizing electrical circuits and equipment.

As per the dictionary definition, a switch is a device for making and breaking the connection in an electric circuit, whereas a switchgear is composed of electrical disconnect switches, fuses or circuit breakers – used to control, protect and isolate electrical equipment.

Thus, a switch needs to be operated manually; it is designed to switch power on and off. But, a switchgear plays a much more comprehensive role. It is used both

to de-energize equipment to allow work to be done and to clear faults downstream. The circuit breaker inside the switchgear breaks the circuit in an overload or faulty condition.

Development of switchgears

The history of switchgears is as old as the beginning of electricity generation. As per Wikipedia, "The first models were very primitive: all components were simply fixed to a wall. Later they were mounted on wooden panels. For reasons of fire protection, the wood was replaced by slate or marble. This led to a further improvement, because the switching and measuring devices could be attached to the front, while the wiring was on the back. The tumbler switch with ordinary fuse is the simplest form of switchgear and was used to control and protect lights and other equipment in homes, offices etc. For circuits of a higher rating, a High-Rupturing Capacity (H.R.C.) fuse in conjunction with a switch might have served the purpose of controlling and protecting the circuit." However, such switchgears could not be used profitably on high voltage systems. Thus, the race of improvement continued.

Outdoor switchgears are generally used for voltages beyond 66 kV. As they are insulated by air, they need a very large space. Thus, the better (less space) option is Gas-Insulated High-Voltage Switchgear (GIS), which is a compact switchgear enclosed in a metal box. So, within limited space, for high voltage power isolation GIS is a better option, and it is now being used in city buildings, on roofs, on offshore platforms, industrial plants, power plants and so on.

We started with reference of Green Power, and as the U.S. voluntary market defines green power as electricity produced from solar, wind, geothermal, biogas, eligible biomass, and low-impact small hydroelectric sources – worldwide people are mostly focused on that, however, 'Green' or environment-friendly & safe practices can be implemented at different pockets of generation, transmission and distribution. So, there lies a huge scope in the area of energising and de-energising of a network or circuit. The components or devices used here are also contributing a lot towards building the Green Power Environment. Let us now see some recent examples.

"At Stedin, we believe that acting sustainably is the most important thing. Where possible, we want to reduce the use of SF_6 gas in our switchgear. However, the alternatives are limited and more expensive to purchase. This creates a difficult situation for network operators who want to invest while keeping costs as low as possible."

- David Peters, Chief Technology Officer at Stedin

"g^3 was a natural choice for Evonik. Not only do the g^3 products offer us the same reliability and ease of handling as our previous SF_6 equipment, they will go a long way in helping us reach our goal of halving our absolute Scope 1 and Scope 2 greenhouse gas emissions by 2025."

- Jürgen Bücker, Head of Regulation Management Energy Networks at Evonik

The status-quo

As per Wikipedia, "The first high-voltage SF_6 circuit breaker with a high short-circuit current capability was produced by Westinghouse in 1959. This circuit breaker in a grounded tank (called a dead tank), could interrupt 41.8 kA under 138 kV (10,000 MV·A) and 37.6 kA under 230 kV (15,000 MV·A)." Then the trend continued.

A recent survey report by Kenneth Research communicates, "The SF_6 Circuit Breaker Market is anticipated to grow with a modest CAGR over the forecast period, i.e., 2020-2025, owing to the growing semiconductor industry, backed by the rising demand for advanced electronic devices."

A recent report from Markets And Markets states that, "Imperfect joints in the manufacturing of SF_6 circuit breakers leads to the leakage of the SF_6 gas, which is a choking gas to some extent. At the time of leakage in the breaker tank, the SF_6 gas settles in the surroundings as it is heavier than air and this gas precipitation may lead to suffocation of the operating personnel. The arced form of the SF_6 gas is poisonous and can be harmful if inhaled. The Environmental Protection Agency (EPA) in the US has taken measures to find a solution to detect the leakage of the SF_6 gas in the breaker tank of SF_6 circuit breakers, as the leakage is destructive when an arc is formed."

The report also indicates, "The internal parts of SF_6 circuit breakers require exhaustive cleaning during periodic maintenance under clean and dry environment. The

Eaton's Xiria E MV Switchgear...

sensitive parts of the device are damaged – if not cleaned at a regular interval. Special amenities are required for the transportation and maintenance of the quality of this gas. Any deterioration in the quality of the gas would affect its performance, which, in turn, would affect the reliability of SF_6 circuit breakers. The innovation of SF_6 proved to be a challenge for the circuit breaker and fuse industry, which needs to be addressed by the industry players and technical experts in the industry." So, obviously, it's the high time when these issues must be addressed...

Towards the green path

Last year, in Hanover fair, ABB exhibited the air-insulated switchgear UniSec as a completely SF_6-free switchgear solution for networks up to 24 kiloVolt (kV). It uses the HySec AirPlus, a multifunction apparatus, combining the functions of circuit breaker, line disconnector and earthing switch all-in-one, which is now available with AirPlus insulation gas.

According to ABB, "AirPlus is a groundbreaking climate-friendly gas mixture with a 99.99 per cent lower Global Warming Potential (GWP) compared to SF_6. AirPlus is the first 'green' alternative gas on the market for medium-voltage switchgear and is part of ABB's ongoing strategy to develop eco-efficient technologies. AirPlus is a gas mixture based on a fluoroketone molecule and more than 80 per cent dry air."

A few months back, a good news has come from Eaton. The company has declared, "In the coming years, Eaton will supply thousands of SF_6-free switchgear systems to network operator Stedin. SF_6 gas is one of the most potent greenhouse gases and is still used extensively by the electrical sector for switchgear systems. Stedin has put together plans to expand its electricity network even further over the next few years. A key part of developing these plans was finding a partner to make the expansion as environmentally friendly as possible. The SF_6-free installations from Eaton will help Stedin reduce their use of SF_6 gas by an average of 1,950 kg of SF_6 per year."

g^3, GE's game-changing alternative to SF_6...

Eaton wants to completely eliminate the use of SF_6 gas and has therefore developed the Xiria switchgear. The Xiria is insulated using dry air instead of SF_6 gas, and switching is carried out using a vacuum interrupter. The Xiria can switch more than 10,000 times, making it particularly suitable for applications where the switch needs to be actuated several times a day, such as wind farms and solar parks generating renewable energy.

Being in the same race, GE Renewable Energy's Grid Solutions business has secured its first 'Green Gas for Grid' - or 'g^3' (pronounced 'g-cubed') – industrial orders. Together, German's specialty chemicals leader Evonik and UK's Omexom, an Engineering Procurement and Construction (EPC) company, recently ordered a total of 18 g^3 Gas Insulated Switchgear (GIS) bays.

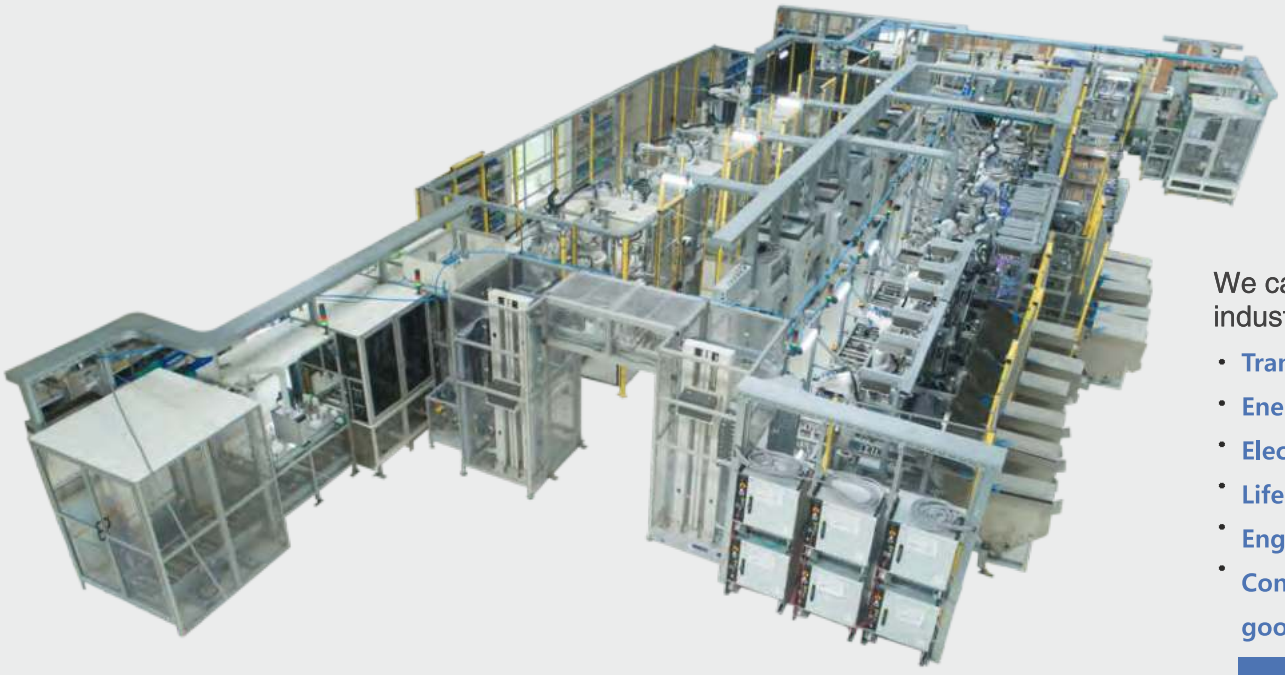
g^3 is GE's game-changing alternative to SF_6. g^3 products feature the same high performance and reliability as SF_6 equipment but have a gas mass with more than a 99% reduced CO_2 equivalent value. More importantly, Life-Cycle Assessments (LCAs) have shown that g^3 products have a greatly reduced CO_2 impact on the environment compared with SF_6 products. Additionally, g^3 products do not cause pollution transfers to other environmental indicators because they have the same compact dimensions as traditional SF_6 products.

There are many other initiatives from the big as well as small players. However, still the demand for SF_6-based switchgears is quite high. The question that arises at this point is: how far in the short-run the users will be ready to spend for SF_6-free technologies in the post-COVID 19 pandemic era, with the dwindled down economic status?

Nurturing Passion for **ENGINEERING & TECHNOLOGY**

TEAL
TITAN ENGINEERING & AUTOMATION LIMITED

TITAN ENGINEERING & AUTOMATION LIMITED (TEAL) - Automation Solutions, is a wholly owned subsidiary of TITAN COMPANY LIMITED. We are in the business of Providing **world class Turnkey assembly and testing solutions**



We cater to various industry segments like:

- Transportation
- Energy
- Electronics
- Life sciences
- Engineering
- Consumer packaged goods (CPG)

WE OFFER

Our Capability

- Assembly Technology
- Testing & Measurement
- controls & Software
- Industry 4.0 Enabled Solutions

Our Solutions

- Fully automatic assembly lines
- Lean Assembly cells
- Test rigs, Robotic Cells, Vision Inspection system
- Industry 4.0 Enabled solutions

For Enquiries Contact

Head Office	Northern Region	Southern Region	Western Region	Global
Mr. Hari.E	Mr. Aditya Shandilya	Mr. Praveen Kumar	Mr. Kiran Naik	Mr. Anto Jauspher
+91 – 94422 67678	+91 – 96500 91004	+91 – 73977 01444	+91 – 94421 65044	+91 – 94425 05271
harie@titan.co.in	aditya@titan.co.in	praveenk1@titan.co.in	kiran@titan.co.in	antoj@titan.co.in

Reach us at:

TITAN ENGINEERING & AUTOMATION LIMITED (TEAL),

UNIT 1 :- Automation Solutions, No. 27 & 28, SIPCOT Industrial Complex, Hosur - 635126, Tamil Nadu, India

Tel :- +91- 4344 664 876 / 891 / 840 Email:- infotas@titan.co.in , Website :- www.titanteal.com

SMART GRID INFRASTRUCTURE

IN INDIA TO WITNESS HIGH GROWTH

Frost & Sullivan estimates that the Indian smart grid products and solutions market is expected to grow three times from $6.5 billion in CY 2019 to $18.5 billion by CY 2030. This will help reduce India's staggering 18.5% (approximately) transmission and distribution loss rate in FY 2019 to 15% in the next two years, according to the Central Electricity Authority of India. India is expected to have a market share of 5% - 6% by 2030 in the global smart grid products and solutions market…

Frost & Sullivan has projected that the majority of the investment will be for transmission enhancement products and solutions like superconductors, Flexible Alternating Current Transmission Systems (FACTS), High- Voltage Direct Current (HVDC), automatic recovery systems etc. This

area is expected to grow at a CAGR of 5%-6% over the next decade. The next largest investment is expected to be in electric charging infrastructure and customer side systems like batteries, inverters, energy billing systems, smart Grid-to-Vehicle charging (G2V) etc. The electric charging and customer side systems products and solutions are expected to grow at a CAGR of 13.6% through CY 2030. Advanced metering infrastructure, which was the key component across pilot smart grid projects, is expected to grow faster, with a CAGR of 34% through 2025 and CAGR of 20% until 2030. India is expected to install more than 250 million smart meters by 2025. Other products and solutions of smart grids like distributed grid management, wide-area monitoring and control, and ICT integration are expected to grow at a CAGR of 16%, 19%, and 23% respectively.

