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Hello and welcome once again to *Electrical India*.

India tops the list of the fastest growing economies in the world. To sustain this high growth rate India has achieved, the country needs a healthy power sector. With the slew of reforms, the country's power sector has witnessed remarkable growth in the past decade. Once a notoriously power-deficit nation, India became a net exporter of power in 2017, selling 5,798 million units to Nepal, Bangladesh and Myanmar. Buoyed by positive policy reforms, the private firms added 54,279 MW of capacity of the total 99,209 MW capacity added during the

12th Five-Year Plan. Electricity shortage went from 4.2% of demand in 2014 to 0.7% in 2017.

The country also claims to have achieved '100% Village Electrification' this year. April 28th, when Leisang, a tiny hamlet in the remote north-eastern state of Manipur, was connected to the grid, Prime Minister Narendra Modi tweeted that it would be "remembered as a historic day in the development journey of India."

However, all is not so well with the India's power sector. The sector continues to be plagued on account of financial health of state electricity boards, underutilised assets and looming coal crash. Of late, it is reported that 34 stressed thermal power projects, with a capacity of 40 GW and a combined debt of Rs 1.7 lakh crore, are on the verge of bankruptcy thanks to India's muddled coal policy. Some of those stressed projects include Adani Power's Korba (Chhattisgarh) plant, Adhunik's Jharkhand plant and GMR's Kamalanga (Odisha) plant.

Further, drastic fall in solar and wind tariff is pushing some electricity buyers to those new sources, adding to the woes of coal producers and their lenders. Earlier, the Coal Ministry announced of achieving the target of coal production of 1.5 billion tonne by 2020 out of which 1 billion tonne was expected to be contributed by Coal India alone. However, lately, Coal India announced a revised plan to undertake "challenge" of 700 million tonne output aim for FY'20 and pushed back the target to produce 1 billion tonnes annually by six years to 2026.

We are sure that the current distress will not last longer as the country is committed to bringing reliable power to all.

Hope you will enjoy reading the issue as always. Do send me your comments at miyer@charypublications.in

Mahadevan

Publisher & Editor-In-Chief

Directors

Pravita Iyer
Mahadevan Iyer

Publisher & Editor-In-Chief

Mahadevan Iyer
miyer@charypublications.in

Group Editor

Subhajit Roy
subhajit@charypublications.in

Editorial Department

Associate Editor
Supriya Oundhakar
editorial@charypublications.in

Editorial Co-ordinator

Nafisa Kaisar
nafisa@charypublications.in

Advertising Department

Director Advertisement

Pravita Iyer
pravita@charypublications.in

Advertising Manager

Yasmeen Kazi
yasmeen@electricalindia.in

Advertising Executive

Nafisa Khan
advnt@electricalindia.in

Design

Nilesh Nimkar
charydesign@charypublications.in

Subscription Department

Priyanka Alugade
sub@charypublications.in

Accounts Department

Dattakumar Barge
Bhakti Thakkar
accounts@charypublications.in

Digital Department

Ronak Parekh
dgmarketing@charypublications.in

Chary Publications Pvt. Ltd.

906, The Corporate Park, Plot 14 & 15,
Sector 18, Vashi, Navi Mumbai 400703
Phone: 022 2777 7170 / 71

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Power Market goes **Green**



IEX is integrating Solar, Wind and Bio-Mass Generators on the exchange platform

So far the conventional power generators have been leveraging exchange markets, but now, it makes viable proposition to sell renewable power in the day-ahead market on the Exchange. Already, a few renewable generators have been selling on exchange platform at attractive prices compared to competitively bid tariffs.

IEX STATISTICS*

- ⚡ 6,200+ Participants
- ⚡ Participants located across 29 States & 5 UTs
- ⚡ 50+ Discoms
- ⚡ 4000+ Open Access Consumers
- ⚡ 480+ Private Generators
- 153 MU[#] Daily Average Cleared Volume

VALUE PROPOSITION

- ⚡ Efficient Price Discovery
- ⚡ Flexibility in scheduling
- ⚡ 24*7 trading
- ⚡ 4 hour Gate closure (Intra-Day)
- ⚡ Diverse Participation
- ⚡ From April-June'18, 5 Solar generators with size varying from 3-100 MW sold 8.88 MU in day-ahead market

PRODUCT PORTFOLIO

- ⚡ Electricity Market
 - Day-Ahead Market
 - Intraday and Day-Ahead Contingency
 - Term-Ahead Market
- ⚡ Renewable energy certificates
Solar & Non-solar certificates
- ⚡ Energy Saving Certificates



*Statistics for FY19 as on 30th June, 2018
[#]MU=Million Units

IEX is approved and regulated by Central Electricity Regulatory Commission (CERC)

www.iexindia.com

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Palash Nandy

CEO
Numeric

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Towards Six Decades of Dedicated Service To Power Sector

CPRI

RESEARCH

- Collaborative Research between R&D Institutions, Industry and Academia
- Coordinates In-House R&D (IHRD), Research Scheme on Power (RSoP) and Research Projects under National Perspective Plan (NPP)

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- High Power Short Circuit testing of Transformers/Switchgear
- Ultra High Voltage testing upto 1200kV
- Transmission line Towers & accessories
- Power Cables & Capacitors
- Material characterization including CRGO
- Insulators & Lightning Arresters
- Vibration studies, Transformer Oil
- Seismic Qualification
- Relays, Energymeters and Smart Meters
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- Domestic appliances including LED and SPV Lighting Systems

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- Third Party Inspection Services and Vendor Assessment for Utilities

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- Corporate Member in DLMS UA, UCA IUG
- Association with UL, TUV



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Bangalore - 560080, Karnataka, India
Tel: -91 80 22072210, 22072213, 22072208. Fax: -91 80 23601213
Email: drvarughese@cpri.in / kamala@cpri.in / ramdas@cpri.in
Website: www.cpri.in

ABB CEO Discusses e-mobility, RE with PM

Spiesshofer's talks with the Prime Minister focused on how ABB can support the government's renewable energy targets and accelerate public transportation's transition to electric power. "By embracing e-mobility now, India can leapfrog other nations and become a world leader in e-mobility, while at the same time reducing emissions and dependence on fossil fuels. ABB is a technology leader for electric mobility and we are well positioned to partner India's electric mobility mission 2030," said Spiesshofer.

Spiesshofer's meeting with the Prime Minister



comes at a time when India has set an ambitious target of producing 227 GW of renewable energy by 2022 and has launched an initiative to electrically power majority of its public transport vehicles. India is also investing to make its power grid more resilient in the face of growing demand.

"This is not just limited to EV charging infrastructure, but also includes the entire electricity value chain. We very much look forward to continuing sharing of ideas on driving forward India's e-mobility revolution," he added.

15

Power Ministry Launches Program on Energy Efficiency in Chillers

Chillers consume more than 40 per cent of the total energy in commercial buildings Chiller star labelling program to save more than 500 million units of electricity in 2019 along with Green House Gases reduction. Ministry of Power launched an ambitious program to encourage the deployment of energy efficient chiller systems in the country. The Chiller Star Labelling Program has been formulated by Bureau of Energy Efficiency (BEE). The program envisages providing star rating in terms of its energy performance. Initially, the program is launched on voluntary basis and will be valid up to 31st December 2020. A K Bhalla, Secretary, Power, emphasised the

need to improve energy efficiency in space and process cooling sector, considering the occasion of 24th World Ozone Day and the 31st Anniversary of Montreal Protocol. "This initiative will promote advancement technology for central HVAC systems and will also facilitate energy efficient solutions for the large commercial and industrial applications", Bhalla added. Chillers are used extensively for space conditioning of buildings and for industrial process cooling applications. The size of Indian chiller market which stood at 1 MT per year at 2017, is projected to grow at a CAGR of 3.6 per cent fuelled by a growth in the retail, hospitality and infrastructure projects.

15

'IEEMA should provide platform to the industry'

The government of India is taking a series of measures to improve India's position in the World Bank's 'Doing Business' ranking. The process adopted by the government has been inclusive and rigorous, which has resulted in India going up significantly, from 130 to 100, in the Doing Business 2018 ranking. Joining hands with the Government of India in this process, IEEMA themed its Annual Convention as 'Go Global'. The Convention was inaugurated Dr P V Ramesh, CMD, Rural Electrification Corporation. The convention witnessed the presence



of around 200 delegates from the electrical equipment industry. Like any evolving country, India too cannot overlook the essential role of the power sector in fueling its overall development. After a

sluggish 2017, the Indian power sector revived itself in the year 2018 with 12.8 per cent growth. The implementation of the various reform measures in India has given immense opportunities to the countries of the world to come and invest in India and promote bilateral trade, technology sharing and transfer and also joint membership.

15



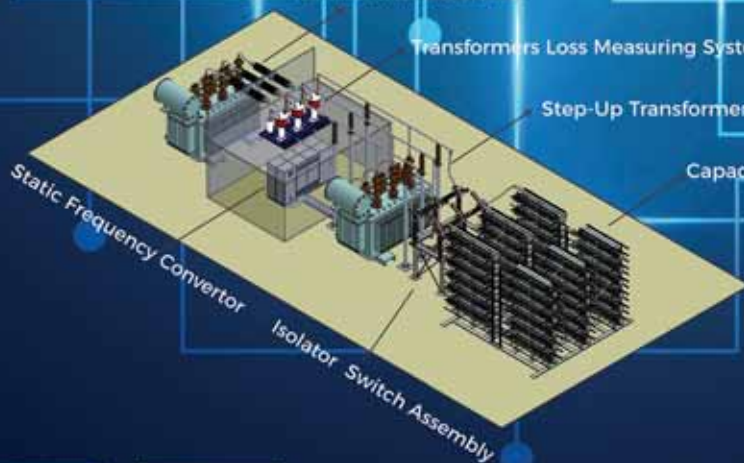
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- ❖ HT Switchgear
- ❖ Motors & Generators
- ❖ Epoxy Components

USERS

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- ❖ Third Party Test Labs
- ❖ Educational Institutes

SERVICES

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Government to inject competition in distribution sector: Power Secretary

Power Secretary Ajay Kumar Bhalla said that the government is injecting competition in the power distribution sector through content and carriage reforms to make the supply of power consumer-friendly.

Speaking at a workshop on Ensuring Sustainability of India's Electricity Sector Through Tariff Reforms, Industry Involvement and Innovative Business Models organised by FICCI jointly with Shakti Sustainable Energy Foundation and PwC, Bhalla stressed on the need for the regulators to be market-oriented and stakeholder-friendly.

The workshop was held at a time when Ministry of



Power is taking concerted steps to simplify and rationalise power tariffs in the country through amendments in policies and provisions.

The workshop witnessed deliberations among participants on the necessity of tariffs and market reforms for the overall benefit of the sector. Tariff reforms can act as a powerful tool to tackle issues pertaining to financial distress in the distribution sector, high levels of cross subsidies, peak power deficits, and lack of competition in the sector. The prevailing tariff structure across the states are complex, non-uniform and do not adequately reflect the costs that are incurred in power supply. **IE**

Ashok Leyland Inaugurates Cutting Edge EV Facility in Ennore

Ashok Leyland inaugurated its cutting edge electric vehicle (EV) facility in its Ennore plant. It is India's first integrated facility for design, prototyping, testing, process prototyping and solutions design.

The in-house facilities include engineering, prototyping and testing for motors, battery modules and packs and a power electronics lab. Keeping in mind the rapidly evolving and changing market and technology, it has been conceived as an in-house start-up facility in order to stay flexible and fast. Sharing his views, Vinod Dasari, Managing Director - Ashok Leyland, said, "In our 70th year, we are laying the

foundation for our future. Currently, we are the only OEM globally to offer different Energy Management strategies and an architecture which is modular.

Our plan is to start working on new product platforms in EVs such as eLCV, Low Floor City Buses, Last Mile Connectivity and Power Solutions products. We have also launched a host of new Business Models including eMaaS (eMobility as a Service) and eMSol (eMobility as a Solution) which ensures that we are closer to our end customers and capture more value." The Government's eMobility vision is an opportunity for the country to save forex and to reduce oil dependence. **IE**

Azure Roof Power to Electrify Government Buildings in MP & Delhi

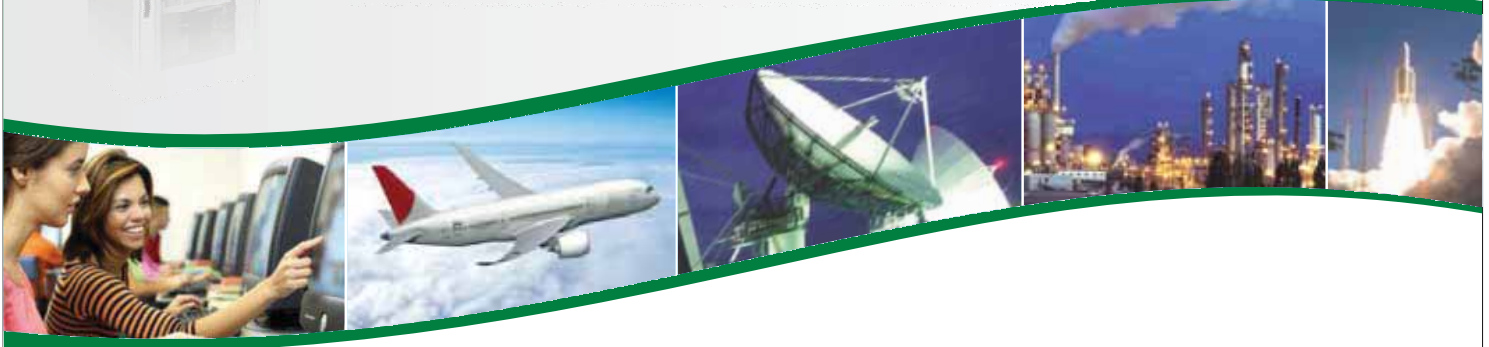
Azure Power has won 11.2 MW and 600 KW rooftop solar power projects in bids conducted by Madhya Pradesh Urja Vikas Nigam Limited (MPUVNL) and Indraprastha Power Generation Company Ltd (IPGCL) respectively. Azure Power will provide power for 25 years to various Government establishments in Madhya Pradesh and Delhi which will be spread across approximately 600 project sites. Azure Power qualifies for a capital incentive which results in a weighted average levelised tariff of INR 4.50 (~US 6.6 cents) per kWh for the MPUVNL project and a weighted average levelised tariff of INR 5.91 (~US 8.6 cents) per kWh for the IPGCL project.

For the bid tendered by MPUVNL, World Bank is

the technical partner which provided pre-identified project sites with technical due diligence. Azure Power's win of 11.2 MW is the largest allocation in the bid, which includes approximate 90 per cent of the total project sites allocated and covers Government Buildings. Azure Roof Power offers superior rooftop solar power solutions for commercial, industrial, government, and institutional customers in cities across India to lower their energy bill and meet their greenhouse gas (GHG) emission reduction targets. With over 200 MWs of high quality, operating and committed solar assets across 23 states, Azure Roof Power has one of the largest rooftop portfolios in the country. **IE**



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ReNew Power Commissions 126 MW Wind Energy Project in GJ

ReNew Power announced the successful commissioning of Phase 1 (126 MW) of its 250 MW wind project located in Kutch district of Gujarat. This project is part of the India's first wind power reverse auction concluded by Solar Energy Corporation of India Limited (SECI) in February 2017 under the 1000 MW Inter-State Transmission System (ISTS). The power generated from this project will be supplied to the Northern and Eastern states of UP, Bihar, Jharkhand & Odisha using the ISTS network.

The 250MW wind power project was won at a tariff of 3.46 INR/unit by Ostro Kutch Wind Pvt Ltd in April 2017, which, through an acquisition of Ostro Energy and its portfolio of wind and solar energy projects


became part of ReNew Power in March 2018. Sumant Sinha, Chairman and Managing Director, ReNew Power, said, "ReNew Power is India's first renewable energy company to commission the first wind power project under ISTS scheme of SECI I wind auction. This is indeed a memorable moment for all of us as this milestone was achieved well ahead of commissioning date and I want to thank all the stakeholders who supported us."

Ostro Kutch Wind, now a part of ReNew Power, awarded this 250MW turnkey project to Vestas Wind Technology, which includes delivery, installation and commissioning of 125 V110- 2.0 MW turbines, as well as the project's BoP works (Civil & Electrical). 