India has unique challenges compared to other countries in implementing smart grid projects. Key challenges identified by Frost & Sullivan include:

- Diverse stakeholder-related challenges: The scope of smart grid projects and associated stakeholders are not uniform, including transmission- and sub-transmission-related smart initiatives driven by PGCIL (Power Grid Corporation of India Limited), smart meter rollouts managed by over 120 distribution companies that are under huge financial stress and other initiatives driven by NSGM (National Smart Grid Mission).
- Technology gaps and project implementation challenges: Smart grid projects have higher capital costs due to lack of experience of the bidders, who end up allocating disproportionately high costs toward contingencies. There is a lack of awareness when it comes to the usage of relevant technology solutions.
- Cost and capital-related issues: Commercial terms for many smart grid bids and qualification requirements are complex and difficult to fulfill, even by reputed power sector players.
- Lack of long-term asset management: Long-term maintenance of smart assets is a challenge.

To address the above-mentioned challenges, companies have to position themselves as an end-to-end solution and service provider for smart grid projects through strategic partnerships – and offer integrated solutions and service offerings, including Operation and Maintenance (O&M) support for smart grids. Addressing challenges of utilities in the process of digitalization and having the long-term vision to integrate the smart grid into the smart ecosystem will be the key for companies operating in this space.

As per Frost & Sullivan's analysis, power utilities will be the single largest target segment for smart grid products/solutions, which require integrated smart grid solutions and service offerings along with O&M support. There is a need for utility 3.0 transformation and platform solutions that cater to specific smart grid needs like energy trading/exchange, smart meter standard interoperability, etc. Another area of focus will

be enabling two-way communication between supply and demand and an IT-based Electric Vehicle (EV) operating interoperability platform for industrial, residential, commercial, EV infrastructure, and prosumers.

Currently, suppliers of products and solutions for the smart grid industry are dominated by platform providers – primarily IT solution providers that form a consortium with communication system integrators and equipment suppliers. Key components required to cater to smart grid projects are device/product manufacturing, system integration, software/platform development, and communication technology providers.

There is abundant scope for leading global players and companies from Asia, Europe, and North America that have participated in pilot smart grid projects and grid upgradation projects. International companies are looking for Joint Ventures (JVs) to participate in large-scale smart grid projects to be rolled out in the coming years. Apart from large meter manufacturing companies like Schneider Electric, L&T, Genus Power, HPL India, Itron India, Secure Meters, Landis + Gyr, Elster, etc., large system integrators that constitute key bidders in almost all smart grid projects, including Hitachi, GE, Siemens, HCL Infosystems, Capgemini, Wipro, Cyan, Accenture, CDAC, Cisco, Enzen, Analogics, Synergy, Chemtrols and Fluentgrid, either have JVs or tie-ups with product/ solutions or software developers to provide complete solutions for smart grid projects. Apart from the private companies, ECIL (Electronics Corporation of India Limited), a government of India enterprise, is also involved in the implementation of smart grid projects.

Companies catering to public and private utility companies need to provide the complete package of smart grid products and solutions, including wide-area monitoring and control, ICT integration, transmission enhancement, distribution grid management, advanced metering infrastructure, electric vehicle charging infrastructure and cyber and network security solutions. Smart grid solutions for industrial customers require distribution grid management, EV charging infrastructure, customer-side systems, and cyber and network security solutions. Residential and commercial building end-users need only EV charging infrastructure and customer side systems and solutions like smart appliances, routers, in-home displays, building automation systems, energy management systems, etc., as part of smart grid projects. Prosumers are the latest emerging customer segment for smart grids in India, creating huge opportunities in the Indian smart grid space over the next decade.

The smart grid products and solutions market is driven by government initiatives like large-scale smart metering roll-out – and implementation of advanced metering infrastructure; a government target of achieving 175 GW of renewable energy capacity by 2022, which is further expected to grow to 500 GW by 2030; 100 smart city projects supporting smart grid initiatives; and the government's intention to replace all conventional electricity meters with prepaid smart meters in the next three years, which is a sub-component of the smart grid project.

As per Frost & Sullivan's analysis, to achieve success in the smart grid industry, companies need to adopt the following strategies:

Identify your target geographies (where to sell) for the near and long terms. In the near term, the focus should be on:

- National grid operator Power Grid Corporation of India Ltd (PGCIL) and National Smart Grid Mission (NSGM)-driven projects.
- Progressive state utilities driving smart grid initiatives (Gujarat, Maharashtra, Telangana, Tamil Nadu, and Karnataka).
- Private distribution utilities like Reliance Infrastructure (Delhi) and Tata Power (Mumbai) and CESC (West Bengal).

In the long term, the focus should be on non-utility business segments like industries, residential and commercial EV charging infrastructure, etc.

- Build strategy towards how to sell by adopting a JV strategy to tap into market opportunities with alliances across communication system integrators, software/ platform developers, equipment manufacturers, etc.
- Look at price and promotion since smart grid projects across utilities are primarily driven by the tendering approach with preference given to L1 bidders. Companies should focus on bidding on public-private partnership projects, undertaking all aspects of build, own, operate, and maintain.

Vinay HP
Senior Consultant
(Industrial Practice) in
Frost & Sullivan

Latest Trends in EV in India

The time is right for electric cars – in fact the time is critical…

"Environmentally friendly cars will soon cease to be an option…they will become a necessity…" Fujio Cho, Ex Honorary Chairman of Toyota Motors.

Going a step further towards the dream of electric mobility, the coming decade is expected to be the decade of electric cars. The rise of electric vehicles is inevitable around the world and India alike. Electric vehicles sales, excluding e-rickshaws, grew by 20 per cent in India in 2019-20. Electric Vehicles promise zero tail pipe emissions and a reduction in air pollution in cities. This article vividly describes the existence and latest trends of electric vehicles in India.

Electric traction is one of the most promising technologies that can lead to significant improvements in vehicle performance, energy utilization efficiency and reducing emission. An Electric Vehicle (EV) is a vehicle that uses one or more electric motors or traction motors for propulsion. It has the advantage of high performance, high fuel efficiency, very low emissions and long operating range. An electric vehicle may be powered through a collector system by electricity from off-vehicle sources, or may be self-contained with a battery, solar panels or an electric generator to convert fuel to electricity. EVs first came into existence in the mid-19th century.

Around the world

Electric car deployment has been growing rapidly over the past ten years, with the global stock of electric passenger cars passing 5 million in 2018, an increase of 63% from the previous year. Around 45% of electric cars on the road in 2018 were in China – a total of 2.3 million – compared to 39% in 2017. In comparison, Europe accounted for 24% of the global fleet, and the United States 22%.

China has the largest number of electric car sales worldwide, followed by Europe and the United States.

Ford Mustang-inspired electric SUV, Mach E can run up to 119 km with 10 minutes charging, reveals the new test data of Ford Motor Company.

Existence in India

Electric vehicles in India have opened ample business opportunities for automobile companies within the country – as well as across the globe. India has great expectations of achieving a high level of penetration in E-mobility by 2030.

The reason is not very surprising; the alarming levels of pollution indices that keep on rising and the colossal dollars, the country must pay for annual crude oil imports. In December 2017, New Delhi was in a state of red alert. If India successfully manages to achieve this target by 2030, it can save about 1 Giga Tonne of emissions.

Start-ups that have been leading the adoption of electric mobility in India are now running out of road due to lack of financial support amidst this long ongoing lockdown.

Challenges to be faced

There are many challenges to be faced while implementing the electric vehicles in India. The main challenges are:

Car Prices: Electric car prices are higher than petrol or diesel-fuelled cars.

- The average cost of electric cars in India is around INR 13 Lakh, much higher than the average INR 5 Lakh for economical cars run on traditional fuel.
- The price of electric scooters and motorcycles in India is between the price range of INR 70K – INR 1.25 Lakh, as compared to INR 30K – INR 40K cost range of Internal Combustion Engine bikes and even lower for scooters.

If there were a greater demand for EVs, battery sales volumes would drive down the price, there is a good chance that technology will allow future batteries to be cheaper, bringing the price of battery-powered vehicles down. Prices are likely to decrease as the production volume increase and battery technology continues to mature.

Charging Infrastructure: India was reported to have 650 charging stations in 2018, whereas China had over 456K charging points in the same year. It was raised to 13,000 in July 2019, the number is constantly growing. However, they are not evenly distributed. The average distance between two electric car charge points is about 3.8 miles and some places have a gap of up to 47 miles.

In addition to charging points, the lack of private parking spaces is also noted. According to auto giant Maruti Suzuki's research, 60% of Indian customers don't have their own parking space. "There is no way they can charge the vehicle, therefore, it's not easy to adopt to EV"

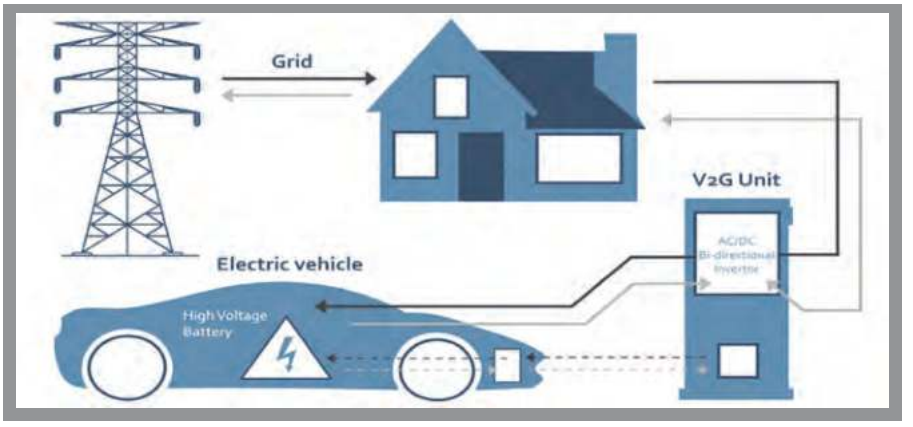
FAME Policy Flip-Flops: While no one doubts that the Indian government is doing all it can to push EVs, the Faster Adoption and Manufacture Of (Hybrid) Electric Vehicles (FAME) policy has been criticised by the industry in the past. The government had initially focused on vehicle standardisation with FAME, which was sidelined for an emphasis on manufacturing. At the moment, the government is busy drafting an EV charging infrastructure framework. The government is also planning to tax non-electric vehicles heavier even if the sales of electric vehicles might not justify such a forced transition. And this has put under pressure on automobile original equipment manufacturers.

Energy from grid

In India electricity is mainly produced by burning coal, which produces a great amount of greenhouse emissions. If smart charging of BEVs occur, it helps in managing the evening ramping requirements, system peak demand and lower the cost of RE grid integration. When electric vehicles are charging from grid then that mode of operation is known as grid to Vehicles (G2V) and vice versa it is known as vehicle to grid (V2G). The survey was done on an Odhpura 132 kV substation located at Hathras district, Uttar Pradesh, India. The variations of demand of a substation during 24 hours are clearly seen. At 5 a.m. the substation has a minimum demand of 18.86 MW, whereas the peak demand of 48.99 MW occurs at 1 PM. There is a great difference in demand between peak team and off-peak time. Therefore, it is proposed that the EVs are fully charged during off-peak time and it supplies back to the grid during peak time.

Top electric vehicles in 2020

Electric cars have been around for a while now. Tata Nexon EV, MG ZS



EV and the Mahindra eVerito were launched within a month. That has expanded the choice for electric car lovers that Indian market has been lacking.

Hero Electric:

Hero Electric, a part of Hero Group, launced electric vehicles in the country. The company has been among the front runners in the

electric vehicle segment. Across its ER series (E2 series and E5 series), Hero electric rolls out a range of Optima, Nyx, Flash and Photon electric scooters.

Tata Motors:

Tata Motors has lately unveiled the **Nexon** in electric version as well it has been introduced with ZIPTRON technology. The

company will launch the Nexon EV in a price of Rs. 15-17 lakhs. It has also supplied Tata Tigor in electric version to Energy Efficiency Services Limited (EESL).

Ather Energy:

Ather Energy launched its Ather 450 & Ather 340 electric scooter models in India last year that have been primarily designed for city

usage. Ather Energy is also offering **Ather One plan** that includes free access to public and home charging, breakdown assistance as well as unlimited data service among others.

Mahindra Electric:

Mahindra spearheaded with its very first and much famous Reva electric car. Over the years the company

offers a range of electric vans, electric autos and e-three wheelers like Mahindra E2o, Mahindra eAlfa Mini, Mahindra eSupro, Mahindra Treo and Mahindra eVerito.

Lohia Auto:

Lohia Auto offers a range of electric scooters, electric three wheelers as well as e-autos in the country.

Comfort E- Auto HS by Lohia Auto was launched at Delhi Auto Expo in 2018 that offers a load capacity of 40 kg and offers a seating for five people including the driver.

TwentyTwo Motors:

Rolling out electric scooters in India, **Twenty Two Motors** tied up with Taiwanese electric two-wheeler manufacturer Kwang Yang Motor

Company (KYMCO) is to expand its horizons in the country. They are developing solutions across fast charging, standard charging to battery swapping.

BYD Olectra:

Among the leaders in electric buses segment, **Olectra BYD** claims to sell over 100 electric vehicles in the country across various state

transport undertakings. Nearly 40 electric buses spanning 12m in length deployed by Telegana State Road Transport Corporation have been supplied by Olectra BYD.