CLP India, Suzlon Joint Venture for Two Solar Projects

CLP India and Suzlon announced a joint venture for two solar projects of 50 MW and 20 MW in Dhule, Maharashtra. As per the agreement signed between CLP India and Suzlon Group on September 10, 2018, CLP India has agreed to acquire 49 per cent stake in Gale Solar Farms Limited and Tornado Solar Farms Limited, two special purpose vehicles (SPV) set-up by Suzlon. CLP India has the option to acquire the balance 51 per cent stake in the future. Suzlon is responsible to provide comprehensive operation and maintenance services for these projects that are already commissioned.

Rajiv Mishra, Managing Director, CLP India, said, "In


the last 16 years, we have built one of the most diversified fuel mix portfolios in the country and we are committed to expanding our renewable energy portfolio on the back of supportive government policies. With wind energy, we have been able to grow our footprint to almost 1,000 MWs and we are confident of steadily building on our solar energy footprint." Mahesh Makhija, Director, Business Development and Commercial (Renewables), CLP India said, "Renewable energy has been a key pillar for us in our growth journey. We believe the renewables sector has transformed over the years and introduced several international best practices." 

Vikram Solar Launches Half-Cut-Cell Module

Vikram Solar has launched a new line of solar modules at Renewable Energy India Expo, Greater Noida. The new modules are based on the latest half-cell technology that increases module output by ~15 Wp per module compared to standard PV modules. The technology also boasts efficiency up of 19.56 per cent. The new high-density module technology is engineered to generate more power from advanced mono-PERC half-cells, thus, achieving better Levelised Cost of Energy (LCOE). The innovative design principle minimises shadow-loss through a series-parallel cell



connection, when one-half of the modules are affected by shading. The high efficiency half-cell modules are the perfect fit for all utility and rooftop projects. On the occasion Ivan Saha, BU Head-Solar Manufacturing and CTO, Vikram Solar commented, "We are taking a big step by introducing advanced new High-Density

Monocrystalline Modules using innovative Cell-Cleaving Technology. The design, superior price performance, increased shade tolerance and reduced power loss is expected to make a big splash in the market." 

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- 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)
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- Single speed or two speeds motors
- All motors designed for inverter duty



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- 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.



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Adani Group Enters Retail Electricity Distribution Business

Adani Transmission announced that it has acquired Reliance Infrastructure's integrated business of generation, transmission and retail electricity distribution. The integrated business includes the power generation units based at Dahanu, power transmission network across Mumbai and Maharashtra and the retail power distribution network in Mumbai suburbs.

The acquisition shall be housed in Adani Electricity Mumbai (AEML), a newly formed entity and a subsidiary of Adani Transmission Limited (ATL). This acquisition marks the firm's foray into the large-scale electricity distribution sector, the most vital function



within the power supply chain. Business operations at AEML post-acquisition will continue to function seamlessly with the absorption of about 5,000 existing employees across three business areas. Speaking on the acquisition, Gautam Adani, Chairman, Adani Group said, "I am delighted to announce our significant launch into large scale city electricity distribution business and are privileged to serve over 3 million consumers in the city of Mumbai. We aspire to enter into electricity distribution business in key cities and districts in India in pursuit of Government of India's Vision to enable 'Power for all by 2020'."

13

KEC International Wins New Orders of Rs 1,010 crore

KEC International has secured new orders of Rs 1,010 crore across its businesses. Transmission & Distribution: The T&D business has secured turnkey orders of Rs 491 crore across India, Middle East and The Americas: • GIS substation and other orders across India from PGCIL • Variation orders in the Middle East • Orders from the Americas received by SAE Towers

Cables: The cables business has secured orders of Rs 250 crore for various types of cables.

Solar: The solar business has secured orders of Rs 195 crore from various private players across India.

Civil: The civil business has secured orders of Rs 74 crore for civil and structural works from a leading automobile company and a leading cement company.

Vimal Kejriwal, MD & CEO, KEC International commented, "We are delighted with the new order wins, especially in T&D and civil. With the new orders in Solar, we are witnessing a gradual revival in the business outlook of the industry."

14

Photonsolar to Provide Green Energy Solution to IKEA in India

Photon Energy Systems (Photonsolar) announced the commissioning of IKEA's first store 800kWp rooftop solar plant in Hyderabad followed by Bengaluru and Navi Mumbai

The IKEA Hyderabad solar rooftop plant is among India's maximum solar power installed per square meter plant by using class leading mono-perc modules with over 21% efficiency cells. The solar plant consisting of 2223 modules and 10 inverters was installed in 30 days' time and innovatively anchored to the rooftop without any civil footings or roof drilling. The solar plant will create significant cost savings in IKEA's monthly energy bills by generating 1300 MWh per annum and reducing carbon dioxide



emissions by over 960 tons. 3E, the independent global engineering consultancy company provided the design validation and technical clearances ensuring best global engineering design and execution of the plant.

Gautham Nalamada, Executive Director said, "We are very proud

to be associated with a global retail leader like IKEA and to partner with them in rolling out solar plants on all their stores across India. This association validates Photon's technical expertise and engineering strengths. Photon will also install and commission solar rooftops on all Ikea's upcoming stores starting with Navi Mumbai and Bengaluru stores next. Designing of these plants is now underway."

15

A NEW LINK BETWEEN PV & GENSET POWER PLANTS

DEIF has a strong track record in developing emergency, standby and backup power solutions for mission-critical facilities and businesses.

Designed to serve as a link between photovoltaic (PV) power plants and genset power plants, DEIF's Automatic Sustainable Controller (ASC Plant Management) is an automated, safe and reliable control solution for PV/genset hybrid plants.

The ASC Plant Management solution is suitable for stand-alone applications with or without DEIF controllers and for power management applications equipped with DEIF's AGC Plant Management Controllers. It supports numerous communication protocols for inverter interfacing, including the widely used SunSpec protocol.



UNIQUE CONTROL SOLUTION FOR PV/GENSET HYBRID PLANTS

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CG Installs Offshore Transmission Substation in Germany

Avantha Group Company, CG Power and Industrial Solutions Limited (CG) through its wholly-owned subsidiary at Belgium in consortium, fabricated the largest ever Offshore Transmission Substation with overall electrical transmission design, manufacturing, installation to commissioning and energisation of all main power transformers, high & medium voltage equipment and control and protection systems for the electrical transmission platform. In 2015, CG along with ENGIE Fabricom and Smulders contracted to design, supply and install the offshore substation for the German utility EnBW (Energie Baden-Württemberg).

The structure is 55 metres long, 30 metres high

and weighs 4500 tonnes with 3 Main Transformers and 3 Shunt Reactors. Hohe See is the largest substation built so far at the Hoboken yard. The Hohe See Wind Farm is the biggest planned offshore wind project in Germany with 71 turbines- a total capacity of 497 MW. It is expected to generate approximately 2 billion kilowatt-hours of renewable electricity per year, adequate to power 560,000 households and reduce CO₂ emissions by over 1.5 million tons per year. On 29th May 2018, the jacket for the EnBW Hohe See Offshore Wind Farm left the Smulders yards in Vlissingen. The jacket will be installed in the German North Sea. The substation is shipped directly from Hoboken to its final destination. 


Hanergy Clinches \$ 4.3 mn Contracts with 15 US Companies

Hanergy Thin Film Power announced its entry into Latin America region by venturing in Brazil. The company also has inked cooperation contracts worth USD 4.3 million with 15 companies from Brazil, Chile, and other Latin American countries.

Under the aegis of these contracts, Hanergy will cooperate with local partners in several aspects, including Building-integrated Photovoltaics products, the construction of thin film solar chip production lines, distribution of Hanergy mobile energy products



like HanPack, Humbrella, HanPaper, and localisation of R&D for solar energy solutions. Hanergy signed a distribution contract with Brazil's largest umbrella dealer, Greenhouse, for distribution of Humbrella,


Hanergy's solar umbrella product. Similarly, Hanergy also signed with the IT Center Renato Archer, a research unit of Brazil Ministry of Science, Technology, Innovations and Communications, to develop the BIPV technology application in Brazil. Hanergy also reached an MoU agreement with Queiroz Galvao. 

Building Energy Inaugurates Largest Solar PV Plant in US

Building Energy through its renewable energy subsidiary Annapolis Solar Park announced the inauguration of its largest solar PV project built in North America. Built by EDF Renewables, the project is located on a closed landfill in the City of Annapolis, Anne Arundel County, Maryland.

"Annapolis Solar Park is the seventh renewable energy plant commissioned by Building Energy in the US and the most important project in North America as it represents for Building Energy the largest PV Solar Project to start operations in the country," said Andrea Braccialarghe, Managing Director North America at Building Energy. "We are glad to celebrate this important company achievement in Annapolis

with the whole community and their representatives that made it possible. With the Annapolis Solar Park going into operation, Building Energy is strengthening its presence in Maryland as well as its commitment to boost the development of the state's RE sector. We are planning to further expand our generation capacity in the State, continuing to leverage on our multi-technology strategy with our commitment to environmental responsibility."

The PV plant is supported by Power Purchasing Agreements for the sale of the entire energy generation for 20 years with the City of Annapolis, Anne Arundel County and the Anne Arundel County Board of Education. 

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Mitsubishi Electric's New Power Semi-Conductor Module for EVs

The Indian Government has ambitious plans to shift on a mass scale to electric vehicles (EVs) by 2030. The plans are opulent and certainly held several paybacks for environment conservation. While the transformative thrust for electric vehicles is a very positive move for India and the world, it presents myriad opportunities as well as challenges.

Mitsubishi Electric has already taken a step towards making the idea of mass scale shifting to electric vehicles a reality. The company recently launched a new J-Series transfer molded power semiconductor module (T-PM) mainly for motor drive applications in electric and hybrid vehicles. It is known that automotive components must especially meet stringent safety

standards. Mitsubishi Electric pioneered the mass production of power semiconductor modules for hybrid vehicles in 1997. The company's new module is expected to contribute to further compactness, weight reduction and reduced power consumption in inverters for electric and hybrid vehicles. It has some cutting-edge features like reduced inverter size and weight achieved through the extra compact package with high integration. The compact power semiconductor module features a highly integrated sixth-generation IGBT with a carrier-stored trench-gate bipolar transistor (CSTBTM) structure and high-thermal conductivity isolation sheet in a transfer molded package. 


Sony Joins Global Initiative RE100

Sony Corporation has joined RE100, an initiative operated by the international Non-Government Organisation (NGO) climate group in partnership with cdp. Sony will aim to use 100 per cent renewable electricity for all of its business sites by 2040. RE100 consists of companies committed to using 100 per cent renewable electricity and comprises over 140-member companies worldwide as of September 10, 2018.

The climate group's mission is to accelerate climate action to achieve a world of under 2°C of global



warming. It does this by bringing together powerful networks of business and governments that shift global markets and policies – so that we can go further and faster in driving climate action. CDP is an international non-profit that drives companies and governments to reduce their greenhouse gas emissions, safeguard water resources and protect

forests. Backed by investors with assets of USD 87 trillion, it runs the global environmental disclosure system used by thousands of companies and hundreds of cities, providing data analysis and expert insights. 


B&R Joins Huawei's OPC UA TSN Testbed

B&R has joined the OPC UA TSN testbed of Chinese network equipment vendor Huawei. The Austrian automation specialist is now participating in all three of the world's most significant platforms for practical testing of the new communication technology. The two other testbeds are those organised by the Industrial Internet Consortium (IIC) in the USA and Labs Network Industries 4.0 (LNI) in Europe.

"Huawei's testbed gives us the opportunity to advance the standardisation of OPC UA TSN in Asia," explained B&R Marketing Manager Stefan Schönegger



during the presentation of the testbed at the Hannover Messe. "In doing so, we're making another important contribution toward globally harmonised industrial communication."

Huawei's testbed will feature an OPC UA TSN network simulating all aspects of smart factory communication – from individual sensors to the ERP system and on into the cloud. Data will be transmitted exclusively via OPC UA TSN – regardless of whether it is real-time motion control data or aggregated performance metrics for executive management. There is no need for communication interfaces of any kind. 



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K N Vyas is Chairman of Atomic Energy Commission


Renowned scientist Kamlesh Nilkanth Vyas has been selected as the secretary of the Department of Atomic Energy and Chairman of the Atomic Energy Commission, according to an official order. "The appointment committee of the Cabinet has approved his appointment till he attains the age of 64 years on May 3, 2021," the order issued by the Personnel Ministry said.

Vyas, who is at present Director of Bhabha Atomic Research Centre (BARC), has been appointed in



K N Vyas

place of Shekhar Basu. Vyas is a Mechanical Engineering graduate from MS University, Vadodara. After completion of training in BARC training school in 1979, he joined Fuel Design and Development Section of Reactor Engineering Division of BARC. Vyas has worked for design and analysis of nuclear reactor fuels, according to his official bio-data. He was also responsible

for design and development of a novel fuel for strategic applications. Vyas has worked extensively in thermal hydraulics and stress analysis. 

Sterlite Power Appoints Rui Chammas as Brazil CEO


Sterlite Power has appointed Rui Chammas, former CEO for Biosev, as the leader of its Brazil business. The company has a portfolio of nine projects, entailing an investment close to USD 1.7 bn in the country.

Pratik Agarwal, Group CEO Sterlite Power, said, "We are delighted to welcome Rui to Sterlite Brazil. He has a rich experience in running large organisations in the energy industry. With his appointment, we reinstate our deep commitment to the Brazilian Transmission



Rui Chammas

Sector."

Chammas has worked for more than 11 years in the Brazilian petrochemical company, Braskem. Prior to that, he was associated with the French chemical company Rhodia for 13 years. He graduated from the Technological Institute of Aeronautics (in Portuguese Instituto Tecnológico de Aeronáutica - ITA) and holds an MBA from Getúlio Vargas Institute. He has also done an Executive program on Business Dynamics at MIT Sloan. 

TechnoNICOL Corporation appoints Ramnik Kohli as India CEO

TechnoNICOL Corporation, an international manufacturer and supplier of roofing, waterproofing, thermal insulation, and sound absorption materials, has announced the appointment of Ramnik Kohli as the Chief Executive Officer for India. His appointment comes as a part of strengthening and expanding TechnoNICOL's presence in the Indian market as the country is witnessing rapid growth in roads, bridges, railways, airports, residential and commercial buildings, and power generation construction, which calls for the concerted focus on building materials.


TechnoNICOL Corporation integrates 53 production sites, six R&D centres with 6,500 qualified



Ramnik Kohli

staff and has 25 years of market experience. The company specialises in selling building materials and tools for industrial, civil and private housing construction.

"Ramnik is an accomplished leader with an outstanding track record. India is an important country and part of TechnoNICOL's global growth strategy.

Ramnik will develop and further accelerate our growth plans in the Indian market," said Anton Belyakov, Managing Director for Asia region. "The mission of TechnoNICOL is to produce high quality, reliable and effective construction materials and solutions, which we strive to make available at very effective price-points," he added. 



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APSPDCL Gets Two National Awards at the India Green Energy Award 2018

Andhra Pradesh Southern Power Distribution Company Limited (APSPDCL) has won two prestigious national awards at the 'India Green Energy Award 2018' ceremony held in New Delhi.




APSPDCL Chief General Manager K Nanda Kumar receiving awards on behalf of the APSPDCL

General Manager K Nanda Kumar had received these awards on behalf of the APSPDCL.

Speaking on this occasion, APSPDCL Chairman and Managing Director M Nayak termed the awards as the

The programme was organised by Indian Federation of Green Energy. The SPDCL stood as winner in the category of 'Outstanding State Discom Supporting Green Energy Uptake' and also runner up in the category of Outstanding Community based Green Energy Project' category. SPDCL Chief

recognition of the hard work of the employees in promoting green energy and rendering best services to consumers.

He exhorted the employees to continue the same spirit to get more and more national-level recognition in the power sector. 

Sumant Sinha Gets ET Award 2018 for Entrepreneur of the Year

Sumant Sinha, Chairman and Managing Director of ReNew Power has won Entrepreneur of the Year award at ET awards 2018.


Sinha has led ReNew Power Ventures to the position of India's largest clean energy company in a short span of time, overtaking older rivals on the way with a mix of mostly organic growth and a major acquisition in the rapidly growing but extremely competitive sector. Sinha is an alumnus of IIT-Delhi, IIM-Calcutta and Columbia University.

"We are committed to supporting the communities in which we live and work. We are at a turning point where transformational use of natural resources of energy will define our future," said Sinha. The company raised debt and equity from global marquee investors ranging from Goldman Sachs, which acquired a substantial stake in the



Sumant Sinha

early days of ReNew Power to Canada Pension Plan Investment Board, that recently invested \$247 million on top of its \$144 million investment in January 2018. He holds a bachelor's degree in civil engineering from the Indian Institute of Technology, Delhi, a post-graduate diploma in management from the Indian Institute of Management, Calcutta and a master's degree in International Affairs from the Columbia University.

He is also a CFA charter holder and a member of the Institute. He worked as an investment banker in the United States and the United Kingdom at Citicorp Securities and ING Barings Services Limited, respectively, before returning to India as Senior President, Finance, of the Aditya Birla Group and subsequently as the Chief Executive Officer of Aditya Birla Retail. 

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Global Switchgear Market to be worth USD 125.10 bn by 2022

The global market is set to witness a significant growth due to the continued growth of construction and developmental activities, increasing access to electricity, and growth of renewable power generation projects.

According to MarketsandMarkets report, the switchgear market is expected to grow from an estimated USD 88.71 Billion in 2017 to USD 125.10 Billion by 2022, at a CAGR of 7.12%, from 2017 to 2022. The global market is set to witness a significant growth due to the continued growth of construction and developmental activities, increasing access to electricity, and growth of renewable power generation projects.

The transmission and distribution utilities segment is expected to hold the largest share of the switchgear market, by end-user, during the forecast period.

The transmission and distribution utilities sub-segment of the end-user segment led the switchgear market in 2016 and is projected to dominate the market during the forecast period. The transmission and distribution utilities segment is also expected to grow at the fastest rate during the forecast period.

The growth of the transmission and distribution utilities segment is primarily driven by increasing investments in sub-station automation, modernisation of electric grid, and smart utilities which includes smart grids and smart meters. This would enhance the protection by decreasing energy losses due to poor operational efficiency of traditional equipment. This would ultimately create new revenue pockets for the switchgear market during the forecast period.

The gas insulated switchgear is expected to hold the largest share of the switchgear market, by equipment, during the forecast period. The gas insulated switchgear sub-segment of the equipment segment led the switchgear market in 2016 and is projected to dominate the market during the forecast period. Rising energy demand and extension/replacement of old switchgear at sub-stations can drive the gas insulated switchgear

equipment in the switchgear market. However, the circuit breaker sub-segment accounted for the second largest share in 2016 in the switchgear market, based on the equipment segment.

North America: The leading market for switchgear

In this report, the switchgear market has been analysed with respect to five regions, namely, Asia Pacific, Europe, North America, the Middle-East and Africa, and South America. The market in Asia Pacific led the global switchgear market in 2016. Increasing grid investments especially in developing economies, such as China and India and plans for electrification in remote areas in countries, such as Vietnam, Indonesia, and the Philippines are expected to drive the switchgear market in Asia Pacific. Indonesia aims to achieve 90 per cent electrification rate by 2025 and the countries, such as the Philippines and Malaysia have similar plans. Rise in investments in smart grid technologies including distribution grid automation, smart meters, and demand response systems in countries, such as Japan, South Korea, and Australia would create opportunities for the switchgear market in the Asia Pacific region.

To enable an in-depth understanding of the competitive landscape, the report includes profiles of some of the top players in the switchgear market. The key players include ABB Ltd. (Switzerland), General Electric Company (US), Siemens AG (Germany), Eaton Corporation plc (Ireland), Hitachi Ltd. (Japan), Schneider Electric SE (France), and Mitsubishi Electric Corporation (Japan) among others. The leading players are trying to understand the markets in developing economies and are adopting various strategies to increase their market shares.

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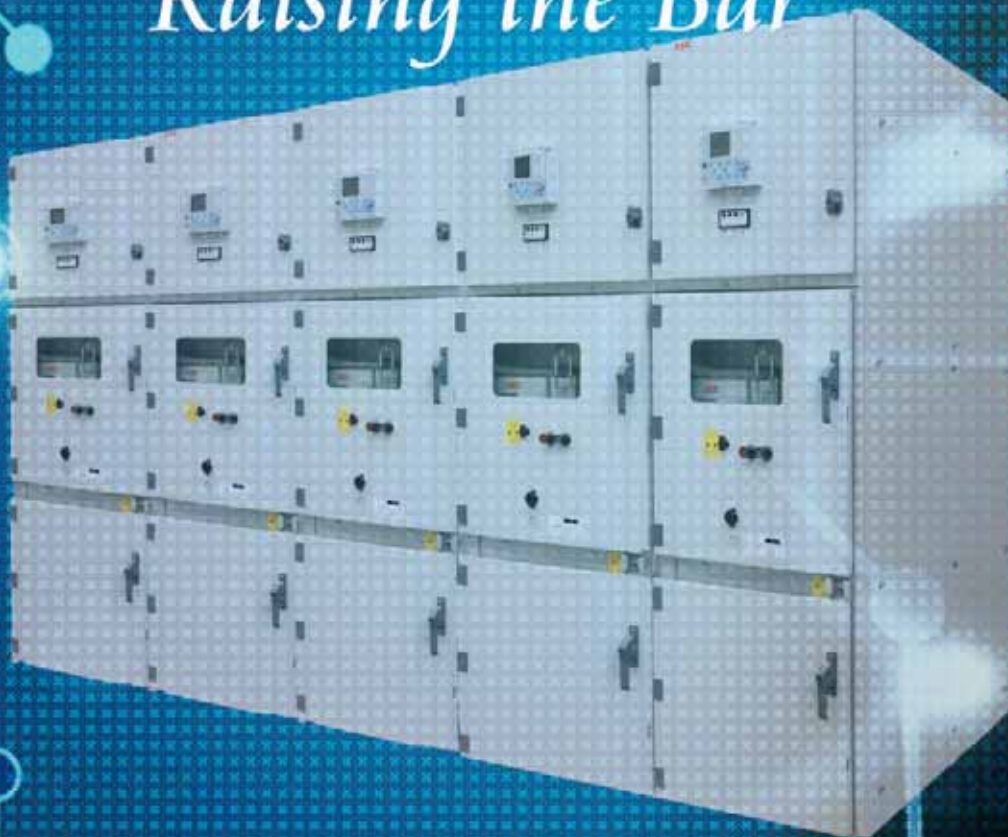
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Digital Switchgear

Raising the Bar



In-depth analysis on how digitisation helps in improving performance and reliability of switchgears.

By Subhajit Roy, Group Editor

Globally, as in India, the power sector is undergoing an unprecedented transformation, fuelled by digital disruption. Digitisation helps in improving the performance and reliability of switchgears as smart switchgears allow grid optimisation and enhance performance,

efficiency and minimise both transmission as well as operational losses. Digitisation drives switchgears to new levels of efficiency as monitoring and analysing of information becomes extremely reliable, reducing monthly maintenance costs. Besides, this is done without

regular checks by maintenance crews, lowering costs even more since digital switchgear permits greater visibility of current, voltage, power loss, operating cycles, temperatures and other measurable metrics.

AV Jagdish, Senior Vice President, Havells India Ltd, said, "Smart switchgears are embedded with sensors and smart systems which enable a safe, reliable and flexible distribution within a fully controlled system. Smart switchgears can also be pre-programmed and embedded with intelligent devices for monitoring and automatic load management for energy savings and easy maintenance."

Anil Kadam, General Manager, Solutions Architect, Schneider Electric, said, "Digitisation works on the principle of using less for more by enhancing energy efficiency and reliability. Thereby, less energy is used in providing more output. Less energy usage improves the reliability of switchgears and requires less maintenance too."

Commenting on how digitisation helps in improving performance and reliability of switchgears, Sameer Saxena, Director- Marketing, Legrand (Group) India said, "Digitalisation will have a great impact on the electrical distribution as it will improve operations and increase flexibility through the chain. Installing digital switchgear today contributes greatly to increasing operational efficiency. It can be done by optimising switchgear footprint in the substation room and by using the energy efficiently for switchgear operation. It also helps in self-monitoring and diagnostic of the switchgear by way of which the reliability can be enhanced."

By creating a 'digital twin' of the physical switchgear, engineers are able to rapidly study the behaviour of the switchgear under different conditions, and test new innovations quickly and cost-effectively, explains Syed Sajjad Ali, Managing Director – India, Electrical Sector, Eaton. He adds, "For the end-users, digitisation helps them to operate the facility more efficiently and reliably with the help of better information-based decision making. This in turn ensures the switchgears operate within their design specifications – increasing the overall life and ROI of the system."

According to ABB, "Digitalisation creates efficiency gains, including 25 per cent footprint reductions and weight optimisation. Installation and commissioning times are decreased up to 25 per cent and delivery



AV Jagdish, Senior Vice President, Havells India Ltd.

Smart switchgears are embedded with sensors and smart systems which enable a safe, reliable and flexible distribution within a fully controlled system.

capabilities are up to 30 per cent faster compared with conventional switchgear."

With digital switchgear, modifications are easy to implement when electrical loads are changed or added or a need for adaptation is identified late in the switchgear project. This new generation of switchgear allows for flexibility and expansion of the equipment without the need for complex additional wiring. "Digital switchgear is easily adapted, as changes can be made using software logic in the protection relays, using the concept of interoperability in the IEC 61850 standard for communication, bringing with it both operational efficiency and unprecedented flexibility," a statement earlier issued by ABB said.

Digital Readiness

Schneider Electric portfolio of smart integrated solution

Schneider Electric has an entire portfolio of smart integrated solution offerings. This includes complete power distribution solutions (including LV and MV) integrated with energy monitoring software that provide the customer with all the tools and analysis to improve the efficiency of their system. In turn, this results in efficient productivity and maximum profits. "Our key pillars include asset management, network management and energy management – a comprehensive range of solutions being offered under each pillar," informs Anil Kadam of Schneider Electric.



Anil Kadam, General Manager, Solutions Architect, Schneider Electric

Digitisation works on the principle of using less for more by enhancing energy efficiency and reliability.



For the end-users, digitisation helps them to operate the facility more efficiently and reliably with the help of better information-based decision making.

Syed Sajjad Ali, Managing Director – India, Electrical Sector, Eaton

Schneider Electric recently launched EcoStruxure Asset Connect and Asset Advisor is an integrated approach towards next generation services by delivering predictive analytics to secure electrical distribution through monitoring your critical connected products.

EcoStruxure Asset Connect installs sensors (thermal, environmental) into an electrical equipment, through which plants and industries are able to capture data and monitor the health of the equipment. It reduces periodic checking and maintenance costs and protects investment by maximising the lifespan of an equipment. This approach combines a best-of-breed technological platform, EcoStruxure Asset Advisor that offers the ability to anticipate and address issues before they become critical incidents, mitigating safety risks, avoiding unplanned downtime, operational losses and expensive maintenance interventions.

Legrand products high on digital integration

Digital switchgear combines the latest digital technologies. They enable easy integration to increase smart functionality, such as power management, real-time diagnostics and remote monitoring. "We have a host of products which are high on digital integration. This includes both hardware aspect involving high-end electronics as well as associated software solutions which help our clients to optimise their energy consumption," informs Sameer Saxena of Legrand (Group) India.



Digitalisation will have a great impact on the electrical distribution as it will improve operations and increase flexibility through the chain.

Sameer Saxena, Director- Marketing, Legrand (Group) India

Eaton's digital switchgear range

In 1957, Eaton's Moeller segment developed the first fault current protection switch, and with this a new era of electrical safety engineering began. The tradition continues. The company's new digital switchgear range in the Eaton xEffect series communicates potential problems in advance and sets new standards in precision, security and convenient service.

At this year's Hannover Fair, Eaton demonstrated many practical applications for machine builders, building owners and grid operators to take advantage of the Internet of Things and Energy Transition (towards renewable energy and distributed energy resources).



Eaton Xiria Plus SF6 Free Ring Main Unit

Under the theme of integrated industry technologies, Eaton showcased Cloud-enabled electrical and hydraulic systems for more efficient, safe and intelligent machines. This included Eaton's comprehensive range of digital drives and switchgears for safe and efficient machine-building applications. It showcased the new digital NZM circuit breakers, which have been equipped for convenient lifecycle management.

Continued on page 30



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HYDERABAD, INDIA.

Continued from page 28

Under theme of energy transition, Eaton showcased its pioneering SF6-free medium voltage switching equipment used by the industry and distribution grids. This is especially relevant now as the EU reconsiders banning the use of environmentally hazardous SF6 in the coming years.

Eaton showcased xStorage residential and commercial energy storage systems that help energy prosumers reduce energy bills, provide backup power as well as valuable grid services such as frequency regulation. The company also displayed the Microgrid control system Power Xpert Optimizer, which enables increased sustainability and resiliency of power.

ABB's SafeGear Digital

ABB pioneered in the digital switchgear market launching its first MV digital switchgear in 2014 with UniGear Digital. In April this year, ABB introduced the latest addition to its digital switchgear offering, SafeGear Digital, which enables customers to meet higher performance requirements while adapting to the growing sophistication of power distribution systems.

Digital switchgear, as part of the ABB Ability portfolio of connected solutions, is based on the optimised integration of current and voltage sensors into medium-voltage switchgear, combined with the Relion protection and control relays, and the capability



ABB SafeGear

of the IEC 61850 standard for communication. This new technology for protection, control, and automation, when applied to conventional switchgear, results in a solution that is continuously self-supervising, with maximum error detection within a system.

The new offering creates a simpler and more reliable system to provide consistent power distribution, as well as cost savings through reduction of maintenance requirements, claims ABB. SafeGear Digital can be useful for environments where a reliable power supply must be ensured and personnel are limited, such as oil refineries, utility substations, and data centers.



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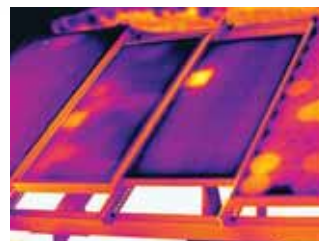
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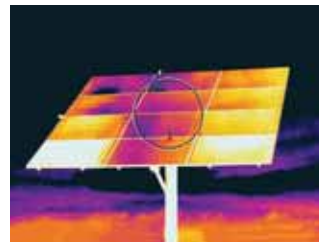
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The FLIR T640 thermal imaging camera is the perfect tool for solar panel inspections.



This hot spot within one solar cell indicates physical damage within the cell.



With thermal imaging complete panels can be inspected in one view. Anomalies in the solar panels clearly show up in these thermal images

Images for illustrative purposes only.

Hybrid HVDC Circuit Breaker

The article shades light on various intricacies of hybrid HVDC Circuit Breaker



Picture Courtesy: www.gegridolutions.com

A circuit breaker is a switching device that interrupts the abnormal or fault current and it is designed for closing or opening of an electrical circuit to protect the electrical system from damage. The circuit breaker is required to perform following three major duties under short circuit conditions.

- It is capable of breaking the faulty section of the system.
- It is capable of making the circuit in the greatest asymmetrical current in the current wave.
- It is capable of carrying fault safely for a short time while the other breaker is clearing the fault. In addition to the above rating,

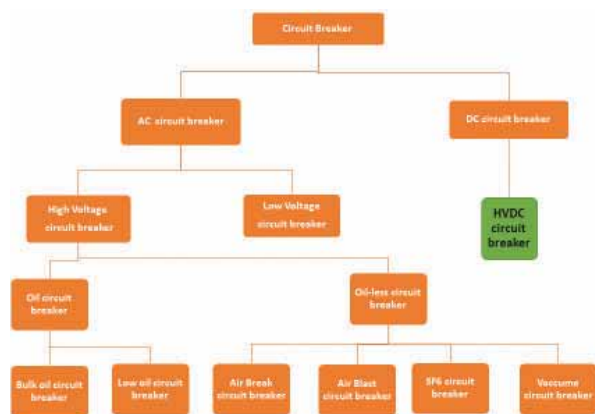


Figure 1: The classification of the circuit breaker

the circuit breakers should be specified in terms of

- Number of poles
- Rated voltage
- Rated current
- Rated frequency
- Operating voltage

The classification of the circuit breaker is shown in the Figure 1.

HVDC Circuit Breaker

Over current protection of DC system is more challenging than AC system due to absence of natural zero crossing in a DC circuit. The design and operation DC system is different from AC circuit.

The basic requirements of a HVDC circuit breaker are:

- Creation of artificial current zero
- Dissipate the energy stored in the system inductances
- Withstand the voltage stress
- Prevention of restriking arc

The breaker which is used for the interruption of the high voltage direct current is known as the HVDC circuit breaker. The voltage breaking capacity of the HVDC circuit breaker is nearly 33KV, and for the current, it is 2KA. The fault current in the HVDC circuit breaker should be reduced to zero by using some external methods. The arc quenching medium of the air break circuit breaker is either oil or air blast.