Hyundai Kona Electric:

Versatile and powerful, the **Hyundai KONA Electric** is the All-Electric SUV in India with ARAI certified

range of 452 km. Its power packed performance provides a thrilling driving experience with high acceleration over long distances. The Kona is equipped with lithium-ion polymer battery for excellent charging and discharging efficiency, designed for Indian conditions.

Ashok Leyland:

Ashok Leyland, the fourth largest bus maker in the world, unveiled its first **electric bus** Circuit in 2016. The company has tied up

with sun mobility to enhance its expertise in electric vehicle domain and introduce battery swapping in electric buses.

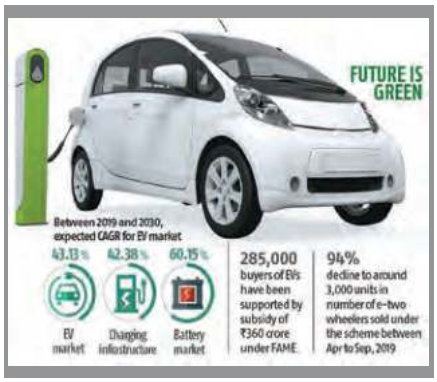
MG Motor:

MG Motor has introduced its **MG ZS electric car**. The MG ZS offers ARAI certified range of 340 kms. It can be charged via two options

– using normal 15 A AC charger in about 6-8 hours and 50 kW DC charger that can charge the vehicle up to 80% in less than an hour.

Greener future

Electric vehicles could be a better alternative to fuel-based automobiles to mitigate air pollution. The government target is to switch to E-vehicles in next 10 years, by Niti Aayog, only electric vehicles after 2030.



- By 2030, the government aims to make India a 100-per cent electric-vehicle nation, it has proposed that two-wheelers below the engine capacity of 150cc sold in the country after March 31, 2025, and three-wheelers sold after March 31, 2023, should be EVs.
- BIS Research says the EV market is anticipated to grow at a compounded annual rate of 43.1%, charging infrastructure at 42.4 % and the battery market at 60.1 % during the period from 2019 to 2030.

Conclusion

The EV segment offers a huge business potential for Indian manufacturers across the value chain, which includes manufacturers, traders as well as service providers. Hybrid and plug-in vehicles can help increase energy security, lower fuel costs and reduce emissions. In the new future, e-mobility in India would not be something of luxury but it would be something necessary for the survival because the pollution level is alarming, and the only solution is the green sources and transmission of energy. Hence, EVs are inevitable, so it is better to plan and organize about how the developments are going to occur rather than dodging the change.

"Small acts, when multiplied by millions of people, can transform the world..."

Images provided by authors.

R. Janani, second year B.E degree in Electronics and Communication Engineering from Kongu Engineering College (Autonomous), Affiliated to Anna University, India.

Dr. N. Kumarappan, Prof. Annamalai University and Chair IEEE Madras section.

Testing Smart Meter

PART - I

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

Smart Meter comprises metrology elements, two-way communication module(s) and controlled load switches [1]. A smart meter has capability for measurement, computation, capturing of tamper events, storing, communication and connect/disconnect control. With the addition of two-way communication between the smart meter and the utility, the consumer will be provided with information about consumption pattern, time based tariff and alert messages. In case of time based tariff,

the consumer will get benefit of smart usage of power with minimum possible tariff. The Smart meters shall be designed to comply with the relevant standards. Bureau of Indian Standards (BIS) is the first organisation to introduce standards for conformity of Smart meters viz., IS 16444 (Part 1) in the year 2015 & 16444 (Part 2) in the year 2017 globally. As per the guidelines of Central Electricity Authority all the utilities are making mandatory for the type testing of smart meters as per the relevant standards to ensure the stability, reliability, interoperability and accurate billing of supply lots. This will also ensure the safety of the personnel and equipment. Therefore, testing is a mandatory requirement by designers, manufacturers and utilities. Testing covers both meteorology testing and DLMS protocol testing.

The rollout of Smart meters in the country by various Utilities are on the fast track as per the guidelines of Ministry of Power, Govt. of India. Many utilities have implemented smart grid pilot projects across the country. In this regard, CPRI has established testing facilities to render testing services to the manufacturers and utilities.

Smart meter is one of the important components in implementation of smart grid. The smart meter shall provide the following minimum functionalities in the smart grid.

- One of the prime requirements for implementation of smart grid is two-way communication between the meter and the control centre.
- Automatic capture of meter readings and provide real time data and information.
- Detect instantaneous tamper events and report to control centre real time and store the data.
- Broadcast of scheduled load shedding to consumers.
- Monitor remotely the load and consumption patterns and allow their consumers to use/schedule their consumption effectively and availability of power supply without interruptions.
- For connect/disconnect of load switches for load management and non-payment of bill etc.

The Smart meter comprises following functional zones:

a. Metering,
b. Load switch,
c. Metering protocol, and
d. Communication modules.

The minimum features of smart meters are:

- Measure and compute electrical parameters.
- Store and communicate requested data as per programmed interval.
- Detect, resolve abnormal & tamper events and store the data.
- Inbuilt memory to store all relevant meter data, events for a required period.
- Communication protocol as per open protocol standard (IEC 62056 DLMS/COSEM).
- Prepaid and post-paid metering options.
- Option for remote configuration.
- Interface to HAN and compatible devices.
- Remote firmware upgrade.
- Support remote load management/load curtailment.
- Load Reconnect / Disconnect switch.
- NAN or WAN module as mandatory communication module for communication to DCU or HES respectively and with IHD optionally.

Communication requirement:

Communication technologies are critical elements for connecting thousands of meters from the field to the utility's Metering Data Management Centre. The communication link is a very vital requirement for the success of the smart grid.

The smart meter requirement is NAN, WAN and IHD communication modules, which are required for establishing connectivity with Smart Meter by the external entities such as DCU and HES respectively – and optionally with IHD. The communication technology chosen by the utility shall be either wired or wireless depending on technical feasibility best suited for a given geographical area. The communication module(s) selected shall be:

- for NAN: PLC or RF and
- for WAN: Cellular technologies or OFC technology.

This article highlights on the details of all tests mentioned in the relevant standards for Smart Meters.

Applicable Indian Standards for Smart Meters

IS 16444 consists of Two parts:

- IS 16444 (Part 1): 2015 was adopted by the BIS in 2015 & subsequently Amendment No. 1, Feb. 2017 & Amendment No. 2, August 2019 were issued by BIS.

The above standard covers the general requirements and tests for a.c. Static Direct connected Watt-hour Smart Meter, Class 1 & 2. It applies to:

- Static Watt-hour direct connected meters consisting of measuring element(s), time of use register (s), display, load switch and built in / plug in type bidirectional communication module all integral with the meter housing.

- Smart meter for indoor use & capable of forward (import) or both forward (import) and reverse (export) energy measurement.

Cross reference Indian Standards for IS 16444 (Part 1): 2015

- IS 13779: 1999 (RA 2014) – a.c. Static watt-hour meters, Class 1 & 2.
- IS 15884: 2010 (RA 2016) – Alternating current direct connected Static Prepayment Meters for Active Energy (Class 1 & 2).
- IS 15959 (Part 1): 2011 (RA 2016) – Data exchange for electricity meter reading, tariff and load control: Companion Specification. Part 1 Static Energy Meter
- IS 15959 (Part 2): 2016 – Data exchange for electricity meter reading, tariff and load control - Companion Specification Part 2 Smart meter.

- IS 16444 (Part 2): 2017 was adopted by the BIS in 2017 & subsequently Amendment No. 1, 2019 was issued by BIS.

The above standard covers the general requirements and tests for a.c. Static Transformer operated Watthour & VAR-Hour Smart Meters, Class 0.2S, 0.5S & 1.0S. It applies to:

- Transformer operated static watt-hour meters & VAR-Hour meters consisting of measuring element(s), time of use register(s), display, load switch and built in / plug in type bidirectional communication module all integral with the meter housing.
- Smart meter for indoor use & capable of forward (import) or import and export energy measurement.

Cross reference Indian Standards for IS 16444 (Part 2): 2017

- IS 14697: 1999 (RA 2019) – a.c. Static Transformer operated Watthour & VAR-Hour meters, Class 0.2S, 0.5S & 1.0S.
- IS 15959 (Part 1): 2011 (RA 2016) – Data exchange for electricity meter reading, tariff and load control: Companion Specification. Part 1 Static Energy Meter.
- IS 15959 (Part 3): 2017 – Data exchange for electricity meter reading, tariff and load control - Companion Specification Part 3 Smart meter (Transformer operated kWh and kVARh, Class 0.2S, 0.5S & 1.0S).

Test Requirements for Smart Meters [1] [2]

Smart meter shall be subject to

- Metrology tests
- Load Switch capability test
- Data Exchange Protocol and
- Smart meter Communicability test (Optional test)

Tests for Metrology include:

- Type tests including Construction requirements, Clearance and Creepage distances, Display of values, Output device and Marking.
- Acceptance tests (Subset of Type test)
- Routine tests (Subset of Acceptance test)

Type Test [3] [4]:

Series of tests carried out on meters of the same type having identical characteristics, selected by manufacturer to prove conformity with all the requirements of standard for the relevant class of meter. These are intended to prove the general qualities & design of a given type of meter.

Acceptance Test [3] [4]:

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

Routine Test [3] [4]:

Tests carried out on each meter to check conformity with the requirements of standard in aspects which are likely to vary during production.

Number of Samples and Criteria for Conformity

- As per IS 16444 (Part 1), Type test shall be made on minimum one or more specimens (1st Set) selected by the manufacturer and test sequence shall be as given in Table 1 [1]. All the specimen shall comply with all the tests given in Table 1 [1]. In case of one test specimen failing to comply in any respect further testing shall be stopped. Further same number(s) of specimen(s) (equivalent to 1st set) shall be taken for testing, all of which shall comply with requirements of standard given in Table 1 [1].

In addition to the above, one additional sample shall comply with load switch requirement of UC1 category and another sample shall comply with data exchange protocol requirement of the standard. For UC2 and UC3 category of meters, the number of samples for load switch requirement shall be as per Annexure G of IS 15884 [5].

Minimum number of Samples required for conformity with the standard are:

For Utilisation Category UC1 type of Smart Meter: 1 Sample for Type test + 1 Sample for Load Switch test + 1 Sample for Test for Data Exchange Protocol and Tests for Smart Meter Communicability.

For Utilisation Category UC2/UC3 type of Smart Meter:

1 Sample for Type test + 4 Samples for Load Switch test + 1 Sample for Test for Data Exchange Protocol and Tests for Smart Meter Communicability.

For acceptance test, recommended sampling plan and the criteria for acceptance of the lot are given in relevant Annex H of IS 13779[3].

- As per IS 16444 (Part 2), Type test shall be made on minimum one or more specimens (1st Set) selected by the manufacturer and test sequence shall be as given in Table 1 [2]. All the specimen shall comply with all the tests given in Table 1[2]. In case of one test specimen failing to comply in any respect further testing shall be stopped. Further same number(s) of specimen(s) (equivalent to 1st set) shall be taken for testing, all of which shall comply with requirements of standard given in Table 1 [2].

In addition to the above, one additional sample shall comply with data exchange protocol requirement of this standard [2].

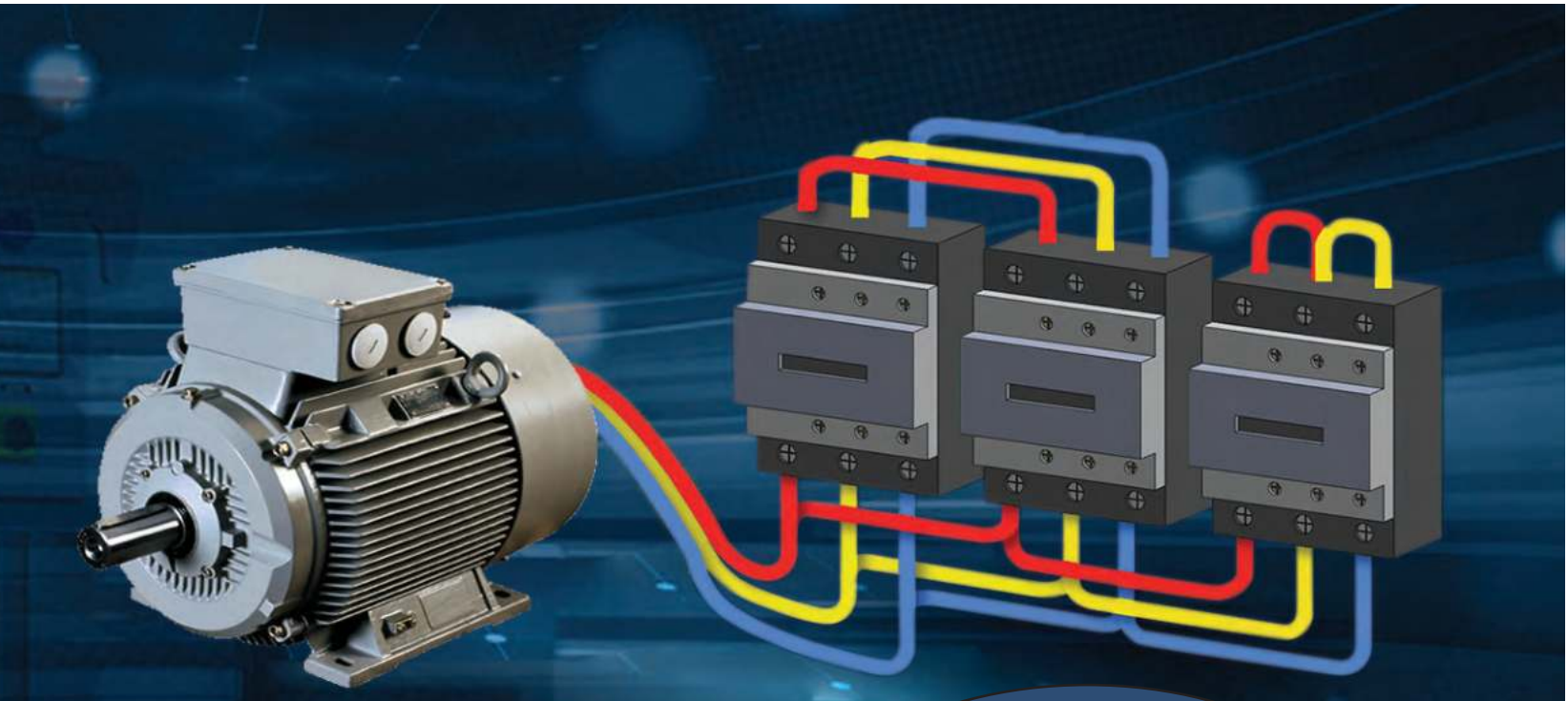
Minimum number of Samples required for conformity with the standard are:

1 Sample for Type test + 1 Sample for Test for Data Exchange Protocol and Tests for Smart Meter Communicability.

For acceptance test, recommended sampling plan and the criteria for acceptance of the lot are given in relevant Annex E of IS 14697[4]....to be continued.

V. Suresh holds Bachelor's degree in Electronics & Communication Engineering and Master of Business Administration in Finance from Bangalore University. He is with Central Power Research Institute for 30.5 years and presently working in Metering & Utility Automation Division.

P. V. Harinath Babu holds Bachelor's degree in Electronics. He is having experience of 35 years in academic and Central Power Research Institute and is heading Metering & Utility Automation Division there.



Using Automatic Star-Delta-Star Starter

An AC induction motor can be single phase, poly-phase, brushed or brushless. Since industries are consuming major part of the power, we have to concentrate on energy saving from this area...

Power is the basic necessity for the economic development of a country. The power should be handled in an efficient manner to meet the power requirement. This article presents the effective usage of star – delta starter in a power saving way in particular applications. Delta star Converter Module is the system to be interfaced with the existing Star Delta starter. When the load on the motor is less than 50% of full load, it switches the motor to operate in star to save energy. When the load increases beyond 50%, it automatically switches the motor to operate in Delta without disturbing the working of motor. This module is recommended for applications where load changes are not too fast. This is suitable for any capacity motor by using appropriate Current sensing IC and calibrating the same.

By implementing this, we can achieve:

- Energy saving.
- Contribute to reduction in maximum demand.
- Improvement in power factor.

Efficient use of energy and its conservation assumes even greater importance in view of the fact that one unit of energy saved at the consumption level reduces the need for fresh capacity creation by 2 times to 2.5 times. Moreover, such saving through proper usage of energy can be achieved by at less than 1/5th the cost of fresh energy.

Therefore, conservation and proper management of energy saving are very important things. In industries, more than 80% of the motors are AC induction motors. An AC induction motor can be of single phase, poly-phase, brushed, or brushless. Since industries are consuming major part of the power, we have to concentrate on energy saving from this area. Here in this article, a proposal for energy saving in induction motors is being introduced apart from reducing fossil fuel consumption.

Literature Review

There are number of articles published on the performance of induction motor under variable non sinusoidal voltages connection with phase controlled converters. The idea of applying variable voltage to optimize the performance under fractional load is also utilized by many authors in energy saving. Currently available products are costly and do not fully provide entire protection.

Low voltage application is provided for starting of induction motor. This is achieved by using star to delta conversion. Star delta is used in attempt to reduce the start current applied to the motor. This article aims to provide low voltage at starting i.e., at starting the motor is switched in star mode. Therefore, in this article, at starting of motor protection is provided by applying reduced voltage. There is no energy saving provision provided in these article.

Cyclic load converter equipment is made to save power on variable load machine, especially for those which are running in no load or partial load for long time. Using delta to star change over during no load or partial load, the power is saved upto 30 to 40% of the no load power. The simulation of proposed system is done in the PLC simulation software. The logic which has been developed in the PLC is somewhat complicated.

Protection at the starting of induction motor by providing low voltage application by using simple conventional star-delta-starter provides provision for energy saving by using PLC simulation software but the logic which is developed is much complicated.

Therefore in comparison with above mentioned articles, we have developed energy saving provision by using conventional star-delta-star starter but in effective manner, by using arduinouno software/hardware device and also we have developed alternative method of energy saving by using PLC simulation software.

Conventional Star -Delta-Star Starter

The star delta starting is a very common type of starter. Star delta starter is used more than any other type of starters. This method uses the reduced supply voltage in starting. This is achieved by low starting current by first connecting the stator winding in star configuration, and then after the motor reaches a certain speed, throw-switch changes the winding arrangements from star to delta configuration. While starting the motor in star, the starting current can be reduced one-third of the current with compared to delta connection. Since

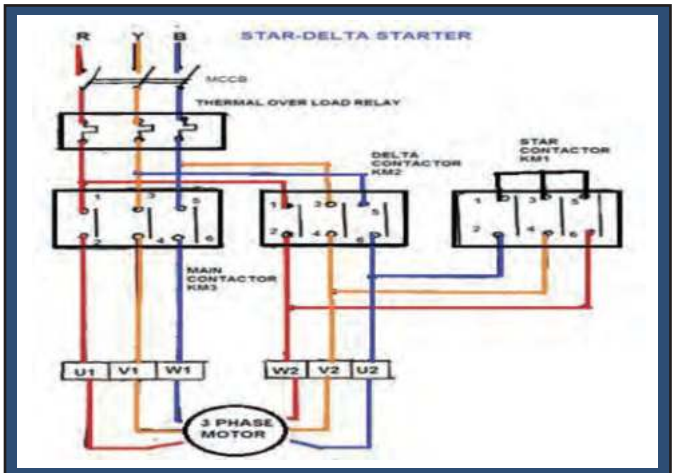


Fig 1.Star Delta Starter

the windings are connected in star in the starting, the windings will get the line voltage across it. Since the torque developed by an induction motor is proportional to the square of the applied voltage, star- delta starting reduces the starting torque by one – third that obtainable by direct delta starting.

Proposed Energy Saving by using Automatic Star -Delta-Star Starter

Now 3 phases supply is given to the induction motor, current sensing element connected in series with any one phase. At start motor will start in star connection, as soon as motor reaches rated speed the stator winding connected in delta. As the load on motor increases current sensing element sense the current flowing through the circuit and the output of this current sensing element (i.e., voltage) fed to the arduinouno device i.e., it is connected to the input pin of arduino. For comparing the output of ACS712 current sensor with a fixed reference current value, we are connecting a resistor pot to one of the input pin of arduino to set a

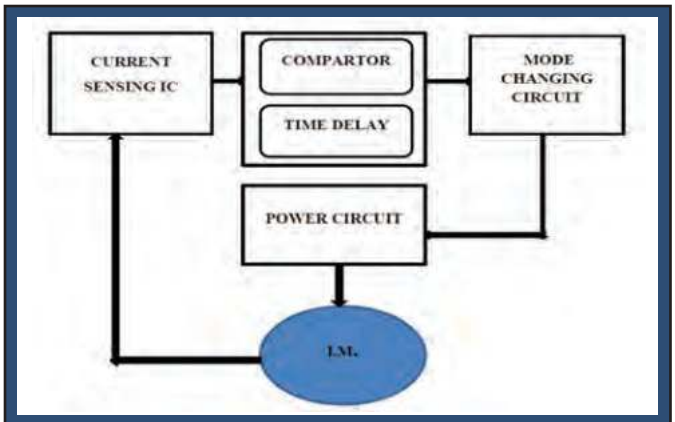


Fig. 2 Block Diagram of Automatic Star-Delta-Star Starter

constant reference current value. Arduino compares the current sensing element output (i.e., voltage) with a set reference current limit. As the Current sensing element input is greater than set limit, it send signal to control circuit to make change of motor connection from star to delta. Similarly, when load on motor decreases then current sensing element output (i.e., voltage) deceases as compared to set limit, so control circuit switches the motor connection from delta to star.

Relationship between P_{Star} and P_{Delta}

V_L is same for Delta & Star load

Z_{ph} is same for Delta & Star load

For Delta connected load:

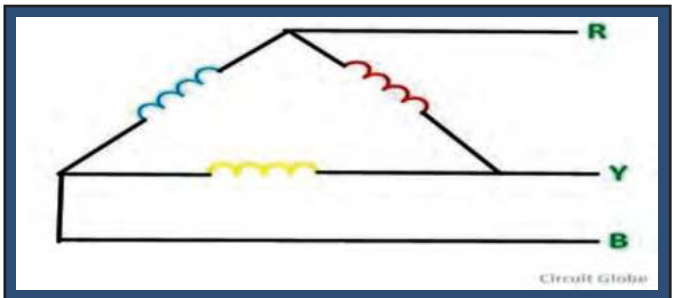


Fig.3 Delta Connection

$P_{Delta} = 3V_{Ph}I_{ph}Cos\theta_{ph}$

As, $I_{ph} = V_{ph} / Z_{ph}$

$P_{Delta} = 3V_{Ph}(V_{ph} / Z_{ph}) Cos\theta_{ph}$

$P_{Delta} = 3 (V_{Ph}) 2Cos\theta_{ph} / Z_{ph}$

As, $V_{ph} = V_L$(For Delta Connection)

$P_{Delta} = 3 (V_L) 2 Cos\theta_{ph} / Z_{ph}$Watts…….. (I)

For Star connected load:

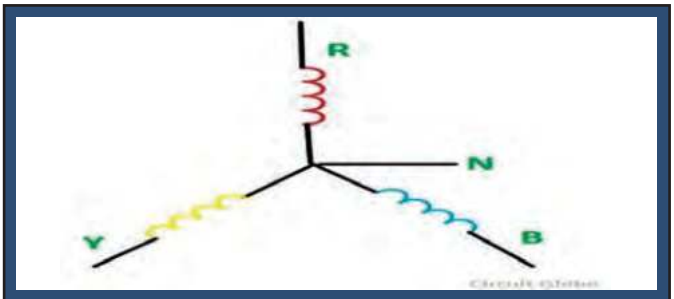


Fig.4. Star Connection

$P_{Star} = 3V_{Ph}I_{ph}Cos\theta_{ph}$

As, $I_{ph} = V_{ph} / Z_{ph}$

$P_{Star} = 3V_{Ph}(V_{ph} / Z_{ph}) Cos\theta_{ph}$

$P_{Star} = 3 (V_{Ph})^2 Cos\theta_{ph} / Z_{ph}$

As, $V_{ph} = V_L / \sqrt{3}$ (For Star Connection)

$P_{Star} = 3 (V_L / \sqrt{3})^2 Cos\theta_{ph} / Z_{ph}$

$P_{Star} = V_L^2 Cos\theta_{ph} / Z_{ph}$Watts…….. (II)

So from (I) & (II) we can see that the power in the Delta connection is 3 times greater than that of the Star connection.

Performance of Energy Saving by using Star Delta Star Starter:

CONTROL CIRCUIT 1:

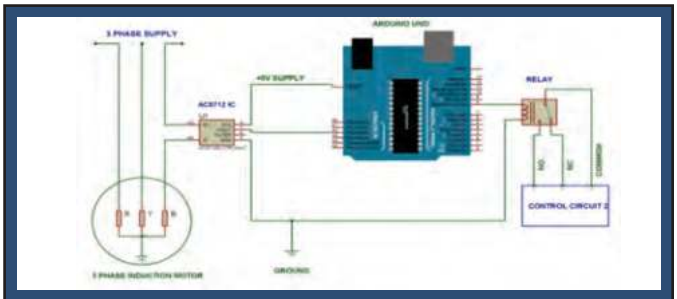


Fig.5. Control Circuit 1

In this article, 5HP DELTA-DELTA connected 3 phase induction motor has been used.ACS712 current sensing IC is connected in series with one of the phase of 3 phase induction motor. However, ACS712 current sensing IC comes in three variants providing current range for ±5A [ACS712-05B], ±20A[ACS712-20B] & ±30A[ACS712-30B].

According to full load current carrying capacity of 3 phase induction motor ACS712 current sensing IC has been selected. Full load current carrying capacity of 5HP 3 phase induction motor is 8.4A, therefore ±20A [ACS712-20B] has been used. Further this ACS712 IC is fed to ARDUINO UNO device (software and hardware) device. As shown in above figure Vcc pin of ACS712 is connected to 5V supply pin of arduino and the Ground(GND) and Vout pin of ACS712 IC is fed to Ground(GND) and analog pin A3 of arduino. Relay is connected to the digital pin D8 and ground pin of arduino device.