The mechanical and solid-state breakers have both merits and demerits. Solid state breakers have ultra-speed, high switching losses and high cost. Mechanical breakers have low losses, low cost and very slow in operations. Integrating both with their merits and eliminating the demerits is called hybrid switching technique.

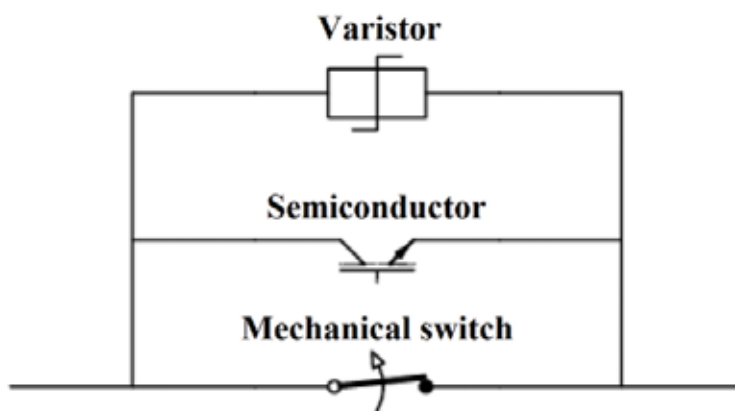


Figure 2: Basic layout of the three parallel branches of a hybrid DC-breaker.

Hybrid HVDC Circuit Breaker

The hybrid DC breaker consists of three parallel branches to handle different tasks of the breaker. The first branch contains a mechanical switch that will carry the nominal current with metallic contacts resulting in conduction losses similar to conventional, mechanical circuit breakers. The second branch consists of semiconductors with a high switching



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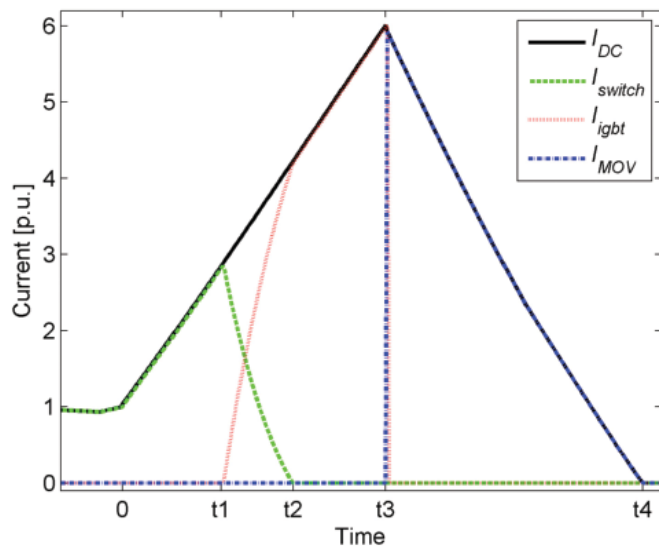


Figure 3: Currents in the different branches of the hybrid DC-breaker during interruption of a fault current.

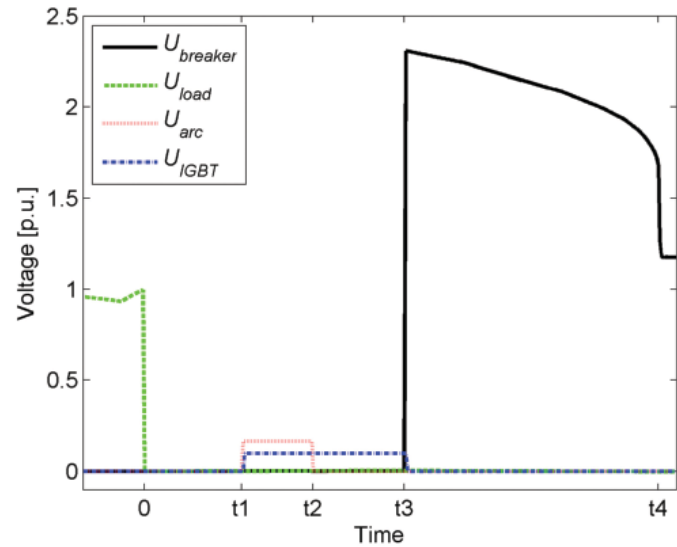


Figure 4: Voltage across the hybrid DC-breaker during interruption of a fault current.

performance. The third branch is metal oxide varistors (MOV) to limit the transient voltages and absorb the magnetic energy stored in the system.

Figures 3 and 4 show the current through the hybrid breaker and the voltage across the breaker when interrupting a rising fault current. The interruption of the current can be divided into five steps: fault detection, commutation, semiconductor conduction, semiconductor turn-off, and current limitation.

The arrangement of a very effective hybrid HVDC circuit breaker shown in figure below.

Hybrid HVDC current consists of fast-mechanical disconnecter (FMD) and a load commutation switch (LCS). The main branch consists of semiconductor interrupted and arrester bank. During normal operation current flows through the auxiliary branch, the current is transferred to main branch in case of fault. This happens through LCS, which is quickly opened and transferred the current to the arresters. To protect the load commutation switch from the voltage, build up across the breaker, the first mechanical disconnector opens as soon as the auxiliary branch does

not carry current. A residual current breaker interrupts the residual arrester current to protect the arrester from thermal overload and isolate the fault line from the HVDC grid.

The HVDC circuit breaker operates in current limit mode. The maximum duration of current limit mode depends on the energy dissipation capability of the arrester breaker. To improve the reliability and rating a matrix LCS can be recommended. The main branch can be connected to a single arrester bank or parallel arrester bank parallel with several semiconductor cells.

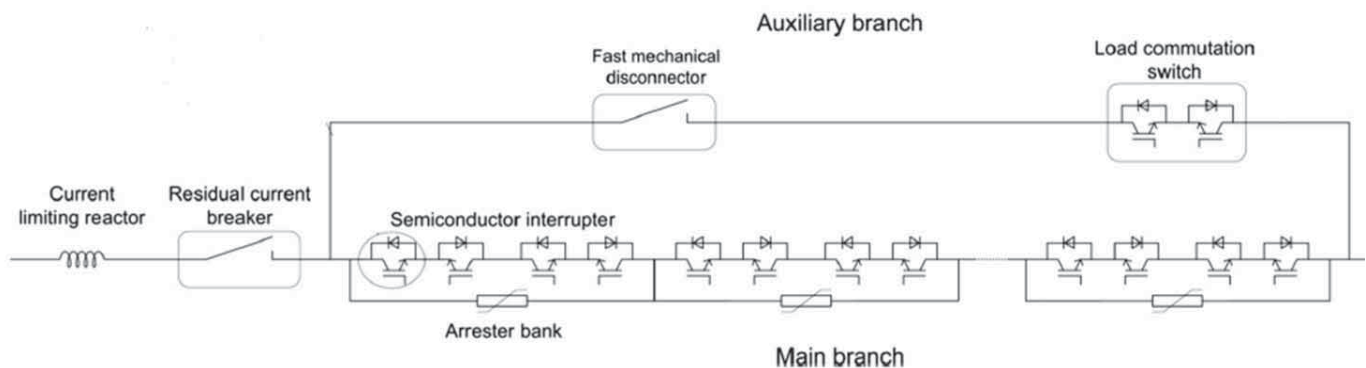


Figure 5: The arrangement of an effective hybrid HVDC circuit breaker

Continued on page 38

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Component Comparison

	BJT	MOSFET	JFET	THYRISTOR	IGBT
Voltage (KV)	1.5	1.7	1.7	1.7	1.2/1.7
Continuous current (A)	2.5	180	4	1600	270/44
Price (SEK)	13.7	5091	471	2156	1021/36
Relative price (SEK/A)	5.48	28.3	118	1.35	3.78/0.8

Table 1

	THYRISTOR (59)	GTO (60)	IGCT (61)	IGBT (62)
Rated Voltage	4200	4500	4500	4500
Rated Current	2192	2000	2670	2000
Max turn off current	-	2000	4000	2000
Voltage drop at 2 KA	1.65/1.55	-/3.5	1.75/1.85	2.7/3.4
Voltage drop at 10 KA	2.8/3.15	10.3	3.25/3.75	10.1

Table 2

Component Comparison

Highest available component ratings, For the IGBT, two different values are given since the highest voltage rating is only available for relatively low current levels. Refer Table 1.

On-state forward voltage drop for ABB high power semiconductor components. The voltage drops are given for a junction temperature of 250C and 1250 respectively. Values in parentheses are interpolated values as they exceed the component ratings. Refer Table 2.

Challenges of Hybrid HVDC Circuit Breaker

Nevertheless, the use of the conventional AC mechanical breaker in combination with a solid-state device is challenging due to:

- Fault detection and interruption times are required for the two components
- Different current rating capabilities, i.e. the conventional AC mechanical breaker can interrupt a fault current of some tens of kA but on the other hand controllable solid-

state devices, such as IGBTs, can interrupt currents of only some kA.

- Arc voltage: The current from the mechanical breaker to the solid-state device an arc voltage which is double as high as the solid-state device voltage drop is required.
- Commutation time: High commutation time results increase in magnitude of the fault current and therefore the solid-state device is forced to interrupt very high currents.
- High-conduction time is required in order to completely commute the current from the mechanical breaker to the solid-state device.

Features of Hybrid HVDC Circuit Breaker

The configurations of the hybrid HVDC circuit breaker should be designed to meet the following features:

- Arc-less interruption
- Lower turn-off current.
- Current limiting ability
- Lower varistor rating is required
- Overall turn-off process completes earlier

- Comparably lower commutation time possible
- Can be used in both AC and DC current interruptions
- Possible reduction of the conduction time of the solid-state breaker
- The solid-state device must handle (dissipate) comparably lower energy
- Lower temperature rise in the solid-state device due to lower peak current.
- Turn-on at lower fault current compared with the conventional hybrid breaker
- Required fault current handling capability of the mechanical contacts can be reduced.

Conclusions

The design of a hybrid DC-breaker is not straight forward. All different aspects have to be considered either by several iterations or by the means of an optimization. Even when optimal designs are found for the technical performance, external parameters as cost and reliability has to be considered for the final design and those parameters are not always easy to quantify. ^(B)



Aradhana Khillo

Student
Dept. of Electrical
Engineering, Parala
Maharaja Engineering
College, Berhampur, Odisha.



Swarnaprabha Panigrahi

Student
Dept. of Electrical
Engineering, Parala
Maharaja Engineering
College Berhampur, Odisha.



Dr. Sarat Kumar Sahoo

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Future of switchgear is digital & smart

The switchgear is turning inherently intelligent, allowing for predictive maintenance. So, the failures and downtime will minimise.
Chandrashekhar Shrotri, Head of Control Products Business, Digital Factory Division, Siemens India

Digitisation is the next disruptive force in the switchgear industry, explains Chandrashekhar Shrotri, Head of Control Products Business, Digital Factory Division, Siemens India in an interview with Electrical India:

What's your take on the recent performance of LV switchgear industry in India?

The LV (low-voltage) switchgear industry in India is well on its growth path, gaining strength as each quarter passes. However, the peak is yet to come.

What are the key growth drivers for LV switchgears?

The growth is seen in both – industry as well as infrastructure segments, driven by initiatives of Government of India such as Make in India, Smart Cities, national mission for clean rivers, road

infrastructure and rail electrification. The government's focus and initiatives for renewable power are also positive for the industry.

How does the Indian switchgear industry compare globally?

Indian switchgear industry today is well-integrated with the global switchgear industry. All the major global manufacturers have operations in India. All companies are selling their latest global products in India. India is a huge market, but at the same time, it is cost-competitive with its unique requirements.

We are at a stage where the demand has critical volume and hence we can afford good technologies and good machinery for high-quality products and with the advantages offered by the digitalisation, we

can produce at globally competitive levels. The cost-competitiveness of the local switchgear industry is reflecting in the growing exports for switchgear products.

What new trends do you see emerging?

The main challenge faced by the customers is of seamless integration of various digitally-enabled products such as switchgear, instrumentation and building automation. These products follow different protocols and need to be brought on the same platform.

Going forward, there will be a harmonisation of these technologies and communication protocols. A new profession – IoT (Internet of Things) integrator – could emerge similar to today's panel builder. The IoT integrator will use the IoT devices from different suppliers, integrate it with available apps or even develop the app himself.

The industry is also seeing the emergence of new business models such as pay as you save. The switchgear is turning inherently intelligent, allowing for predictive maintenance. So, the failures and downtime will minimise.

There will also be convergence of switchgear devices, integrating intelligence and increased safety features. Today, if you need 3-4 devices to accomplish a task; tomorrow you could accomplish the same task with only two devices, or even within a single device! The devices will be merged into each other. This would result in the reduction in footprint of the switchboard resulting in space saving and energy saving.

As the renewable energy sector is witnessing a sea change, how do you see the switchgear industry evolving?

As the renewable energy sector transforms, so will the need to develop and bring-to-market tailor-made products and solutions. Today, this sector is served with existing products. Going forward, dedicated products will be developed for niche applications in the renewable market.

How does digitisation help in improving performance and reliability of switchgears?

Digitisation is the next disruptive force in the switchgear industry and it will impact the switchgear segment in two ways - the way manufacturing is done

and in devices becoming increasingly intelligent.

For example, Siemens India's globally-benchmarked low-voltage switchgear factory at Kalwa is capable of producing more than 180 variants at the rate of one product every nine seconds. The plant can manufacture over five million devices annually, meeting very high degree of precision and quality of global standards. This digital manufacturing helps us enhance our efficiency, fight scale advantage of some other manufacturing countries, minimise manufacturing defect and shorten production time.


On the consumer side, the disruption will be somewhat similar to what happened to cars around 20 years ago when air-conditioning was an option for high-end variants – now it is standard in all cars! Five years from now, practically all switchgear will be communication-capable and connected to IoT!

What's your preparedness in the area of 'digital switchgear'?

We have a manufacturing facility in India that is a true digital factory. Here, all the data is transformed in a digital format. This is a completely digital setup that

The industry is also seeing the emergence of new business models such as pay as you save. The switchgear is turning inherently intelligent, allowing for predictive maintenance. So, the failures and downtime will minimise.

starts at the level of product R&D and goes all the way through manufacturing simulation, building the manufacturing facility from the optimised and simulated product, and plant data. This factory is globally benchmarked and is capable of manufacturing many variants of products with a high degree of precision.

We also have smart switchboards with communication capabilities installed in it. They are capable of communicating to the Cloud through the PLC. We have also developed apps on Mindsphere, the Cloud-based open IoT operating system from Siemens that connects the customers' products, plants, systems, and machines. Using these apps, customers can track their usage pattern, start generating data, run data analytics on it to get meaningful insights on their usage patterns and see where and how they can save energy. This will improve efficiency for the users in the area of industry, infrastructure or buildings. 

Testing & Certification of M V Circuit Breaker

Due to the continuous increase of power handling capacity, increase in network voltages, continuous design improvements and operational requirements of switchgear. In this article, short circuit test duty requirements of 12kV circuit breaker are discussed.



In Electrical Power network, switchgear equipment plays the role of protection to the connected loads and ensure safe operation of entire electrical system.viz., generator, transmission line and downstream distribution network. Due to the continuous increase of power handling capacity, increase in network voltages, continuous design improvements and operational requirements of switchgear are happening all around the globe. Circuit breaker is the prime component of switchgear ensuring the protection to the electrical network.

Role of CPRI

CPRI is a pioneer testing organisation in India with five decades expertise in the short

circuit and dielectric testing, short circuit design data reviews, quality control checks and stage inspection of various power system equipment. Presently, CPRI is expanding its testing activities globally with international institutions such as ASTA Intertek UK, KEMA Netherland and also as a member of STL for testing and certification of various LV and MV Switchgears and Power & Distribution Transformers as per International Standards

Testing laboratories play an important role in determining the capability study as well as development of new technologies. CPRI is continuously engaged in testing of various types of switchgear equipment from last five decades and issuing test certificates and test reports as per national & international standards.

To prove the satisfactory performance of vacuum circuit breakers under different operating conditions, various tests have been carried out as specified in the international and national standards. In the past, large number of circuit breakers has been tested in CPRI, covering different types of interrupters and a large range of short circuit currents.

In CPRI, Bhopal, the medium voltage circuit breakers rated upto 12kV are tested with source power derived from specially made short circuit generators imported from overseas. The circuit breaker has to operate several times switching on and off normal load currents and interrupt huge fault current whenever there is a short circuit happening in the network. Further,

they operate under special switching conditions like capacitor switching and out of phase breaking.