The current flowing in the motor is measured through ACS712 IC which is nothing but measuring current value. Arduino programming has been developed for measurement of current and comparison of measured value with reference value for relay operation. A constant value is set as a reference value.

Relay operates in following condition,

Condition 1: If the current flowing during star mode is greater than reference 1, it transforms contactor from star to delta.

Condition 2: If the current flowing during delta mode is less than reference 2, it transforms contactor from delta to star.

Where,

Reference1=set for conversion from star to delta.

Reference2=set for conversion from delta to star.

Therefore, according to relay condition i.e., when the relay is high then the motor get will connect in DELTA mode. Similarly, when relay is low then the motor will get connected in STAR mode. In this way Energy Conservation takes place.

Control Circuit 2:

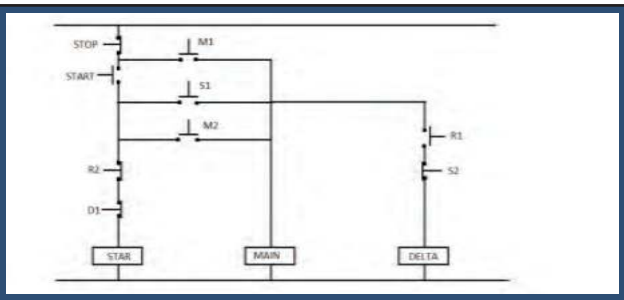


Fig.6. Control Circuit 2

When START push button is pressed STAR contactor get energized through R1 and D1. Due to energization of STAR contactor its auxiliary contacts S1 and S2 becomes NC and NO respectively. Because of S1 MAIN contactor gets energized.

When MAIN gets energized its auxiliary contacts M1 and M2 becomes NC. To keep the MAIN contact energized auxiliary contact M1 is used and M2 to hold the STAR contactor, as START push button is not latch button.

The signal from control circuit 1 actuates the relay contacts in control circuit 2.R1 becomes NC and R2 becomes NO. As a result STAR contactor get de-energized and DELTA get energized. The NC contacts of STAR and DELTA in circuit is used to provide interlocking.

Analytical Results of Energy Saving for 5Hp Motor:

Following are the various results taken on the motor:

Table no.1. Current, Input power & speed at various load conditions.

Sr. No.	Current (Amps)		Power input(Watt)		Force (Kg)		Speed (rpm)	
	ISL	IDL	PS	PD	Star	Delta	Star	Delta
1	0.93	3.8	75	270	0	0	999	1000
2	1.72	4.72	959	1145	9.81	8.98	983	995
3	2.12	4.9	1289	1442	12.78	12.44	977	993
4	2.62	5.5	1469	1679	14.67	15.15	967	991
5	4	5.7	1681	1843	17.11	16.44	952	989
6	4.5	5.93	2026	2082	18.74	19.17	947	983
7	5.2	6.3	2288	2472	22.50	23.35	942	976
8	5.7	6.82	2665	2760	26.42	26.93	918	970
9	6.1	7.83	3054	3243	31.70	32.90	891	964

Table No.2 Torque (N-m),Output Power Losses & Efficiency at different load conditions.

Sr. No.	Torque (N-M)		Power Output(Watt)		Losses (Pin-Pout)(watt)		Efficiency (%)	
	Star	Delta	Star	Delta	Star	Delta	Star	Delta
1	0	0	0	0	75	270	0	0
2	6.76	6.61	696	689	263	456	72	60
3	9.41	9.16	963	953	326	490	74	66
4	10.8	11.15	1094	1158	375	521	74.5	68.9
5	12.59	12.10	1256	1254	425	598	74.7	67
6	13.79	14.11	1368	1453	528	629	67	69.7
7	16.56	17.18	1634	1756	654	716	71	70
8	19.44	19.82	1869	2014	796	746	70	73
9	23.23	24.21	2168	2445	886	798	70	75.4

Graphical Representation of Various Parameters of Induction Motor:

Output Power Vs Current:

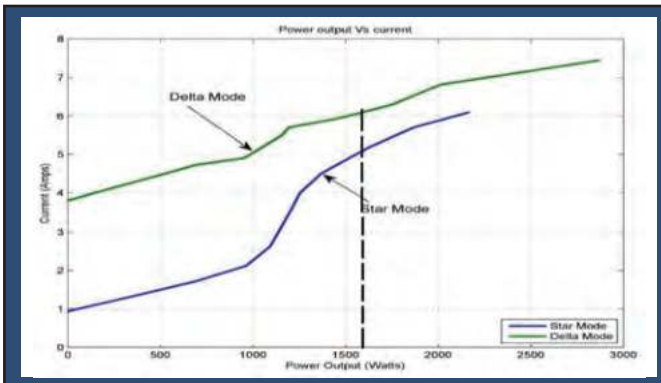


Fig. 7 Graph of Output Power Vs Current

The graph of output power Vs current is plotted by taking power output on x-axis and line current on y-axis. From graph, we see that at no load the current in delta mode is large as compare to current in delta mode.

Output Power Vs Efficiency:

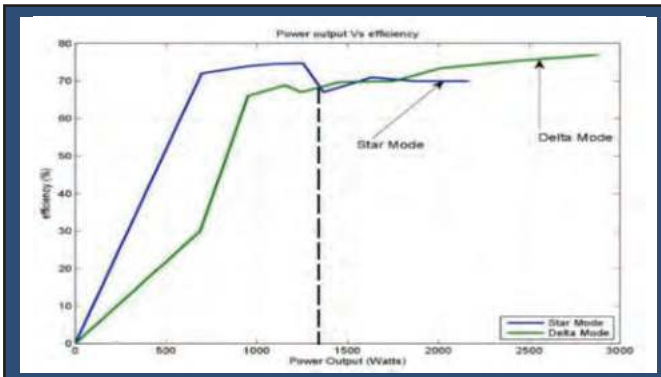


Fig.8 Graph of Output Power Vs Efficiency

The graph of output power Vs efficiency is plotted by taking power output on x-axis and efficiency on y-axis. From the graph, we see that efficiency for star mode

increases in linearly and after 40% of loading it becomes constant. The efficiency for delta gradually get increases and after cross over point it increases. So, we can say that after cross over point delta mode is more efficient than star.

Output Power Vs Losses:

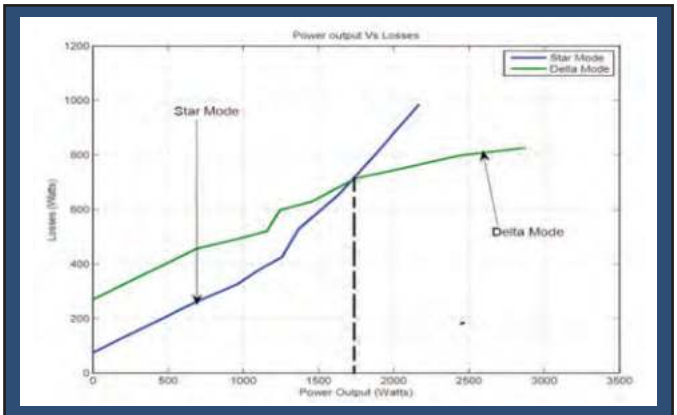


Fig. 9 Graph of Output Power Vs Losses

The graph of output power Vs losses is plotted by taking power output on x-axis and losses on y-axis. At no load losses in star mode are less as compare to losses in delta mode. So, after the cross over point, losses in star mode get increases.

Energy Saving Results:

From above graph of output power Vs losses

Energy saving in star:

At, output power = 1000 watts

Losses in star = 336 watts

Losses in delta = 495 watts

Therefore energy saving in induction motor running in star mode

at output power = 1000 watts is,

Power saving = Losses in delta – Losses in star

= 495 – 336

= 159 watts

For a time period of 1 hour running in star at these load the energy saving will be,

Energy saving = Power saving (watts) × Operating time period (hr) = 159 × 1

= 159 watt-hr.

Energy saving in Delta :

At, output power = 2000 watts

Losses in star = 886 watts

Losses in delta = 746 watts

Therefore, energy saving in induction motor running in Delta mode at output power = 1000 watts is,

Power saving =Losses in Star – Losses in Delta = 886 – 746 = 140 watts.

For a time period of 1 hour running in star at this load the energy saving will be,

Energy saving = Power saving (watts) × Operating time period (hr) = 140 × 1 = 140 watt-hr.

Advantages, Disadvantages & Applications:

Advantages:

- Energy saving is possible.
- Contributing to reduction in maximum demand.
- Improvement in power factor.
- After removing the load motor reconnected to star.
- Economic as compare to auto transformer.
- Energy Saving is more as compare to DOL starter.
- It has better efficiency.

Disadvantages:

- Contactor switching losses take place.
- Six terminals must be required on terminal box.
- At the time of starting motor must be in star mode.

Applications:

- Use for starting large capacity motor.
- Use in lathe machine at mechanical workshops.
- Use in wood processing machine.
- Use in Compressor.
- Use in press machine.

Conclusion

This article intended to meet the requirements of modern age starter of induction motor with additional provision of energy saving in general starting & accelerating period, and discussing a method to improve the total efficiency of the induction motors used in press Machines, Injection Molding Machines, Agitators Conveyors and Textile Mills etc. The life span of the machine is also increased by implementation of this starter.

Acknowledgement

I would like to thank Dr. J. B. Dafedar, Principal, NKOCET, Solapur, Prof. V. S. Shirwal, HOD, Electrical Department, NKOCET, Solapur and my colleagues for their most support and encouragement.

Prof. Adarsh J. Mehta
Assistant Professor, Electrical Engineering Department, DBATU University, N K Orchid College of Engineering & Technology, Solapur

"ABB is a world leader in fast charging solutions..."

***ABB** has installed more than 14,000 **DC fast chargers** in over 80 countries. Also, the company has several pioneering EV fast charging projects to its credit, in India. In an exclusive **e-interview with P. K. Chatterjee, C. P. Vyas, President - Electrification Business, ABB India,** describes his company's contributions to the deployment of Electric Vehicles in India. Excerpts...*

Please tell us about the value add for EV charging with ABB products.

ABB has been in the EV charging business since 2010, right when electric vehicles were accepted commercially. At that time, people couldn't imagine charging a commercial bus in 6 minutes, let alone driving an EV for 200 km without charging. Over the last decade, we have consistently invested in delivering power for the transportation of tomorrow, bringing the digital and physical worlds together. We are now the partner of choice for the world's biggest electric vehicle OEMs and nationwide EV charging network operators. We are committed to pushing the boundaries of technology to achieve a sustainable future and we have made it our mission to deliver value chain solutions from sub-station to EV charging socket.

We are the global market leader in DC charging with 99.6% uptime. Furthermore, in our drive to enhance the EV charging ecosystem, we became the first company to deliver a high-power charging system, the Terra HP, which can deliver up to 200km of range in as little as 8 mins. We launched the Terra HP in India at the MOVE Summit in 2018. ABB has focused on making its EV solutions universally acceptable to keep up with future demand and has also installed new smart charging features like dynamic load management to prevent electric fuse blow off and enable customers to maximise charging power and cost efficiency.

In July, we also installed the first public DC fast charger in Delhi in association with EV Motors India for BYPL. The Terra54 is a cloud-connected charger that is linked through Open Charge Point Protocol (OCPP) 1.6 to EV Motors' backend office and will allow passengers to charge their cars in about 40-50 minutes from 0 to 80%. ABB's fast chargers come with ABB Ability™, a digital web enabled offering that measures 400 parameter and allows network operators to keep a check on charger's performance and fix issues remotely with minimal downtime.

Kindly elaborate on some of ABB's most significant EV Charging projects in India?

We installed our first fast charging solution - ABB Terra 53 fast charging station for electric vehicles - at Niti Ayog's headquarters in the heart of New Delhi in 2018. ABB also supported the Nagpur Municipal Corporation's vision for a green city with clean and affordable energy and installed five EV fast chargers in the city. In July this year, we launched the first public DC fast charger in Delhi in association with EV Motors India for BYPL. On World EV Day, 9th September, which was instituted by ABB in partnership with Green.TV and other partners, we announced charging stations across Ludhiana for the hospitality sector with AAR Power Solutions with their brand AAR GO EV Smart, Chennai for the busy market of T Nagar with Saravanaa Aircon MEP and their brand Simplycharge, and in the textile hub of Tirupur with Zeon International

What is the market response in India towards EV Charging infrastructure? Have you collected any feedback from the users of ABB's EV Chargers?

ABB is a world leader in fast charging solutions with more than 14,000 DC fast chargers sold in over 80 countries and is the title sponsor of the ABB FIA Formula E Championship. We are a global technology leader in charging technology with a firm vision to deliver a reliable and robust infrastructure with a strong and enhanced grid and renewable integration. We are supporting industry needs by creating products that achieve multiple standards in a single solution.

India predominantly has been an ICE vehicle market. Over the last decade, we have seen a rise in EV innovation with the automobile industry slowly shifting towards EVs and manufacturing EVs. To help grow the e-mobility ecosystem in India we also need a well-established EV charging ecosystem. We strongly believe that collaborating with key stakeholders in the industry will help facilitate adoption of fast chargers in India and build an EV charging ecosystem. ABB has tied up with local partners to set up charging stations in hospitality segment, real estate segment and public charging stations across Chennai, Coimbatore, Ludhiana, Delhi, Nagpur with more to come.

ABB India has been collaborating with key industry stakeholders ever since we moved into the space, including government think tanks, innovative start-ups and electric vehicle OEMs to further encourage the adoption of EVs as well as support creativity and entrepreneurship in the space. We have also invested in an EV technology start-up NumoCity which is complementary to ABB's wide portfolio in e-mobility.

Some of the great feedback we have received from our customers includes:

- Hyundai Kona's customer who used the Terra54 50Kw charger in Delhi and had a wonderful and smooth charging experience, specifically pointing out the charger's HMI, which was very informative and that the charging process was quick, especially compared to home charging.
- TATA Nexon's customer used ABB's Terra AC Wallbox charger in Ludhiana, and was able to quickly get accustomed with ABB's Chargesync app, with particular appreciation for the level of information available on the app.

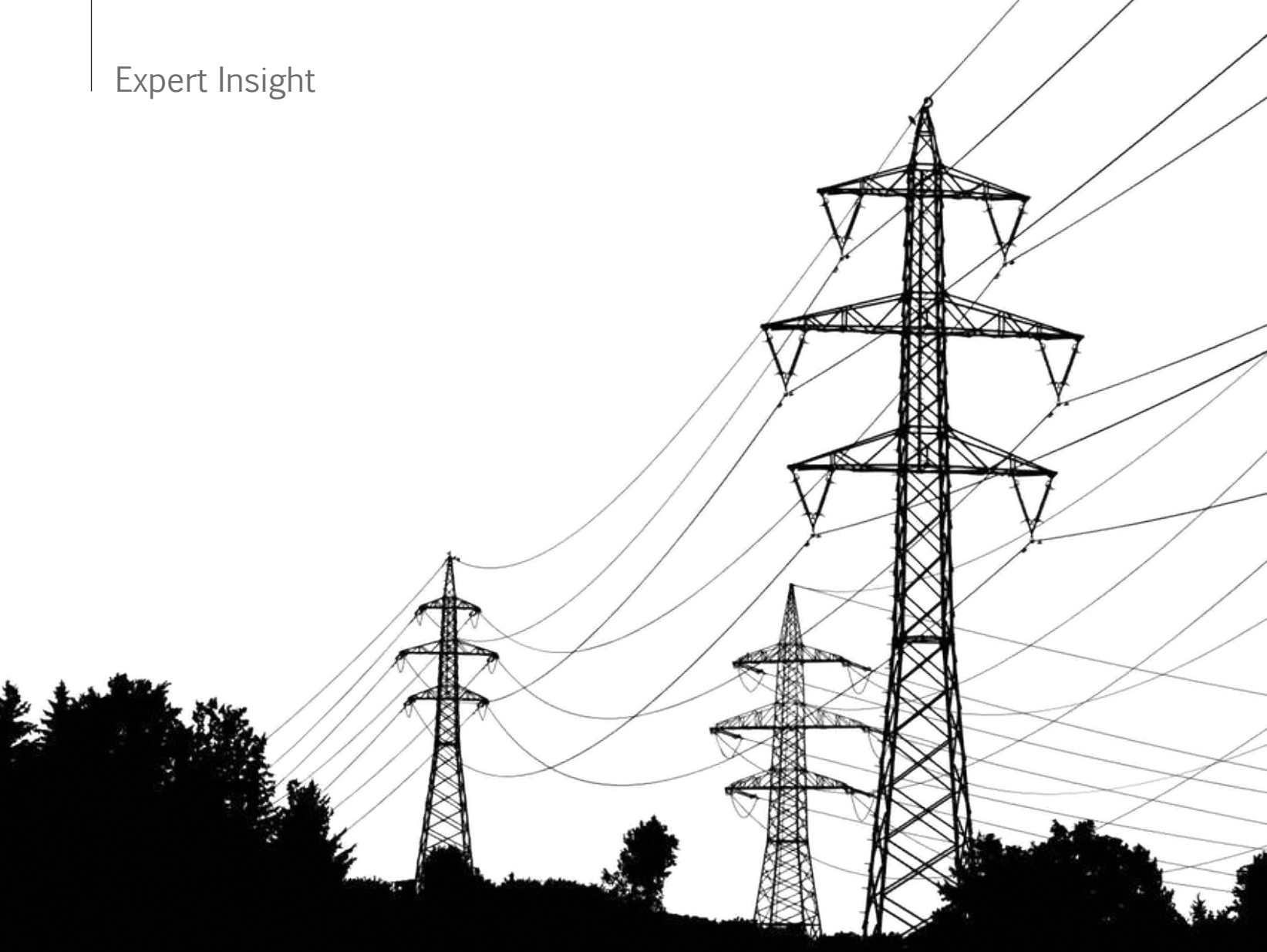
How do you ascertain the safety of using ABB chargers?

ABB provides globally consistent product quality and design, which meet international standards and legislation. The products are CE certified by a third party, making our products universally applicable and safe to use. Another value addition is the EMC Class B certification, which makes our chargers safe to use at residential areas.

Would you like to highlight any other important area?

ABB's partnership with Formula E, which began in January 2018, is an opportunity for technological development and represents ABB and Formula E's shared vision for the future of a cleaner, more sustainable world for all. It brings together the global leader in electric vehicle fast charging with the world's first fully electric international motorsport class, which is also the fastest-growing series in motorsport.

The ABB FIA Formula E Championship is a natural fit for ABB, at the forefront of the latest electrification and digital technologies. It provides ABB with a unique opportunity to engage with customers around the world while bringing more of our technology to this global platform as we seek to push the boundaries to take performance to new levels, drive progress and help build a more sustainable future.



MOVING TOWARDS

BETTER INDIAN ELECTRICITY GRID DISCIPLINE - PART 3

Figure 3 shows the all the year-wise adjustments in the allowable frequency range. It is clearly evident how wisely the commission has continued to adjust the operating range, which has achieved significant milestones in achieving better grid discipline that is discussed in the latter section.

Now, considering the shift in the way of trading power from bilateral trading to the power exchanges like Indian Energy

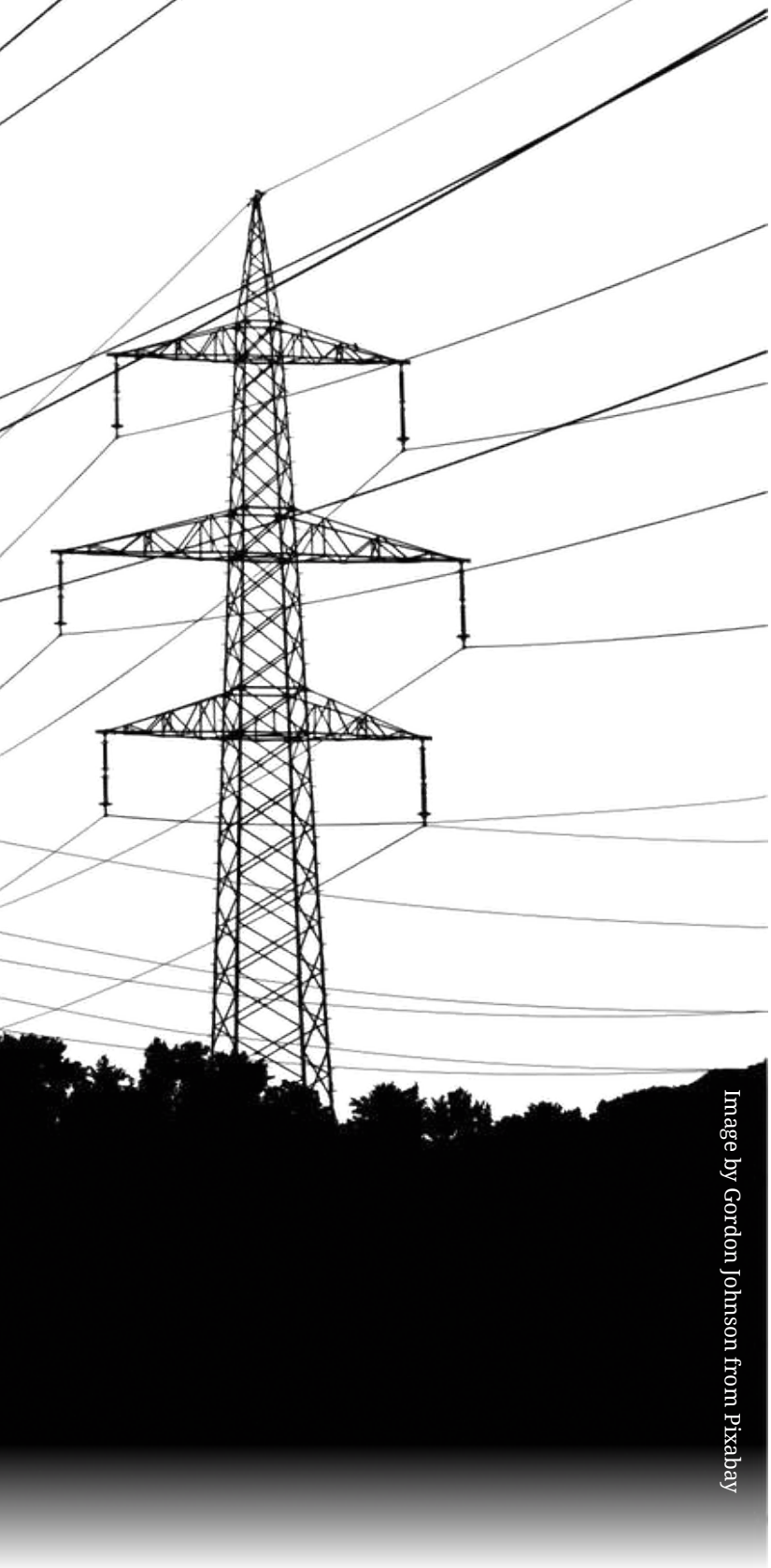


Image by Gordon Johnson from Pixabay

Exchange & Power Exchange of India Limited, Table 8 shows the volume of electricity trading by various methods like UI transaction, power exchange transaction, and total bilateral transactions. Also, Figure 4 shows the UI' s contribution in total short term transaction since after the power exchanges came into the picture.

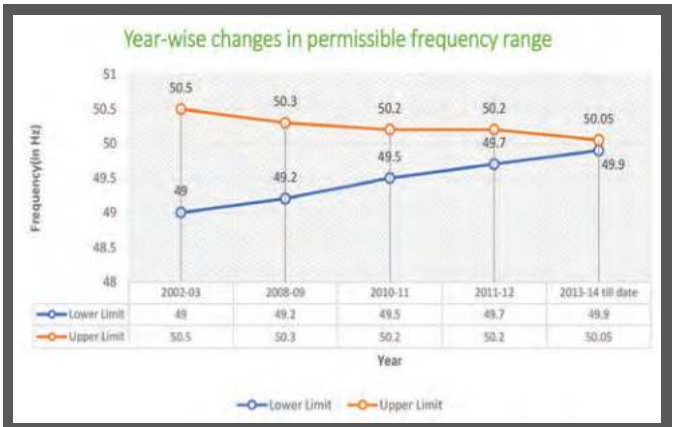


Fig.3. Year-wise changes in permissible frequency spectrum...

Fig.4. Year-wise percentage contribution of UI transaction in total short term transactions...

Following section illustrates some of the benefits through ABT implementation:

- **Remarkable Improvement in the grid frequency**
  The frequency profile of all regions has been greatly improved after ABT has been implemented and Figure 5 shows the frequency comparison of all regions within one year of pre-ABT and post-ABT.

Fig.5. Percentage time frequency between 49 Hz to 50.5 Hz...

Table 8. Volume of short-term transactions of electricity (MUs)[15].					
Year	Total Bilateral Transaction	Total Power Exchange Transaction	Total UI Transaction	Total Short Term Transaction	Percentage of UI transaction
2008-09	25134.08	3974.58	20317.82	49426.48	41.10
2009-10	30426.6	5793.69	24413.06	60633.35	40.26
2010-11	37958.66	15520.40	28078.28	81557.34	34.42
2011-12	51210.84	15543.46	27757.82	94512.12	29.36
2012-13	50639.11	23542.20	24759.13	98940.44	25.02
2013-14	52494	30671	21471	104635	20.51
2014-15	50137.50	29402.11	19447.20	98986.81	19.64
2015-16	59471.20	35005.05	20754.43	115230.68	18.01
2016-17	54889.65	41122.67	23218.03	119230.35	19.47
2017-18	55710	47700	24210	127620	18.97
2018-19	66550	53520	25130	145200	17.30

- **Improved frequency profile on Northern region**
  Figure 6 shows the remarkable change in the frequency profile after ABT has been introduced, and it can be seen how the average grid frequency is approaching the nominal value of grid frequency.

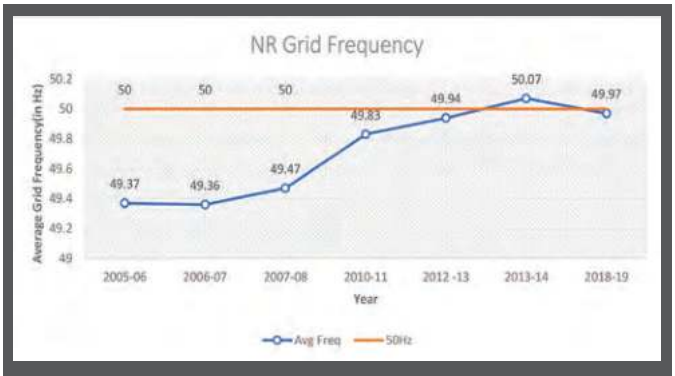


Fig.6. NR Region year-wise frequency vs. nominal grid frequency...