Type Tests Certification Procedure

When a circuit breaker has satisfied the specific requirements, the STL member will, upon request, issue one of the following types of certificate:

Type Test Certificate of Complete Type Tests

This certificate provides the verification of the rated characteristics of a circuit-breaker assigned by the manufacturer in accordance with clause 4 of IEC 62271-100. The certificate comprises those tests necessary to show compliance with all type test requirements as detailed in clause 6 of IEC 62271-100.

Type Test Certificate of Dielectric Performance

This certificate provides verification of the dielectric performance of a circuit-breaker in accordance with the requirements of clause 4, item b) of IEC 62271-100. The certificate comprises those tests necessary to prove compliance with the applicable lightning and switching impulse voltage test requirements, the power frequency voltage test requirements (wet and dry) and the radio interference voltage tests, as detailed in sub-clause 6.2 and 6.3 of IEC 62271-100 and when tested in accordance with IEC 60060-1.

Type Test Certificate of Temperature Rise Performance

This certificate provides verification of the temperature-rise limits and measurement of the

resistance of the main circuits of a circuit-breaker in accordance with sub-clause 4 d) of IEC 62271-100. The certificate comprises those tests necessary to prove compliance with sub-clause 6.5 of IEC 62271-1 and sub-clauses 6.4 and 6.5 of IEC 62271-100.

Type Test Certificate of Short-Circuit Performance

This certificate provides verification of the short-circuit ratings assigned by the manufacturer in accordance with clause 4, items e) to p) inclusive and also s) of IEC 62271-100. The certificate comprises those tests necessary to show compliance as detailed in sub-clause 6.6 of IEC 62271-1 and sub-clauses 6.6, 6.102 to 6.110 and 6.112 of IEC 62271-100.

Significance of Short-Circuit Test Duties

The different short circuit or terminal fault test duties represent different situation in actual operation and the test stresses chosen accordingly. The basic aim of each test duty is as follows:

Test Duty – T10

Test duty T10 consists of the rated operating sequence at 10 per cent of the rated short-circuit breaking current (Tolerance ± 20 per cent) with a d.c. component at contact separation not exceeding 20 per cent and power frequency recovery voltage ± 5 per cent of rated voltage.

In the system when breaker is connected to the primary circuit of a transformer and a fault occurs on the secondary side, the fault current is limited to a very low magnitude owing to the impedance of the transformer. Under these

Basic type test certificate	(a)	(b)	(c)	(d)	(e)
Mandatory type tests for certification					
Dielectric tests	*	*			
Measurement of the resistance of the main circuit	*		*		
Temperature-rise tests	*		*		
Short-time and peak withstand current tests	*			*	
EMC tests	*	+	+	+	+
Mechanical operation test at ambient tests	*	+	+	+	+
Short-circuit current making and breaking tests	*			*	
Capacitive current switching tests	*				*
Mandatory type tests for certification, where applicable					
Radio interference voltage tests	⊗	⊕			
Tightness tests	⊗	⊕	⊕	⊕	⊕
Verification of the degree of protection	⊗	⊕	⊕	⊕	⊕
Extended mechanical endurance tests	⊗	⊕	⊕	⊕	⊕
Low and high temperature tests	⊗	⊕	⊕	⊕	⊕
Humidity test	⊗	⊕	⊕	⊕	⊕
Static terminal load tests	⊗	⊕	⊕	⊕	⊕
Critical current tests	⊗			⊗	
Short-line fault tests	⊗			⊗	
Out-of-phase making and breaking tests	⊗			⊗	
Electrical endurance tests	⊗			⊗	
Tests to prove operation under severe ice conditions	⊗	⊕	⊕	⊕	⊕
Single-phase and double earth fault tests	⊗			⊗	
Capacitive current switching tests	⊗				⊗
Switching of shunt reactors and motors	#				#

Basic type test certificates:

- Type Test Certificate of Complete Type Test
- Type Test Certificate of Dielectric Performance
- Type Test Certificate of Temperature Rise Performance
- Type Test Certificate of Short-circuit
- Type Test Certificate of Switching Performance – When verifying the condition of circuit-breakers after capacitive current switching tests evidence of short-circuit performance must be available to the testing laboratory performing the capacitive current switching tests and the certificate shall have preferably been issued by a registered laboratory of the same STL member. Alternatively, the certificate may have been issued by another STL recognised testing laboratory but it is to be the decision of the laboratory conducting the capacitive current switching tests as to its acceptability.

* Mandatory

+ Choice of Certificate. See General Guide, Clause 5, note b)

⊗ Mandatory, if applicable

⊕ May be added to the certificate if relevant. See General Guide, Clause 5, note b)

May be added to the certificate if relevant. In this case the standard IEC 62271-110 "Inductive load switching" shall be applied.

Continued on Page 46



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Continued from Page 44

conditions, the rate of rise of recovery peak voltage are high. In order to stress the breaker for maximum TRV the test current should be kept symmetrical, hence the influence of dc component on the stress is negligible. The rate of rise of TRV is 1.92kV/μSec with 25kVpeak @ 12kV(specified in IEC62271-100).

Test Duty – T30

Test duty T30 consists of the rated operating sequence at 30 per cent of the rated short-circuit breaking current (Tolerance ±20 per cent) with a dc component at contact separation not exceeding 20 per cent and power frequency recovery voltage ±5 per cent of rated voltage.

In the interconnected system invariably, the load is fed by several sources in parallel. In the event of fault occurring with only the local source connected and others disconnected, the stresses appearing represent the situation of this duty. It may then have dc component much higher than the maximum possible at rated short circuit breaking current. The test duty should, therefore, verify the ability of a breaker to cope with high dc component.

Test Duty –T60

Test duty T60 consists of the rated operating sequence at 60 per cent of the rated short-circuit breaking current (Tolerance ±10 per cent) with a dc component at contact separation not exceeding 20 per cent and power frequency recovery voltage ±5 per cent of rated voltage.

This test duty may be regarded to prove a somewhat higher rate of rise of TRV at reduced short

circuit current compared to 100 per cent short circuit current. The choice of symmetrical current seems logical as the objective is to verify the higher TRV rate of rise capability at reduced short circuit current. The rate of rise of TRV is 0.81kV/μSec with 22.0kVpeak @ 12kV (specified in IEC 62271-100).

Test Duty – T100s

Test duty T100s consists of the rated operating sequence at 100 per cent of the rated short-circuit breaking current (Tolerance +5 per cent) with the percentage of the dc component at contact separation shall not exceed 20 per cent of the ac component.

An important message in the test is related to the implementation of recovery voltage over the arc.

- i. The ability to interrupt rated symmetrical short circuit breaking current at full TRV,
- ii. Reclosing capability and
- iii. Ability to perform the rated operating cycle. A long tripping delay in the CO operations is maintained to allow the dc component to decay giving an essentially symmetrical current, hence to achieve full TRV (The rate of rise of TRV is 0.34kV/μSec with 20.6kVpeak @12kV as specified in IEC 62271-100).

The characterisation is slightly easy, as current zeros are showing every 60 electrical degree. The imposing time for recovery voltage has been defined by IEC standard.

Mostly testing stations have an inherently higher X/R ratio resulting in higher peak/rms factor. Hence, there is a provision in the standard to split the 100 per cent symmetrical duty into making and breaking capacity tests respectively to keep

the making current within the safe limits of the breaker. The making capacity tests (test duty T100s(a)) is duty with rated operating cycle and short circuit current slightly lower than the rated short circuit breaking current in order to achieve the required making current. However, by adding power resistors in the test circuit the splitting of TD-T100s(a) can be avoided. The breaking capacity test (test duty T100s(b)) consists of only break shots at 100 per cent rated short circuit current.

There are three specific operating sequences namely:

- a O–3min–CO–3min–CO
- b CO–15sec–CO (Auto Reclose Duty)
- c O–0.3sec–CO–3min–CO (Rapid Auto Reclose Duty)

The objective of keeping 3-minute interval is to allow the operating personnel to accept the fault and to reclose the circuit manually after taking appropriate decision. The 0.3 second interval presumes the nature of fault to be transient which may die down within this time span of 0.3 second and is termed as the rapid auto reclose duty. The 15 second interval depicts an alternative operating sequence for auto reclose duty. The choice may depend upon the type of application.

Test Duty – T100a (100 per cent Asymmetrical current test)

This duty seems to be the most onerous duty for many circuit breakers to prove the capability in following respects:

- i. Interrupting capability after maximum arc energy condition

Continued on Page 48

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Continued from Page 46

ii. Sufficient operating energy.

Test-duty T100a is only applicable when the minimum opening time top of the circuit-breaker, as stated by the manufacturer, plus the relay time is such that the dc component at the instant of contact separation is greater than 20 per cent.

Single-phase and double-earth fault tests

Circuit-breakers shall be capable of clearing single-phase short-circuit currents which may occur in two different cases:

- In effectively earthed neutral systems in case of single-phase faults or,
- In non-effectively earthed neutral systems in case of double earth faults, i.e. earth fault on two different phases, one of which occurs on one side of the circuit-breaker and the other one on the other side.


Depending on the neutral earthing condition of the system in which the circuit-breaker is

intended to be used. This is applicable only to three pole breakers intended for use on an effectively earthed system, with the three poles coupled mechanically and fitted with a common opening release. The tests are intended to show the operations of the circuit breakers, not adversely affected by the unbalanced forces produced. Tests on breakers with operating rods eccentric to the mechanism are conducted on the pole which is farthest from the operating rod, which gives the maximum unbalanced forces on the inter-pole coupling mechanism.

Conclusion

When the circuit breaker is interrupting short circuit currents, a high magnitude and fast rising transient recovery voltage (TRV) appears on the circuit breaker terminals which stresses the insulation medium of circuit breakers. In the testing laboratory, the source has to supply high fault

current and fast rising TRVs to evaluate the circuit breaker performance. The guidelines for setting the fault current magnitude and Transient Recovery Voltage parameters are given in IEC standard 62271-100. These parameters represent the most onerous system conditions.

The medium voltage switchgear manufacturer in and around central part of our country and other places utilise CPRI, Bhopal laboratory for circuit breaker certification and development. This facility is a boon for developing not only breakers and other switchgear equipment like fuses, disconnectors, earth switches and lightning arresters etc. The STDS, Station-1 is serving our nation for development of switchgear for past 57 years. 



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“Smart Cities, Digitisation etc will impact the growth of UPS market in India”

The UPS market in India will witness strong growth in the future, informs **Palash Nandy, CEO, Numeric** during an interaction with **Electrical India**.

Please take us through the milestones of the company.

Established in the year 1984, Numeric is now one of the top three UPS manufacturers in India. Numeric introduced its first UPS in the year 1985. And subsequently, we also launched other power conditioning products. The combination of having very good quality products with the best-in-class service infrastructure helped us to build a sustainable business model. Today Numeric has evolved as the undisputed leader in Single Phase UPS and Line Interactive UPS for the last 25 years.

Numeric has a complete solution in UPS across Line Interactive, Online Single Phase, Three-Phase and the latest generation Modular UPS. This enables Numeric

to cater to any application from 600 VA to 21 MW and across all market verticals.

Numeric, over the years has built the largest service networks, consisting of 254 service centres across India. Close to 1,200 people are dedicated in the service operations, of which, there are close to 900 field technicians. We provide our customers with proper service irrespective of their business locations. Being a part of the Legrand group, Numeric now gets access to the best-in-class technology worldwide and our own experience in the domestic market provides us fantastic market knowledge. We now proudly mention ourselves as a GLOCAL company- Global expertise and local knowledge.

We have recently unveiled our new identity. It builds

along four pillars – innovation, smart solutions, power to people and pre-emptive partnership. Our new identity is – new energy to power.

What is the USP of your products? What kind of innovations would you like to make in your products to make them more energy and cost-efficient?

What sets Numeric Group apart is a combination of two amazing advantages. Firstly, Numeric became a part of Legrand Group in 2012, which gives us complete access to Legrand's global expertise. Secondly, we have a strong experience of the Indian market and are precisely aware of the customer requirements. So, our global expertise coupled with local experience and knowledge is a perfect combination which is extremely difficult to beat.

Another amazing benefit of Numeric is our broad and strong product portfolio and exemplary service. We are perhaps the only company with a wide product portfolio from 600 VA to 21 MW catering to diverse applications ranging from small projects to large data centres. This is further complemented by our extensive service network.

We, at Numeric, are constantly engaged in maximising value for our customers. Maximising value in terms of technological advancement, customer friendliness in terms of product usage, installation, commissioning and after sales; and provide customers the right service back up. We do not believe in only price competition. We strive to provide the best price vs value proposition to our customers.

R&D at Numeric has been an important asset and a growth driver. Our R&D centre in Chennai enables us to ensure that the products we introduce in the Indian market are perfectly adapted to Indian conditions and habits. We strongly believe in making products environment-friendly and user-friendly– right from selection to installation, to commissioning, usage and trouble shooting. Our products are extremely energy efficient, compact with minimum footprint.

We have been introducing new products at a fast



KEOR Series of Three Phase UPS
- Keor HP by Numeric India

pace. We have introduced three new ranges in the last one year – Keor HP, Keor HPE and UPSaver. All three ranges are extremely energy efficient. In fact, they are the best in class in India today. Along with that all products are extremely customer friendly - small footprint thereby, saving space, easy for installation, commissioning and maintenance. These products are suitable for various applications like large data centres, IT/ITes, industrial, commercial and infrastructure applications.

What is your take on digitisation of UPS?

UPS systems have become an important part of commercial and industrial sectors such as IT or ITES, BFSI, healthcare, retail, educational and research institutes, telecommunication, textile industry, etc. Digitalisation is inevitable in the UPS category. With the advent of IoT and Industry 4.0 UPS will also be expected to be connected. All our UPS are extremely communication friendly. Our range has plenty of connectivity options like USB, RS485, SNMP etc. Through these options it's perfectly possible to supervise and actuate UPS installations from remote. Thereby, ensuring fool proof operations and minimum downtime.

R&D at Numeric has been an important asset and a growth driver. Our R&D centre in Chennai enables us to ensure that the products we introduce in the Indian market are perfectly adapted to Indian conditions and habits. We strongly believe in making products environment-friendly and user-friendly– right from selection to installation, to commissioning, usage and trouble shooting.

What kind of hurdles do you face while offering the company's services or products? What kind of support would you expect from the government?

Due to lack of standardisation- we would like Bureau of Indian Standards (BIS) to be more proactive in terms of ensuring that the products that are being sold in India adhere to the standards prescribed by BIS. There has been a lot of progress in recent years in terms of making BIS registration mandatory for UPS upto 10 kVA. What needs to be strengthened is

the surveillance of the implementation of the same.

There is volatility in the price of lead and the USD exchange rate. Lead is an important component and in the recent months and it has been extremely volatile. This affects the input costs and as a consequence the price and margin. Same is true for USD.

Some of the market segments have become extremely price sensitive. The only factor that has been considered is the price and not the value. Hence, a lot of cheap imports are coming in.

GST implementation has been a great help in making the market better in terms of compliance. This should help all organised and professional manufacturers like Numeric.

Major manufacturers like Numeric should play a more active role in educating or informing the market stakeholders about the technological changes and its benefits.

Import of Chinese equipment is still a matter of concern for the industry. What measures would you suggest overcoming this problem?

At Numeric, we constantly engaged in maximising value for our customers in terms of technological advancement, customer friendliness in terms of product usage, installation, commissioning and after sales provide customers the right service back up. We strongly believe that once consumers have enough of information, they will be well equipped to take informed decisions. Hence, all leaders of the industry should be investing in making the customers more



KEOR T Numeric UPS

informed. We at Numeric are constantly engaged in the same.

In line with our objective of continuously upgrading of product offer, we have launched new products. Our recently launched UPSaver® has flexible operating modes for large facilities, data centres and business-critical applications, the new range allows users range upto 21 MW.

The Government has up-scaled the target of renewable energy capacity to 227 GW by the year 2022. Going ahead, what potential will it generate for the power segment?

We already have products that are compatible with renewable energy sources like solar and wind. As part of the Legrand group, we are closely watching and contributing to the discussions and developments that are

happening in this space and would be ready with required products as and when the demand for the same would arise. We expect incremental business opportunities for the power segment as a result of this development in the renewable energy space.

What is your outlook for the sector?

The UPS market in India will witness strong growth in the future. This growth will be driven by segments like Data Centres, Infrastructure, Healthcare, Education, Modern Retail etc. On top of that initiatives like Smart Cities, digitalisation, ICT @ Schools etc will positively impact the growth of the UPS market in India. This is over and above the need for clean and consistent power for all electronic applications. E

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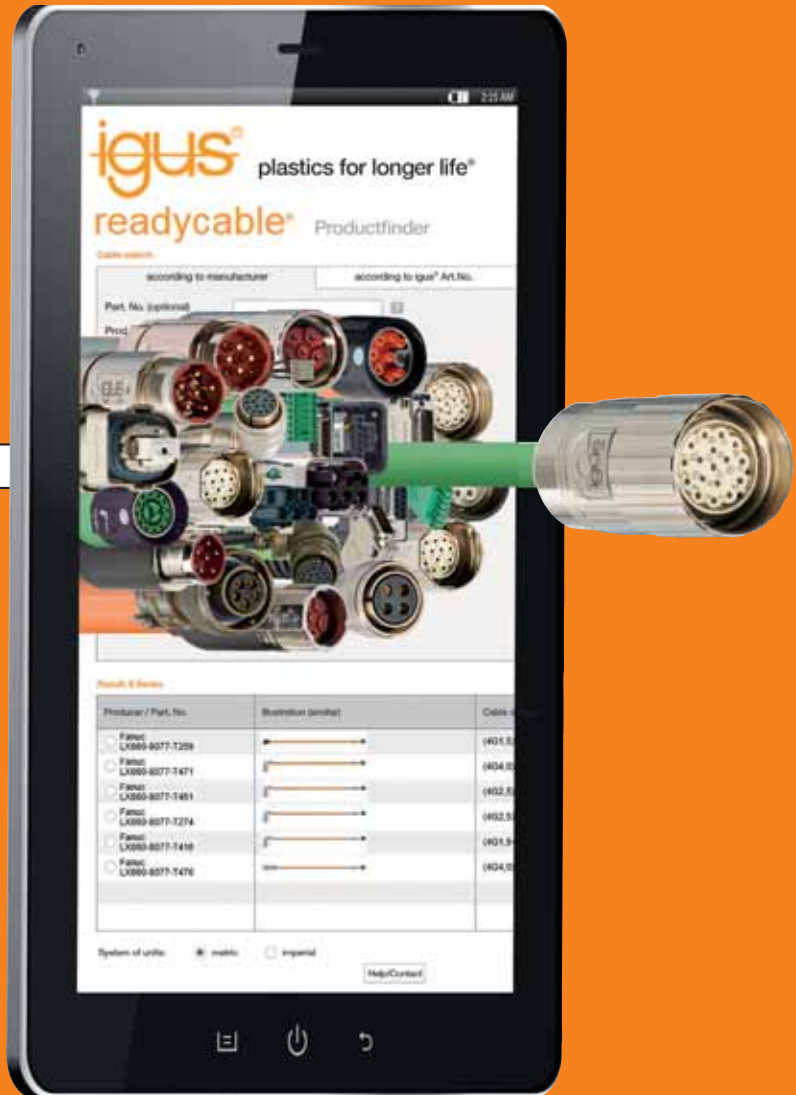
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igus has developed the lokchain energy chain with extending and retracting pins for new machine design concepts

The goal of the new lokchain energy supply system from igus is to automatically increase the operational reliability. This has the potential to reinvent power, data and media supply in many dynamic applications. Automatically extending pins hold the e-chain securely in the guide, allowing completely new solutions in vertical, hanging or circular movement applications.

Whether high-tech or low-tech applications, igus is constantly researching new energy chain solutions to meet the special requirements of industrial applications for flexibility, reliability and low costs. For this reason, the motion plastics specialist developed the lokchain, a new concept consisting of an e-chain with automatically extending pins and a compact guide trough for the dynamic guidance of energy chains. This allows hanging, vertical or side-mounted use of the system with or without lateral acceleration. Even long travels with a moving lower run are possible by fixing the lokchain in the upper run trough. The system can also be used in vertical circular applications. For example, the lokchain is an obvious choice for use in the compact space of rotating C-arm X-ray scanners. The flexibility of this e-chain offers the user the opportunity to develop completely new machine design concepts.



The lokchain principle: automatically extending pins (blue) hold the lokchain firmly in the guide trough. When the chain link bends into the radius, the pin retracts automatically (green) and releases the chain. Due to its flexibility, the e-chain can be used for example in a rotating C-arm X-ray device.

The lokchain principle: automatic locking pin system

The basic principle of lokchain is simple: pins integrated into the side links hold the energy chain firmly in the guide trough. When the chain link is bent into a radius, the pin retracts automatically and releases the chain from the guide. When the chain link comes out of the radius and engages the trough, the pin extends and automatically secures itself back into the trough. This eliminates the need for more costly guide trough systems. In this way, the machine builder saves money.

Silent operation and long service life, even with small bend radii

Due to the special construction of the lokchain there is hardly any abrasion and wear, so the service life of the e-chain is increased. The prototype proved its durability

successfully in an endurance test carried out in the 2,750-sq.m. laboratory at igus. Another advantage of the new e-chain system is the mobility of the chain links. They ensure that the energy chain operates safely and quietly, even with small bending radii and over long travel distances. The new e-chain is currently in the prototype phase, which gives customers the opportunity to help shape the required size and design.

For more details, visit www.igus.in

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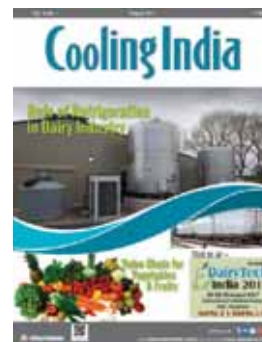
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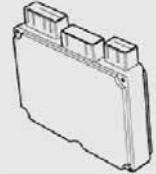
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For Enquiries Contact

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Northern Region

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✉ aditya@titan.co.in

Southern Region

Mr. Praveen Kumar
☎ +91 – 73977 01444
✉ praveenk1@titan.co.in

Western Region

Mr. Kiran Naik
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Technological Development of Switchgears

With the pace of government initiatives for development of smart grid, there is need to develop different kinds of switchgear suitable for smart grid operation and that is more compact, reliable, environment friendly and requires minimum installation and commissioning time.



Picture Courtesy: www.rftraining.co.za

The reliability of a power system directly depends on the efficient functioning of its equipment especially in the wake of greater integration of variable renewable energy with the grid. Substations transform the voltage from high to low and house the various equipment required for

transformation, switching, regulation and protection of transmission and distribution systems. Switchgear is one of the most important and critical components in an electrical system. It includes all the devices that ensure power system protection and regulate power

supply. Switchgear de-energises equipment and clears faults in the system, thereby, ensuring reliable power supply. Electrical switchgear is necessary at every switching point in the electrical power system. Besides the power system, switchgear is also used in the commercial, residential and industrial sectors.

The switchgear comprises devices associated with power system control and protection such as switches, fuses, circuit breakers and relays that are used to control, protect and isolate an electrical equipment to enable continuous and reliable supply of electricity. The use of switchgear helps in protecting against

situations of overload, short circuit, insulation failure etc. Power system protection is a bough of electrical power engineering and it is designed to continuously monitor the power system to ensure maximum continuity of electrical supply without damaging equipment. Since power system developments change its structure, the power system protection becomes very vital.

The switchgear industry in India mainly covers low voltage switchgear (with a rating below 1 kV) products. With huge emphasis on electrification, the medium voltage switchgear (with ratings between 1 kV to 33 kV) requirement is expending at a rapid pace. The

demand for high voltage and ultra high voltage switchgear is also picking up on the back of investments being undertaken by the government for the development of high voltage and ultra high voltage transmission infrastructure. In addition, with the continuously increasing renewable energy capacity, switchgear has become pivotal in ensuring that networks operate in a synchronous manner with minimum faults. Further, modern business requirements call for upgraded switchgear that can ensure safety, reliable power supply and continued business operation.

The design of switchgear has to ensure that it will be able to detect



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abnormal or undesirable conditions and then trip the circuit to disconnect the affected area without affecting other undesired areas. Air-insulated switchgear and gas-insulated switchgear are the most widely deployed switchgear technologies in India and worldwide. However, there are several modern technologies available now including hybrid switchgear, green switchgear and intelligent switchgear that are more compact, environment friendly and smart. The switchgear industry has witnessed technological advancements across all voltage levels. Industrialists are constantly trying to develop different kinds of switchgear that is more compact, reliable and environment friendly, and require minimum installation and commissioning time.

Switchgear Classification

The technology and range of switchgear varies across different segments of the grid, depending on the voltage level. Based on the load-bearing capacity, the switchgears are categorised into three segments – low voltage (LV), medium voltage (MV) and high voltage (HV). The LV switchgear segment includes switchgear rated up to 1 kV, the MV segment consists of switchgear rated up to 33 kV, and the HV segment includes devices rated at 66 kV and above. The key consumer segments of LV switchgear include distribution utilities, industries, residential and commercial buildings, and agricultural consumers. Common LV switchgear devices include air circuit breakers (ACBs), moulded case circuit breakers (MCCBs),

motor protection circuit breakers (MPCBs), miniature circuit breakers (MCBs), residual current devices (RCDs), switch fuse (S/F) and fuse switch (F/S) units, high rupturing capacity (HRC) fuses, thermal overload and protection relays, connectors, starters, distribution boards and switches.

MV and HV switchgear is often categorised as one owing to its usage and applications, which are mainly in power systems. MV switchgear includes various types of circuit breakers such as air circuit breakers, minimum oil circuit breakers and vacuum circuit breakers. For the MV and HV segment, transmission and generation utilities are the key users. Depending on the insulating medium, HV switchgear is classified into three major types – air insulated switchgear (AIS), gas-insulated switchgear (GIS) and hybrid switchgear (HS).

The different kinds of switchgears can also be classified on the basis of their load bearing capacity (or voltage class), the medium used to interrupt the current, the interrupting rating (which is the maximum short circuit current that the device can safely interrupt), construction type, operating method and type of current. As per the construction type, switchgear is classified as indoor, outdoor, industrial, live-front, dead-front, open, metal-enclosed, metal-clad, arc resistant etc. With regard to the method of operation, a switchgear is classified either manually operated or motor/stored energy operated, or solenoid operated. Meanwhile, depending on the type of current, it operates either on alternating

current or direct current. In addition, based on the medium used to interrupt the current, a switchgear is classified as either a simple open-air isolator switch or it may be insulated by some other material like oil and vacuum.

New developments in the switchgear industry are vacuum switchgear, hybrid switchgear and intelligent switchgear. Vacuum switching widely used in the medium voltage range, is also emerging as an alternative in HV applications. This trend is being driven by the fact that the vacuum switchgear is more environment friendly than SF₆ switchgear. Hybrid switchgear is a combination of conventional air insulated switchgear and high voltage gas insulated switchgear. With the development of smart grid, the smart switchgear has also become popular. It is also capable to handle increasing integration of variable renewable energy into grid.

Technology Development

Owing to an increasing focus on conserving right of way and ensuring uninterrupted power supply, power utilities are focusing on substation and switchgear technologies that require less space and have a reduced outage. Historically, air-insulated switchgear has been the most commonly used switchgear in India due to the low price. However, gas-insulated switchgear, which use sulphur hexafluoride (SF₆) gas as the insulating medium, are picking up pace and gaining popularity, is the emerging as the preferred technology in India, especially, in the transmission segment. Its compact and

encapsulated structure makes it ideal for areas with space constraints. This kind of switchgear is also suitable for use in locations with severe weather conditions (high temperature and high altitudes) and in industrial environments. GIS substations require approximately 35 per cent less space than AIS substations and have lower maintenance and outage costs. Although the initial cost of GIS substations is about 50 per cent higher than that of their AIS counterparts, the overall capital costs are comparable.

Utilities can also opt for a hybrid switchgear – based substation, which is a mix of AIS and GIS technologies. In a hybrid substation, the busbars are air insulated and all other equipment

such as circuit breakers, bushings, busducts, connecting elements, disconnectors, current transformers and sensors are gas insulated. The initial cost of hybrid substations is approximately 20 per cent higher than that of AIS, and these substations require a moderate size of land.

Ultra high voltage (UHV) and smart switchgear are the other key emerging technology trends. The growing demand for greater transmission of power over long distances and with lower losses necessitates the move to UHV or EHV transmission technologies at 800 kV, 1100 kV and 1200 kV. Powergrid has commissioned the (+/-) 800 kV North East Agra UHDC link, (+/-) 800 kV Champa-Kurukshetra Bipole and the 1200

kV UHVAC Bina National Test Station. It is currently executing the (+/-) 800 kV Raigarh-Pugalur UHVDC link. These large UHV systems require switchgear that can meet safety, performance and reliability demands.

With the increasing integration of renewable energy into grid, there is a need for automatic switchgear solutions that provide better monitoring and control capabilities. To meet this demand, smart internet of things ready switchgear solutions are coming, which can connect to the internet to provide real time monitoring, predictive diagnostics and better protection against faults. These switchgears are embedded with intelligent electronic devices and are preprogrammed for the



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remote monitoring and communication of key electrical parameters like current, voltage, faults etc. This facilitates the automatic regulation of incoming and outgoing power, transfer of power during peak load, and opening and closing of switches to maintain power load. Smart switchgear can also be seamlessly integrated with energy management, building management, supervisory control and data acquisition and other enterprise-level utility systems to control power flow and achieve energy savings.

Smart Grid Operation

In smart grid operation, automated switchgear operation is preferred over conventional operation. In conventional substations, all signals, controls and interlocks are hardwired and records are manually maintained in a logbook. Therefore, a lot of work and efforts is required to draw comparisons for analysis and trouble shooting. An automated substation, wherein all operations are automated, is more efficient and requires less manpower. It also promotes energy efficiency and ensures better utilisation of assets thereby, smartly handled the uninterrupted power flow through smart grid.

Traditionally, remote terminal units were used in substations as a link between the switchgear and the control centre. Some of these remote terminal units had intelligence features such as interlocking features, but no substation or region-wide automation was available. However, now more and more

remote terminal units are being replaced by or complemented with specialised intelligent electrical devices that are capable of multiple protections and measurements in smart grid operation. In addition, intelligent gateways and concentrators have been introduced in the substation. In smart grid operations, monitoring and signaling are becoming an integral part of the switchgear, in addition to protection and control functions. Manufacturers are including intelligent built-in protection and control electronic devices in the switchgear to enhanced grid efficiency and reliability.

Switchgear Digitilisation

Over the past few years, several technological solutions have emerged that have contributed significantly to enhancing the operational efficiency of utilities and to scaling down costs, making projects more viable. Digital switchgear and substations are one such solution which offers a range of benefits to utilities. To begin with, they are equipped with advanced software solutions that protect systems from potential cyber threats, thereby, strengthening system security. Further, all the auxiliaries of the digital switchgear are automated, enabling faster implementation of future technological solutions. Moreover, since utilities can track real-time data from substations and remotely control specific functions of the switchgear, it provides operational and financial benefits. Real time monitoring of data also reduces outage time and increase reliability of the system.

In addition, digital substations and switchgears possess backward compatibility, which enables the smooth integration of new communication technology with the utilities existing systems. Other benefits of digitilisation is reduced maintenance costs. This is primarily because utilities can monitor and control parameters in real time, thereby, reducing the need of periodic maintenance. Apart from the operational and financial benefits, digital switchgears have another crucial purpose. Through compact primary equipment and smaller relay rooms, they reduce the substation footprint, thereby, allowing utilities to use the remaining space more efficiently. Digital switchgear also entail a lower installation time, since there are fewer panels to install and fewer cables to be pulled, connected and tested.

Way Forward

The substation and switchgear industry is set to grow rapidly in the coming years. So far growth in the switchgear industry has been driven by a strong demand for low voltage and medium voltage switchgear from distribution and sub transmission networks. However, in the last year, the growth in demand for high voltage switchgear was greater than that for low voltage and medium voltage switchgear. In the coming year too, the demand for high voltage and ultra high voltage switchgear is expected to drive the growth of the switchgear industry.

With various transmission and distribution strengthening initiatives being undertaken by the government and the target to

achieve 100 per cent household electrification, the switchgear market is likely to continue on its growth trajectory. Various central government schemes aimed at strengthening transmission and distribution networks such as the green energy corridors, IPDS and DDUGJY, and at expanding electricity access such as Saubhagya are also playing a key role in spurring equipment demand. The expansion of HVDC and HVAC transmission projects as well as launch of the smart cities initiatives is expected to further drive the demand for advance substation and switchgear solutions. Switchgear industry is a well established and equipped industry with continuously developing technologies to support

this growth. The transmission voltage landscape has been shifting towards higher voltage as it enables the flow of more power and integration of renewable energy. This is also evident from the current 25 percent share of the 765 kV voltage level in powergrid transmission lines against only 2 percent in 2012. The upcoming trend in the transmission segment is that of the UHV network. The power transfer capacity of a UHV line is around 4 times higher than that of 765 kV line. It will increase the demand of HV and UHV switchgear and associated equipments.