- Before ABT was introduced in the Southern zone, the grid frequency normally waved around 48Hz, but since after its implementation, the southern grid frequency ranged from 49Hz to 50.5Hz for 99% of the time compared to around 80% in November 2002 and 31% in August 2002. This also addressed many stakeholder's concern, as it balanced the varying frequency spectrum of the Southern region, which was low to 47.8 Hz and was high up to 52 Hz in the Eastern region.
- **Lesser mismatch in scheduled and actual drawl**
  Figure 7 illustrates how the gap in scheduled and actual drawl has been reduced, which is good for maintaining discipline in grid.

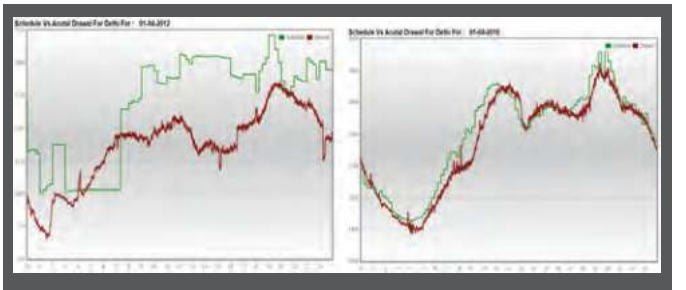


Fig.7. Scheduled and Actual Drawl: 01-04-2012 vs. 01-04-2018 of Delhi region...

- **Better under-drawl/over-drawl strategy & utilization of other resources**
  The ABT mechanism allows strategic over-drawing / under-drawing with the deviations priced at frequency-related levels within the permissible frequency band. Tata Power Company (TPC) had unused capacity of 100-300 MW during off-peak hours, which was utilized by MSEB that otherwise before ABT was may not be exploited by MSEB.

Stability in power system : Example of 31 GW load fall at 21:00 on 5th April, 2020

According to [25], the all India energy consumption on 18.03.2020 (regular day) was 3586 GWh while the all Indian energy consumption on 25.03.2020 (a day in a lockdown) was 2777 GWh so, approximate percentage drop in energy consumption can be calculated as:

Percentage drop=(Erd–Ejcd)/Erd (5)

= (3586 – 2777)/3586 = 22.55 %

Therefore, it is calculated that the energy consumption fell by 22.55 percent in a lockdown day compared to a regular day and this fall is projected to increase day by day till the lockdown removes and everything revives back to normal. Also, in the midst of the darkness spread by the corona pandemic, PM Narendra Modi requested Indians to turn off their lights on April 5, 2020 at 9 p.m. and light a candle or lamp to dispel the darkness spread by coronavirus and exemplify a collective determination to defeat the disease. Unlike normal operation, maintaining a stable grid was not an easy task for grid operators when the load would suddenly fall at 21:00 and eventually rise at 21:09. The expected all India demand fall during this period of 9 minutes was around 12000 - 14000 MW considering that only lights would be switched off but the total reduction in all India demand recorded during the event was 31089 MW. The power demand also dropped from 117 GW to 85.3 GW within a period of 4-5 minutes and engineers at all levels managed this very well. Figure 8 shows how beautifully operators managed to stabilized grid frequency back to 50 Hz at 22:03 pm even after uneven sudden load fall and rise (the data shown is as per the live frequency shown on the SRLDC's website).

Conclusion

By 1st November, 2003 ABT was implemented in all the five respective regions and its adoption has proved to be very effective in maintaining a stable grid frequency to its 50 Hz nominal value. The commission kept on amending IEGC & ABT, bringing new tariff regulations like additional UI charges in the view of improving the grid discipline. After the implementation of ABT, the commission has continuously revised UI price vector, ceiling rates etc. in its annual reports. The article showed the trend of changes in ceiling rate from initial 570 paise per kWh in 2002-03 to 745 paise per kWh in 2006-07 followed by 735 paise per kWh in 2008-09. The permissible frequency range is attenuated from the

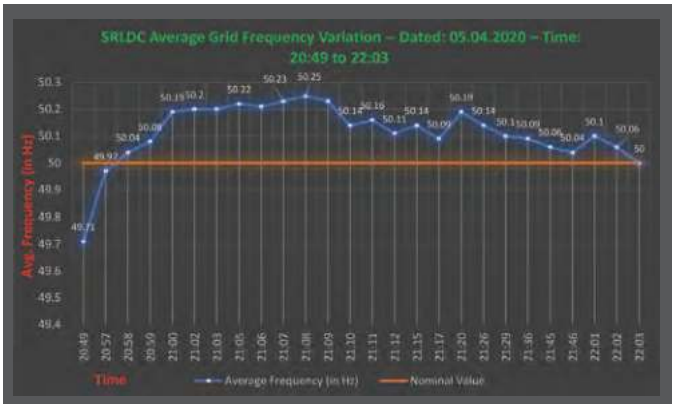
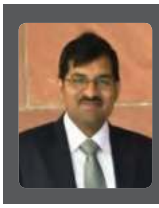


Fig.8. SRLDC's Average Grid Frequency Variation- Dated: 05.04.2020 Time: 20:49 to 22:03...

initial range of 49 – 50.5 Hz in 2002-03 to 49.9 – 50.05 Hz in 2014. All major changes in ABT are addressed and plotted, even a suspected step to weaken the ABT tariff policy was also identified in 2014-15 which fully prohibited the under-drawl / over-drawl of power. This article demonstrated how the northern region has continued to improve the annual average grid frequency from 49.37 Hz in 2005-06 to 50.07 in 2013-14 and 49.97 in 2018-19 since after the successful incorporation of ABT regime. An event was also elaborated in order to exhibit the achieved efficiency regarding stability in operation of the Indian power system. It was also calculated that all India's energy intake fell by 22.55 percent on a lockdown day compared to a normal day and it is comfortably presumed that this significant reduction will increase till the lockdown continues.

Aniket Raj

B-Tech third-year student of Madan Mohan Malaviya University of Technology, Gorakhpur (U.P.) in Electrical Engineering



Dr. Prabhakar Tiwari

Associate Professor, Department of Electrical Engineering, Madan Mohan Malaviya University of Technology

Prof SN Singh

Professor, Department of Electrical Engineering Indian Institute of Technology Kanpur -208016

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

Image by Chris LeBoutillier from Pixabay

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

Do you feel in a vast country like India with widely varied geographic conditions, micro- and mini-grids have a big role to play?

India has wide variety, we appreciate geographical location provide us to use different kinds of energy resources. Simultaneously they also provide the challenges. We have both urban and rural challenges, but Indian power sector's potential exists mostly in rural areas. In this context, Mini Grids can play a key role in rural electrification efforts in areas that are not connected to the grid, and to complement the grid in under electrified areas. With the right policy and investor support, mini-grids can emerge as 'rural utilities' and help provide reliable and improved power supply. Many central sector scheme of the government are supporting efforts to develop a more enabling policy and regulatory environment for

mini-grids, to facilitate mini-grid development and scale up.

In addition to the above, community-owned solar mini-grids are increasingly promoted to provide communities access to reliable electricity, empowering local population or local demand. However, early failures and difficulties in building local capacity based on macro and mini grids have raised questions regarding their long-term sustainability and ability to be replicated to provide socio-economic benefits to the communities. In this regard, effort of the Indian government is appreciable to achieve certain levels of sustainability in India, grids are operating over extensive periods of time using a policy framework to derive its conclusions in the sector.

Can we really call the atomic energy 'a clean energy' just because of having a low carbon footprint?

Clean energy term is very important to understand. Most of the time, we hear this term in energy domain, in the discourse of wastes from energy technologies, sustainability, universal access of energy and sustainable development. It is the fact that most people immediately think of solar panels or wind turbines, but how many of you think of nuclear energy? Let us examine this. Nuclear is often left out of the "clean energy" conversation despite it being the second largest source of low-carbon electricity in the world behind hydropower.

Fundamentally, there are three basic reasons behind it. Firstly, Nuclear energy protects air quality. Nuclear is also a zero-emission clean energy source. It generates power through fission, which is the process of splitting uranium atoms to produce energy. The heat released by fission is used to create steam that spins a turbine to generate electricity without the harmful byproducts emitted by fossil fuels.

We must refer an example, where Nuclear Energy Institute (NEI) quoted that the United States avoided more than 476 million metric tons of carbon dioxide emissions in 2019. That's the equivalent of removing 100 million cars from the road and more than all other clean energy sources combined. There are other reasons on environmental protection term, as nuclear energy also keeps the air clean by removing thousands of tons of harmful air pollutants each year that contribute to acid rain, smog, lung cancer and cardiovascular disease.

Secondly, Nuclear energy's land footprint is small. Despite producing massive amounts of carbon-free power, nuclear energy produces more electricity on less land than any other clean-air source. To give an interesting example, in terms of capacity addition, one would need more than 3 million solar panels to produce the same amount of power as a typical commercial reactor or more than 430 wind turbines if we don't consider the capacity factor.

Lastly, the third reason is that Nuclear energy produces minimal waste as compared to other energy source generators. However, in terms of density, fuel is extremely dense.

It's about 1 million times greater than that of other traditional energy sources and because of this, the amount of used nuclear fuel is not as big as you might think. However, some advanced reactor designs are being developed that could operate on used fuel.

Next part of the interaction will appear in the next issue of EI...

ALL INDIA INSTALLED CAPACITY (IN MW) OF POWER STATIONS
(As on 31.08.2020)

Region	Ownership/ Sector	Mode wise breakup								Grand Total
		Thermal					Nuclear	Hydro	RES * NRE)	
		Coal	Lignite	Gas	Diesel	Total				
Northern Region	State	16659.00	250.00	2879.20	0.00	19788.20	0.00	5777.25	725.01	26290.46
	Private	22425.83	1080.00	558.00	0.00	24063.83	0.00	2817.00	16242.89	43123.72
	Central	14354.96	250.00	2344.06	0.00	16949.02	1620.00	11450.52	379.00	30398.54
	Sub Total	53439.79	1580.00	5781.26	0.00	60801.05	1620.00	20044.77	17346.90	99812.72
Western Region	State	21740.00	1040.00	2849.82	0.00	25629.82	0.00	5446.50	555.54	31631.86
	Private	32847.17	500.00	4676.00	0.00	38023.17	0.00	481.00	25397.44	63901.61
	Central	19147.95	0.00	3280.67	0.00	22428.62	1840.00	1627.50	666.30	26562.42
	Sub Total	73735.12	1540.00	10806.49	0.00	86081.61	1840.00	7555.00	26619.28	122095.89
Southern Region	State	19782.50	0.00	791.98	159.96	20734.44	0.00	11774.83	586.88	33096.15
	Private	12747.00	250.00	5340.24	273.70	18610.95	0.00	0.00	41755.25	60366.20
	Central	11835.02	2990.00	359.58	0.00	15184.60	3320.00	0.00	541.90	19046.50
	Sub Total	44364.52	3240.00	6491.80	433.66	54529.99	3320.00	11774.83	42884.03	112508.85
Eastern Region	State	7450.00	0.00	100.00	0.00	7550.00	0.00	3537.92	275.11	11363.03
	Private	6153.00	0.00	0.00	0.00	6153.00	0.00	96.00	1255.50	7504.50
	Central	13682.05	0.00	0.00	0.00	13682.05	0.00	1005.20	10.00	14697.25
	Sub Total	27285.05	0.00	100.00	0.00	27385.05	0.00	4639.12	1540.61	33564.78
North Eastern Region	State	0.00	0.00	498.86	36.00	534.86	0.00	422.00	233.25	1190.10
	Private	0.00	0.00	24.50	0.00	24.50	0.00	0.00	104.14	128.64
	Central	770.02	0.00	1253.60	0.00	2023.62	0.00	1263.50	30.00	3317.12
	Sub Total	770.02	0.00	1776.96	36.00	2582.98	0.00	1685.50	367.39	4635.86
Islands	State	0.00	0.00	0.00	40.05	40.05	0.00	0.00	5.25	45.30
	Private	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.87	24.87
	Central	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.10	5.10
	Sub Total	0.00	0.00	0.00	40.05	40.05	0.00	0.00	35.22	75.27
ALL INDIA	State	65631.50	1290.00	7119.86	236.01	74277.36	0.00	26958.50	2381.03	103616.90
	Private	74173.00	1830.00	10598.74	273.70	86875.45	0.00	3394.00	84780.09	175049.54
	Central	59790.00	3240.00	7237.91	0.00	70267.91	6780.00	15346.72	1632.30	94026.93
	Total	199594.50	6360.00	24956.51	509.71	231420.72	6780.00	45699.22	88793.43	372693.36

Figures at decimal may not tally due to rounding off

Source: CEA

Energy Power Supply Position (Revised)