Conclusion

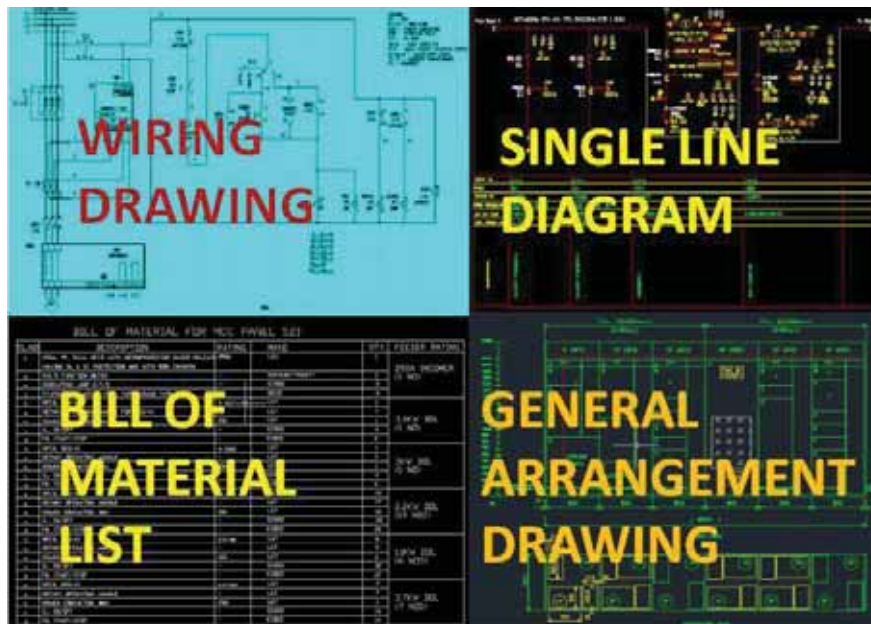
With the pace of government initiatives for development of

smart grid, there is need to develop different kinds of switchgear suitable for smart grid operation and that is more compact, reliable, environment friendly and requires minimum installation and commissioning time. Moreover, as the pace of renewable energy integration increases, utilities would be required to increase the deployment of intelligent switchgear or to undertake modifications to transform the existing switchgear modules into smart switchgear. BT



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Timing measurements on gas-insulated switchgear (GIS) with grounding on both sides

When measuring operating times on GIS with grounding on both sides, testing methods such as dynamic resistance measurement (DRM) don't deliver reliable results due to the low-ohm ground connections that run parallel to the circuit breaker. CIBANO 500 provides a new and simple solution to this problem, which allows the operating times to be determined accurately despite the fact that the GIS is grounded on both sides.

Circuit breaker testing in GIS – why don't conventional methods work?

The operating times during C, O, CO, etc., are measured and compared with the manufacturer's reference values for circuit breakers in gas-insulated switchgears. This allows the condition of the interrupter unit and the operating system to be assessed.

Test sets and the circuit breaker are usually connected by tapping the grounding switches on the switchbay. Due to the low-ohm ground connection resulting from the metallic GIS enclosure that runs parallel to the circuit breaker where both sides are grounded, there is no significant increase in the measured voltage or the resulting resistance at the time of the contact separation. Measuring the operating times is thus rendered impossible, as a suitable resistance threshold value cannot be chosen. Therefore, testing methods such as the DRM cannot be used for measuring the operating times of GIS.

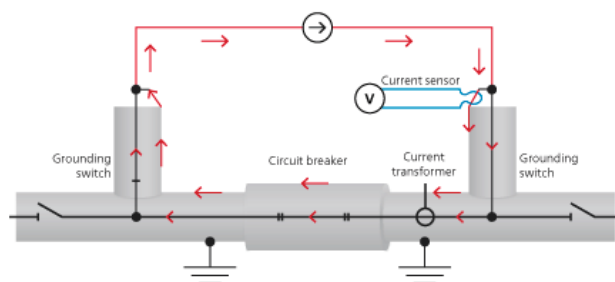


Figure 1: Inductive measurement of the current change with the CSM method

For this reason, timing measurements are often conducted with insulated grounding, or with grounding that is only on one side. Yet this carries the risk of capacitive coupling from adjacent components or switchbay sections on the non-grounded conductor. Therefore, on-site testing using these methods is often impossible or prohibited in many cases.

Which alternative test methods have been used to date?

Test sets that are based on measuring the dynamic circuit breaker capacity (DCM) provide an alternative to the tests that are frequently prohibited when grounding is insulated or only done on one side. As a result of installing additional ferrite cores on the grounding switch, the parallel ground impedance can be increased when using the DCM test procedure. However, the assembly and setup is time-consuming. The feasibility of this process is also more restrictive



Figure 2: Measuring setup of the CSM method



Figure 3: The current sensor is laid around the ground connection of the grounding switch and connected to CB MC2



Figure 4: The Primary Test Manager software shows the results of the timing measurement using CIBANO 500 and the CSM method

and a variety of ferrite core types are needed, which increases the cost.

Current Sensor Measurement (CSM)

CIBANO 500 offers a new, alternative method for measuring operating times in GIS – called the Current Sensor Measurement method, or CSM method for short. The operating time is measured via an inductive current change measurement using the parallel ground connection or the circuit breaker, while the GIS remains grounded on both sides (see Fig. 1).

In order to do this, the circuit breaker is connected to CIBANO 500 via the CB MC2 accessory (Fig. 2). The CB MC2 has a constant current source (e.g., IDC = 200 A) and a measurement channel for the current sensor. The sensor is laid around the ground connection of the grounding switch (Fig. 3). The current change that is measured through the ground connection or the circuit breaker is then used to determine the switch response times. The circuit breaker remains grounded on both sides throughout the entire measurement.

Advantages of the new CSM method

When using this new CSM method, the ground connections on the grounding switch don't need to be removed and additional components don't need to be installed. A current sensor just needs to be connected to the switchbay grounding switch. Since these sensors have a flexible design and can easily be installed on a multitude of different grounding switches, they are ideal for on-site applications in GIS installations. Therefore, the CSM method is a faster and simpler alternative method for precisely measuring the operating times of a GIS that is grounded on both sides.


Did you know?

After timing measurements or high residual currents with transient DC components, there may be some residual magnetism left over in the GIS's current transformer. CIBANO 500 also features the "CT Demagnetisation" function, which quickly and easily demagnetises the current transformer after timing measurements.






Andreas Nenning

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Arc Flash Analytics and Protection

For every process, identification of risk and protection is essential therefore, to ensure safety and regulatory compliance, operators must develop and implement feasible protection schemes for e-hazards at workplace...



According to NFPA 70E, every year more than 2000 workers are hospitalized in extensive injured condition caused by arc flash accidents. Therefore, to recognize and understand Arc flash phenomena and its significant threats, IEEE and NFPA are applying efforts to support research and development.

Arc Flash Phenomena

Arc flash, a type of electrical explosion, is one of the most complex e-Hazard in the workplace. Day by day in the electrical safety world its understanding is gaining significant importance. The basic phenomena of the arc flashes, arc blast, electric arc, electrical explosion are the same. Basically, arc is a flow of

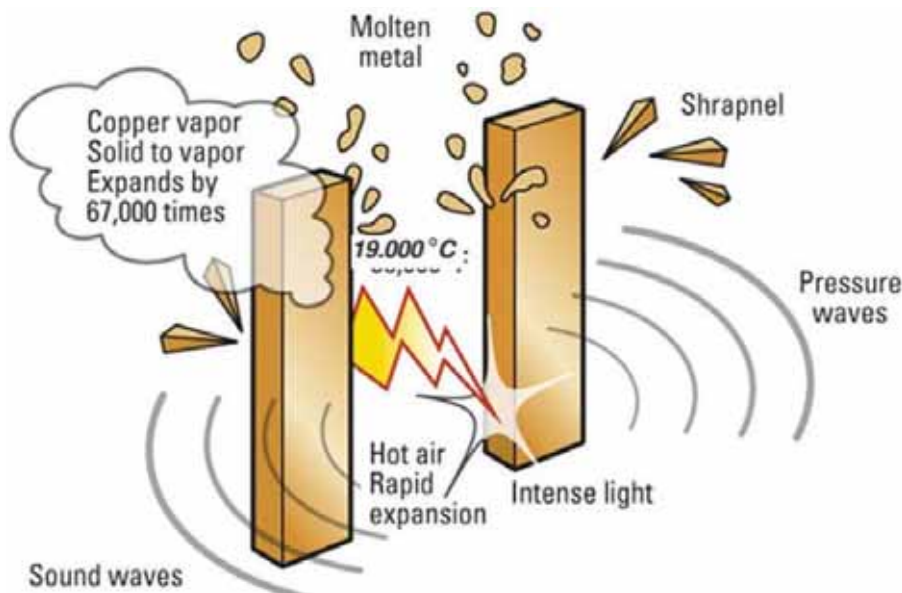


Figure 1: Arc Flash phenomena

electricity through ionized gases. When an arc flash occurs, large amount of energy dissipates from conductive plasma. Superheated ambient air produces a rapid volumetric expansion known as arc blast and consequently an explosion. An arcing fault usually occurs between phase bus bars or from phase to neutral or ground. During this event, intense light with sound waves, shrapnel, molten metal with toxic gases and smoke are generated which become components of the arc flash as shown in Figure 1. Due to the aforesaid hazard, a person exposed to arc flash may suffer severe burns, lung damage, vision loss, eardrum ruptures and even death.

Some Important Arc Flash Terminology

Some important terminologies used for arc flash analysis and mitigation through IEEE Std. 1584 & NFPA 70E are given below.

Fault Current

- Arcing fault current: Fault

current flows through an electrical arc plasma.

- Bolted fault current: Short circuit current flows between conductors at different potentials having zero or negligible impedance.
- Fault current: A current that flows from one conductor to another conductor or one conductor to ground due to an abnormality produced in the system.
- Available fault current: It is the fault current that can be provided by the serving grid or utility, owned generators and large electric motors, subjected to the impedance of the path.

Hazards

- Shock hazard: A dangerous condition associated with the release of energy.
- Electrical hazard: A dangerous

condition as a consequence of shock, arc-flash burn, thermal burn, or blast due to unintentional contact or failure of equipment.

- Electrical shock: Physical stimulation that occurs when electrical current passes through the body.
- Arc-flash hazard: A dangerous condition occurred due to electric arc produced by release of energy.
- Flash hazard analysis: A method to determine the risk of personal injury as a result of exposure to incident energy from an electrical arc flash.

Grounding

The solidly grounded electrode is treated as a grounded system while open or high or low resistance grounding is treated as an ungrounded system.

Total Clearing Time

It is the sum of relay operating time and breaker interrupting time.

Incident Energy

It is the amount of energy incident on the surface at distance of Arc Flash Boundary (AFB).

The Incident Energy of 1.2 Cal/cm² for bare skin is used in solving the equation for arc flash boundary in IEEE 1584 Guide for performing Arc Flash Hazard Calculations.

Incident Energy and Clearing Time vary proportionately. Since in the steep portion of protective

Table 1: Arc Flash Protection Boundaries

Arc Flash Boundaries	Distance from Live conductor to a person within which –
Arc Flash Protection	– Person could receive a second-degree burn
Limited Approach	– A shock hazard exists
Restricted Approach	– Possibilities of electric shock increases

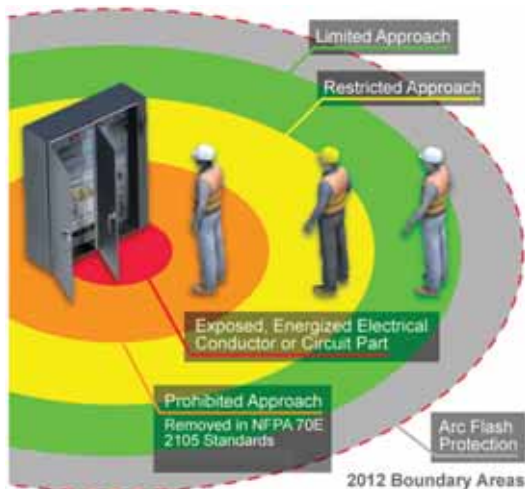


Figure 2: Arc Flash Boundaries

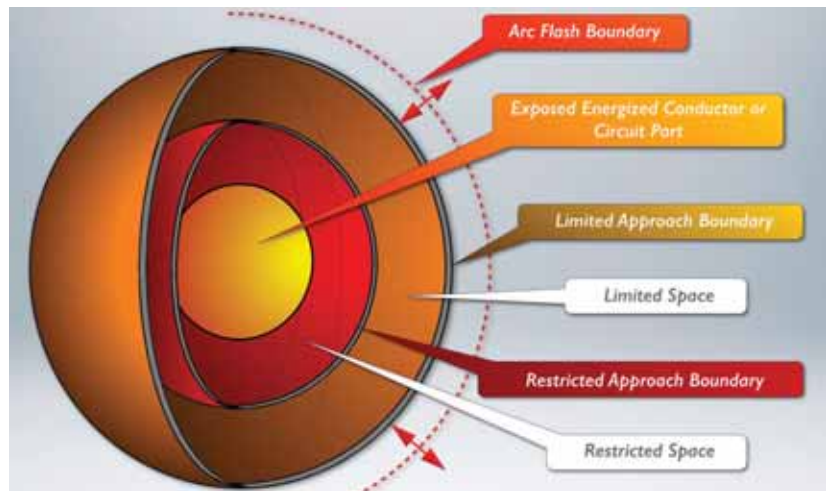


Figure 3: Limits of Approach

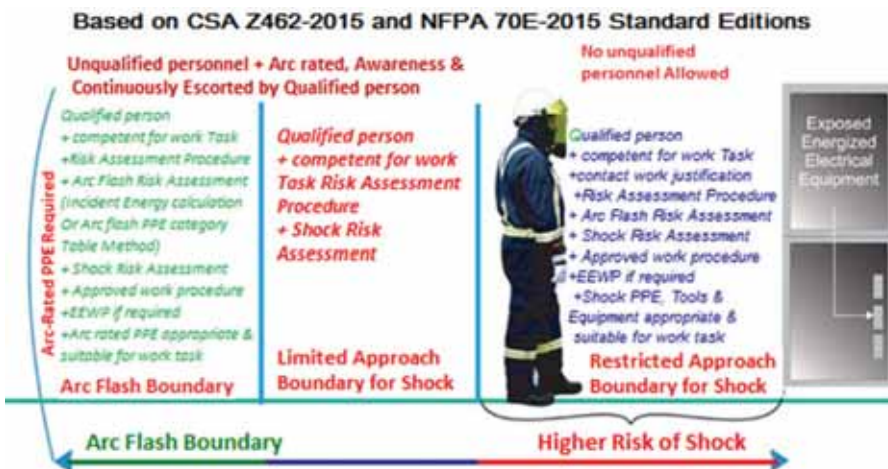


Figure 4: Boundaries for Arc Flash & Shock - Approach Limits

device time-current curves, a small change in current causes a big change in operating time. Therefore, variation in arc current may have a big impact on incident energy.

Arc Flash Boundary & Limits of Approach

Arc Flash Protection Boundaries are described in the table 2. Arc Flash Protection Boundaries are depicted in the figure 2.

Arc flash limits of approach are depicted in the figure 3. Arc Flash

Table 2: Equipment Classes, Distance x Factor & Working Distance

Voltage Range	Equipment Type	Typical Bus gaps	Distance X Factor	Typical working distance
kV		mm		cm
0.208- 1.0	Other	13	2	45.72
	Switchgear/ Switchboard/ Switchrack	32	1.473	60.96
	Cable Bus	13	2	45.72
	Open Air	40	2	45.72
>1.0-5.0	Other	13	2	45.72
	Switchgear/ Switchboard/ Switchrack	102	0.973	91.44
	Cable Bus	13	2	45.72
	Open Air	102	2	45.72
>5.0-15	Other	13	2	45.72
	Switchgear/ Switchboard/ Switchrack	153	0.973	91.44
	Cable Bus	13	2	45.72
	Open Air	153	2	45.72

Continued on Page 70



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— Supporting —



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Table 3: Hazard Category & Recommended PPE

Min Incident Energy	Max Incident Energy	Hazard Category/ Level	Required Min Rating of PPE
Cal/cm ²	Cal/cm ²		Cal/cm ²
0	Eb	0	
Eb	4	1	4
4	8	2	8
8	25	3	25
25	40	4	40
40	and above	Consult	Not Available

Eb: Incident Energy at Boundary distance

Boundaries and Approach Limits as per NFPA 70E-2015 standards are depicted in figure 4.