Figures in MU net

States	July, 2020				April, 2020 to July, 2020			
	Energy Requirement	Energy Supplied	Energy not Supplied		Energy Requirement	Energy Supplied	Energy not Supplied	
	(MU)	(MU)	(MU)	%	(MU)	(MU)	(MU)	%
Chandigarh	186	186	0	0.0	723	723	0	0.0
Delhi	3,166	3,166	1	0.0	13,784	13,781	2	0.0
Haryana	5,765	5,745	20	0.3	23,234	23,214	20	0.1
Himachal Pradesh	863	860	3	0.3	3,649	3,640	9	0.3
UT of J&K and Ladakh	1,366	1,366	0	0.0	7,537	6,628	908	12.1
Punjab	7,558	7,558	0	0.0	27,943	27,943	0	0.0
Rajasthan	6,841	6,837	4	0.1	33,386	33,356	29	0.1
Uttar Pradesh	12,724	12,616	108	0.8	56,250	55,746	505	0.9
Uttarakhand	1,204	1,204	**0**	0.0	5,455	5,455	0	0.0
Northern Region	**39,674**	39,539	134	**0.3**	**171,960**	**170,486**	**1,474**	0.9
Chhattisgarh	2,678	2,678	0	0.0	12,270	12,270	0	0.0
Gujarat	8,156	8,156	0	0.0	42,176	42,176	0	0.0
Madhya Pradesh	5,844	5,844	0	0.0	29,224	29,224	0	0.0
Maharashtra	11,117	11,117	0	0.0	57,512	57,512	0	0.0
Daman & Diu	175	175	0	0	691	691	0	0.0
DNH	462	462	0	0.0	1,570	1,570	0	0.0
Goa	260	260	0	0.0	1,542	1,542	0	0.0
Western Region	**28,692**	**28,692**	**0**	**0.0**	**144,985**	**144,985**	**0**	**0.0**
Andhra Pradesh	5,052	5,051	1	0.0	1	0.0	1	0.0
Telangana	5,711	5,709	1	0.0	1	0.0	1	0.0
Karnataka	4,884	4,883	1	0.0	1	0.0	1	0.0
Kerala	1,933	1,932	1	0.0	1	0.0	1	0.0
Tamil Nadu	8,530	8,528	2	0.0	2	0.0	2	0.0
Puducherry	235	235	0	0.0	0	0.0	0	0.0
Lakshadweep #	4	4	0	0	0	0	0	0
Southern Region	**26,345**	**26,339**	**6**	**0.0**	**6**	**0.0**	**6**	**0.0**
Bihar	3,372	3,372	0	0.0	14,736	14,701	35	0.3
DVC	1,908	1,908	0	0.0	7,834	7,834	0	0.0
Jharkhand	818	818	0	0.0	3,875	3,822	53	1.7
Odisha	2,627	2,627	0	0.0	12,280	12,280	0	0.2
West Bengal	4,676	4,676	0	0.0	21,730	21,651	79	0.4
Sikkim	42	42	0	0.0	206	206	0	0.0
Andaman-Nicobar #	29	27	2	7	144	135	10	6.7
Eastern Region	**13,443**	**13,443**	**0**	**0.0**	**60,661**	**60,494**	**167**	**0.3**
Arunachal Pradesh	59	59	0	0.4	247	245	2	0.9
Assam	1,095	1,060	35	3.2	4,360	4,149	211	4.8
Manipur	83	83	0	0.4	369	366	3	0.7
Meghalaya	163	163	0	0.0	745	738	7	1.0
Mizoram	58	58	0	0.5	274	272	2	0.8
Nagaland	71	71	0	0.3	339	337	2	0.6
Tripura*	150	150	0	0.1	654	651	2	0.4
North-Eastern	1,680	1,644	36	2.2	6,988	6,759	229	3.3
All India	**109,833**	**109,657**	**177**	**0.2**	**515,412**	**513,528**	**1,883**	**0.4**

Lakshadweep and Andaman & Nicobar Islands are stand- alone systems, power supply position of these,does not form part of regional requirement and energy supplied. * Excludes energy exported to Bangladesh.
Note: Power Supply Position Report has been compiled based on the data furnished by StateUtilities/ Electricity Departments.

Source: CEA

SUBSCRIPTION RATES

PERIOD	No. of Issues	Print			Digital	Print+Digital	
		By Normal Post	By Registered Parcel	By Courier	By E-mail	By Registered Parcel	By Courier
ELECTRICAL INDIA							
1 YEAR	12	1000.00	1600.00	1800.00	1000.00	2100.00	2300.00
2 YEARS	24	1750.00	2950.00	3350.00	1750.00	3825.00	4225.00
3 YEARS	36	2500.00	4300.00	4900.00	2500.00	5550.00	6150.00
5 YEARS	60	4000.00	7000.00	8000.00	4000.00	9000.00	10000.00
COOLING INDIA							
1 YEAR	12	1000.00	1600.00	1800.00	1000.00	2100.00	2300.00
2 YEARS	24	1750.00	2950.00	3350.00	1750.00	3825.00	4225.00
3 YEARS	36	2500.00	4300.00	4900.00	2500.00	5550.00	6150.00
5 YEARS	60	4000.00	7000.00	8000.00	4000.00	9000.00	10000.00
LIGHTING INDIA							
1 YEAR	6	750.00	1050.00	1250.00	750.00	1425.00	1625.00
2 YEARS	12	1350.00	1950.00	2350.00	1350.00	2625.00	3025.00
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
MEDICAL EQUIPMENT & AUTOMATION							
1 YEAR	6	750.00	1050.00	1250.00	750.00	1425.00	1625.00
2 YEARS	12	1350.00	1950.00	2350.00	1350.00	2625.00	3025.00
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							
1 YEAR	6	1200.00	1500.00	1700.00	1200.00	1875.00	2075.00
2 YEARS	12	2160.00	2760.00	3160.00	2160.00	3435.00	3835.00
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

Chary Publications Pvt. Ltd. To Subscribe, visit: www.charypublications.in

Subscription Form

Yes, I would like to subscribe **ELECTRICAL INDIA / COOLING INDIA / LIGHTING INDIA / MEDICAL EQUIPMENT & AUTOMATION / AUTOMATION & ROBOTICS WORLD** for _____ years at Rs. _____. Payment needs to be in favour of "**CHARY PUBLICATIONS PVT LTD**"

Cheque/DD.No	Dated	Drawn On

Preferred mode will be NEFT/RTGS for which the details are as under :-

Account Name: Chary Publications Pvt.Ltd	Account Type : Cash Credit
Account Number : 000930110000085	IFSC Code: BKID0000009
Bank : Bank of India	Branch: Chembur, Mumbai-400071

Name:_____ Designation : _____

Company : _____

Address : _____

City : _____ Pin Code : _____

Email : _____Tel.No._____ Mob.No. _____

Signature : Stamp :

Chary Publications Pvt. Ltd.
905-906, The Corporate Park, Plot No. 14 & 15, Sector 18, Opp. Sanpada Railway Station, Vashi, Navi Mumbai - 400 703
Email: sub@charypublications.in • Contact : 022 27777170 / 171 • Website: www.charypublications.in

A transition to clean energy is about investing in the future

Renewable Energy India virtual expo (REI E-Expo) was held on 2nd and 3rd September 2020, organised by Informa Markets. The expo's agenda was 'Powering Enterprises with Renewable Energy Solutions'. The REI E-Expo web-based platform ensured connecting and collaborating with the target audience besides providing knowledge-based conference session.

Yogesh Mudras, Managing Director, Informa Markets in India said: "Despite the global slowdown caused by COVID-19 the renewable energy sector is expected to bounce back quickly as the long-term drivers for investment remain strong, according to the 55th EY Renewable Energy Country Attractiveness Index (RECAI). Stakeholders are looking to collaborate and invest in companies where climate change and sustainable progress is rooted in their strategy. This edition will bring together energy leaders across the globe and focus on powering initiatives in the sector with RE solutions. The two-day conference will discuss market trends, impacts and ways forward in restructuring the RE Sector in the disruptive times like these."

He added: " REI-Expo also inaugurates the Informa Markets in India's Super September - Virtual B2B Celebrations. The digital celebration will cater to 6 key markets, 6 communities and 6 brands that comprise green energy, pharma, travel and tourism, packaging, occupational health, safety and security and, surveillance along with a host of conferences. This year with our strategy to implement a hybrid version of shows, the digital offerings in September will complement the physical shows."

Speaking on how ESMC promotes solar manufacturing in Europe, creating a political environment to support industrial manufacturing and researchers Andre Langwost, Secretary-General, European Solar Manufacturing Council (ESMC) said: "EU and India will enhance their partnership in support of sustainable modernisation. They will boost cooperation to support the clean energy transition, resource efficiency and circular economy and the necessary technological leaps while opening new business opportunities. EU and India will further develop cooperation on smart and sustainable urbanisation, information and communication technology, transport, space and health security."

Discussing the emergency occurred globally due to COVID - 19 Ursula Borak, Deputy Director-General, Ministry for Economic Affairs & Energy, Government of Germany stated: "For Germany, the energy transition is a key instrument to revive our economy. We are convinced that the energy transition is not only essential for climate change but, also sustainable economic growth."

Explaining the challenges faced by the market due to the ongoing pandemic, Tomasz Slusarz, Vision Streamliner, CleanTech Business Club said that their visionary adviser Tony Seba says: "The changes that will happen in the next decade will be a dynamic change like all the previous changes that happened during our last 4 centuries. For instance, the Tesla stock is now valued at more than $US380 billion by market cap and is worth more than ExxonMobil, BP and Shell combined, being the most valuable carmaker in the world."

Ajay Mishra, IAS, Former Special Chief Secretary, Energy Department, Government of Telangana said: "Solar energy has gained importance and significance during COVID-19. The Government of India has set a particular target of 175 Gigavolt of renewable energy by 2022 out of which approximately 86 Gigavolts has already been installed, out of these 86 Gigavolts 36 of them comprises of solar energy."

The live conference agenda further deliberated on global issues related to the RE sector and were focused on topics such as Guiding the Way with Social Distancing & Economic Distancing - Global CEOs' Vision; PV rooftop and storage; BloombergNEF Talk that concentrate on the most important issues and opportunities in the sustainability sector.

Think Quality, Reliability, Performance: Decoding CXO Vision bought in together visionaries and pioneers from the RE space that discussed what each stakeholder can contribute ensuring the convergence of Renewable energy with the upcoming opportunities in this rapidly emerging domain. Linking Technology towards building a sustainable world - RE Hybrid and Financing 450 GW of Renewables: Vision 2030 aimed at deliberate the topical financing challenges with leading policy and sector experts globally and additionally reflected on scaling existing solutions, chalking out new ones.

Company Name	Page No.
Dynamic Cables Ltd	29
DEIF India Pvt. Ltd.	IBC
ESYLUX Asia Ltd	7
H.D Wires Pvt Ltd	21
Hammond Power Solutions	49
Hindustan Platinum Pvt Ltd	BC
igus India Pvt Ltd	35
ISA Advance Instruments (I) Pvt Ltd	9
Jindal Electric & Machinery Corporation	49
Larsen & Toubro Ltd	IFC
MGM Varvel Power Transmission Pvt Ltd	5
Titan Engineering & Automation Ltd	17

THE DIARY

ELECTRICX

Date: 02 - 04 Nov 2020
Location: Egypt
Email: info-mea@informa.com

ELECTRICITY TRANSFORMATION CANADA

Date: 11 - 12 Nov 2020
Location: Canada
Email: info@renewablesassociation.ca

RENEWABLE ENERGY INDIA EXPO

Date: 10 - 12 December 2020
Location: India
Email: amitava.sarkar@informa.com
Contact: +91 93792 29397

POWERGEN INTERNATIONAL

Date: 08 - 10 December 2020
Location: USA
Email: info@clarionevents.com

INTERSOLAR INDIA

Date: 15 - 17 Dec 2020
Location: India
Email: info@solarpromotion.com

WEBINAR

Webinar Name: FERC Order 841 and Energy Storage 101
Date: 8th October 2020
Time: 11:00AM EDT
Organizer: IEEE Smart Grid

Webinar Name: Challenges of Electric Vehicles for Power Systems
Date: 22nd October'2020
Time: 11:00AM EDT
Organizer: IEEE Smart Grid

IN THE NOVEMBER 2020 ISSUE

ELECTRICAL EQUIPMENT | Transformers & Allied Industries, Transmission Lines | T&M, Power Cables

AGC 150

Cost-effective & scalable controller

NEW

- EasyConnect
- User-friendly interface
- Guided experience
- New slim design - Easy to mount
- Built-in analogue AVR and GOV control

DEIF Advanced Genset Controller, AGC 150, meets and surpasses OEM needs for synchronisation. A cost-effective, compact, scalable and all-in-one product.

AGC 150 will be available in three variants: **Core**, **Extended** and **Premium** to meet the diverse user requirements.

Read more about DEIF AGC 150

www.deif.com/products/agc-150

DEIF India Pvt. Ltd.
602, 6th Floor Town Center – II, Andheri Kurla Road, Andheri (East), Mumbai – 400 059
www.deif.com - india@deif.in - Ph.: +91 22 42452000

RNI No.: 6226/1961 • Published and Posted on 5th of every month at Patrika Channel STG. office, Mumbai 400 001.
Postal Registration No. NMB/183/2018-2020 • Licence to post without prepayment WPP Licence No. NMR/TECH/WPP-15/NM/2020