Equipment Classes, Typical Bus gap, and Working distance

The typical values used for Arc Flash analysis, as Equipment classes, Bus gaps, Distance x factor and Working distance with isolated main PD are tabulated.






Typical working distance: It is the sum of the distance between the worker standing in front of the equipment, and from of the front of the equipment to the potential arc source inside the equipment. Thus, it is the space between the possible arc point and head and body of the operator.

Hazard Category/ Level, Incident

Energy and Recommended PPE

Considering the magnitude of the arc energy within the AFB, all parts of the body which may be exposed to the Arc Flash need to be covered by Arc Rated (AR) clothing, helmet or headgear, face shield, safety glasses, gloves, shoes etc. The protective clothing should limit the incident energy reaching the

Table 4: Hazards level or category, description of recommended PPE

Hazard/ PPE Category Level	Personal Protective Equipment (PPE)	
0 Applied to NFPA 70E 2012 & later	Untreated natural fibre long sleeve shirt & pants (long). safety glasses, hearing protection, heavy duty leather & voltage rated gloves.	
1 4 Cal/cm ²	Arc-rated (AR) long sleeve shirt and long pants or Arc rated overall. Arc-rated face shield, jacket, safety glasses, hard hat, hearing protection. Heavy duty leather & voltage rated gloves, and leather footwear.	
2 8 Cal/ Cm ²	Arc-rated (AR) shirt and pants or Arc rated overall. Arc flash rated suit hood, jacket, safety glasses, hard hat, and hearing protection. Heavy duty leather & voltage rated gloves and leather footwear.	
3 25 Cal/cm ²	Arc-rated (AR) coverall over AR long sleeve shirt and Arc rated long pants, Arc rated flash suit, hood, safety glasses, hard hat, hearing protection, AR and voltage gloves, leather and voltage rated gloves and footwear.	
4 40 Cal/cm ²	Multi-layer arc rated (AR) flash suit over AR coverall over AR shirt and AR pants, AR flash suit hood, safety glasses, hard hat, hearing protection, AR and voltage rated gloves, leather work shoes.	

Continued on Page 72

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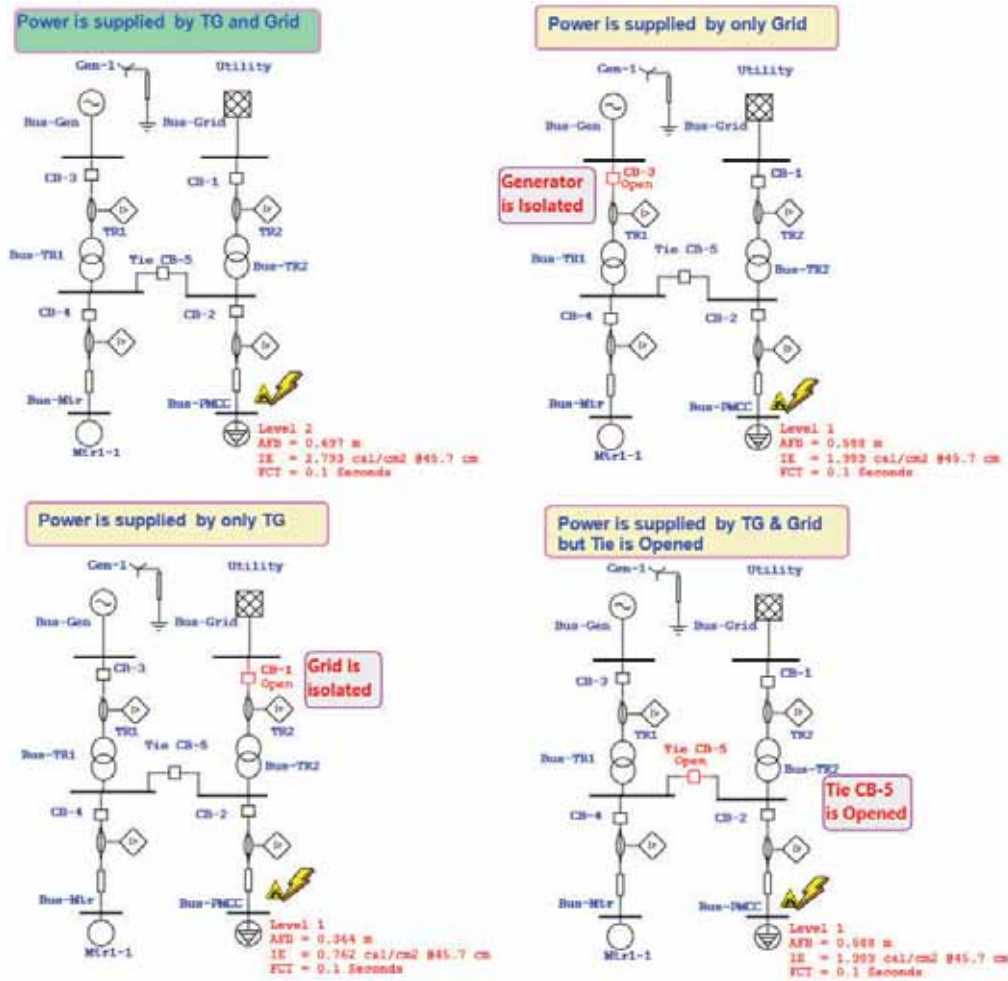
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Continued from Page 70

Figure 5: PMCC cable bus for different configurations of the system



chest or face of the person equal to or less than 1.2 Cal/cm². AR clothing provides thermal insulation and is also self-extinguishing. NFPA's minimum recommended a rating of PPE in Cal/cm² at a working distance from the arc source is depicted in Table 3.

As per hazards level or category, description of recommended PPE is tabulated in the Table 4.

Arc Flash Analysis: NFPA 70E Tables versus IEEE Std.1584

NFPA 70E Tables highlight specific PPE to be used on various electrical equipment. These tables are based on fundamental

assumptions about the available fault current and the overcurrent device clearing time.

In order to provide appropriate protection to the technician, the necessary calculations must be performed to find the short circuit currents and the Over Current Protection Device (OCPD) opening times. For effective use of the tables, it must be verified that the available fault current and the OCPD tripping time are both equal to or lower than the values assumed for developing the tables. IEEE Std.1584-2002 directs analysis procedure with design and real-time configuration data of the network. Perform

coordination for all protective devices and find Bolted and Arc fault current. Find incident energy and arc flash boundary for selected working distance and select the appropriate PPE.

Analysis Procedure as per IEEE Std.1584-2002 is given below.

- Collect the design data of the system and installation from their data sheet.
- Determine the system modes of operation
- Determine the bolted fault currents
- Determine the arc fault currents
- Find the protective device characteristics and the duration of the arcs
- Document the system voltages and classes of equipment
- Select the working distances

- Determine the incident energy for all equipment
- Determine the flash-protection boundary for all equipment
- Select appropriate PPE.

Arc Flash protection - The Best Practices Preventive maintenance

The best practices of preventive maintenance help to reduce arc flash exposure like:

- Prevent entrance of rodents and birds in the panels.
- Check for loose connections,
- Thermography for overheated terminals

Continued on Page 74



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Table 5: Results of simulation

Case No.	Configuration			Arc Flash Boundary (AFB)	Incident Energy (IE)	Hazard Category / Level at Cable Bus
	TG	Grid	Tie			
				Meter	Cal/cm ²	
1	ON	ON	ON	0.697	2.793	2
2	OFF	ON	ON	0.588	1.989	1
3	ON	ON	OFF	0.588	1.989	1
4	ON	OFF	ON	0.364	0.762	1

- Prevent deposition of excessive moisture
- Ensure proper operation of relays, breakers, and contactors
- Clear the fault before placing a new fuse
- Off-line work is always preferable. If it is unavoidable, use insulated tools with torque controller
- Avoid use of cleaning chemicals, spray, painting etc. on live parts.

Protection schemes

• Protection device coordination study

It should be performed in order to select proper settings of the overcurrent protective devices which help to reduce the bolted fault and arcing fault current.

• Temporarily settings of protection device

During system maintenance settings of protective devices should be reduced. It will help to mitigate incident energy exposure.

• Fault level reduction

If system load flow permits, thus, during the maintenance incident energy can be reduced by means of a change of operating configuration of the network by:

- Opening of tie circuit breaker
- Isolation of sources
- Selection of low fault level sources

In the following network, power is supplied by grid and generator. Thus, incident energy at PMCC cable bus for different configurations of the system are simulated as shown in Figure 5.

Results of simulation are summarised in the Table 5.

• Current Limiting Fuse & Reactor

Fault current, as well as arcing current, can also be reduced by use of current limiting fuse and reactors. This limits the incident energy exposure.

• Arcing Time reduction

Incident energy or Arcing Current Time can be reduced



Figure 6: Local switching (Left) vs. Remote switching (Right)




Figure 7: Conventional Racking (left) compared to Robot (right)

by reducing arcing time. Arcing time can be reduced by reducing,

- Safety margin for relay and breaker operation,
- Combination of bus differential protection with instantaneous operation,
- Retrofitting of time-overcurrent relays with the delayed instantaneous trip.
- **Remote operation such as racking and switching**
Racking and switching from remote do not reduce arcing fault energy but keep the operator outside the arc flash boundaries.
- **Arc-resistant switchgear**
This type of switchgear has the capability to confine the incident energy of the arc flash

and vent off the energy out of the switchgear in a direction away from the operator.

- **Optical sensor technology**
This technology detects the light from the arc flash and initiates a shutdown. A combined detection of light and current allows clearing times of the order of 1/4 cycle or even lower.
- **Arc flash current path alternation method**
This method provides with proper arc detection system. As the arc is initiated, an alternate lower impedance current path than the fault path in order to and capture and fast transfer the arcing fault.
Arc flash hazard is a real threat to equipment, operator, and operations. For protection, PPE is

to be used but higher category PPE may be uncomfortable in regular operation causes a further degree of risk increases. Since every industry has a different type of process with a different type of operations, therefore, risk management process is also different for different types of processes. For every process, identification of risk and protection is essential, therefore, to ensure safety and regulatory compliance, operators must develop and implement feasible solutions for mitigation of workplace hazards. 



Rajesh Chourishi

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TEAL delivers reliable end-to-end engineering solutions

Titan Engineering & Automation Limited (TEAL), is a wholly-owned subsidiary of Titan Company Limited, a Tata Enterprise. The company offers world-class turnkey assembly and testing solutions to various industry segments including transportation, energy, electronics, life sciences, engineering and consumer packaged goods (CPG).

TEAL delivers bespoke end-to-end engineering solutions – right from conceptualisation stage to commissioning of the machine. The company believes in customer-centric approach in all its processes and ensure value engineering to the solutions offered. TEAL proudly announced that it is the core for most global firms including OEMs, Tier 1, and Tier 2 companies when it comes to assembly and testing their products for niche quality performance. "Our business values are based on flexibility, innovation, strive for perfection, constructive thinking, and teamwork. With most of these values embedded in our work DNA, we often have a competitive edge in machine building and deliver beyond expectations to the business demands," a spokesperson from the company said.

TEAL has a team of over 300 professionals and committed to provide innovative efficient solutions by understanding the specific needs of the customer i.e. considering product variants, production volume in terms of fully automatic lean assembly cells, semi-automatic lines, test rigs conforming to international standards. The company claims to adding value to the customer with systematic process for engaging the customer right from business development stage till the entire life cycle of the project.

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For more details, visit: www.titanteal.com

Benefits of outsourcing in switchboard design and drafting services

Understanding customer requirement is one of the most important steps to provide proper and accurate design documentation to get approval from reputed consultants like EIL, Mecon etc. Most of the panel manufactures do not read complete technical specifications and prepare improper drawing and waste more time to get approval from customer and consultant. To avoid such situation, some manufacturers repute experienced design engineers to their organisations. This increases the cost of engineering. Easy way to resolve this issue is outsourcing design and drafting services to some experienced organisation. Such type of outsourced service providing company engineers are frequently updating their knowledge and they allot proper time to read consultant technical specification and



prepare design and drawing preparation activity as per specification.

Critical equipment (such as ACB, MCCB, Numerical relays) selection is another major problem in panel manufacturers. Outsourced design service proving experienced organisation engineers are mostly updating their knowledge in switchgear equipment.

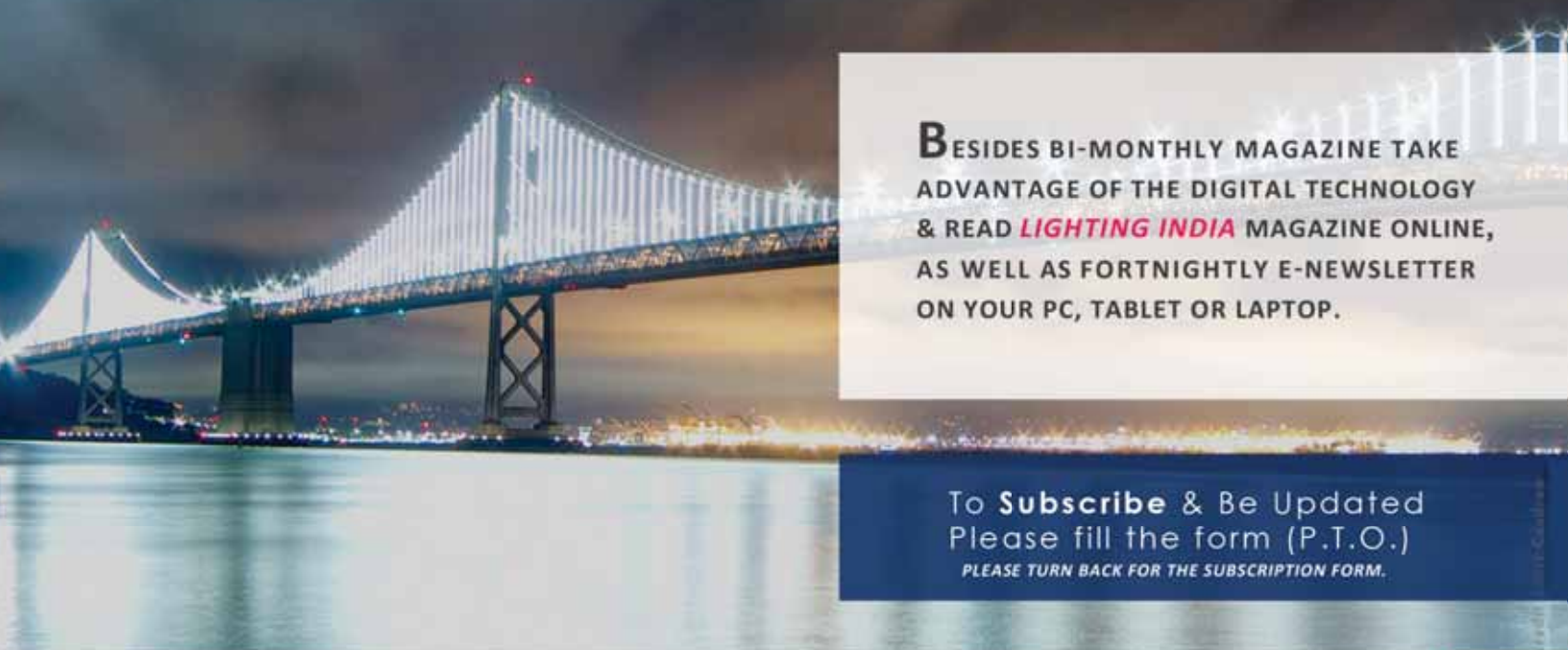
Engineering design drawing preparation is always initial stage of all projects. Good starting is always half completion. So, accuracy of engineering drawing is the most important for perfect project works.

Varipadam Engineering Pvt Ltd is providing switchboard design and drafting service to panel manufacturers from 2007.



For more details, Contact: www.siprotech.com

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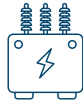
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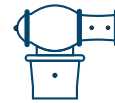
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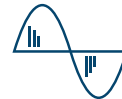
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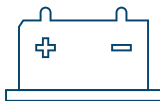
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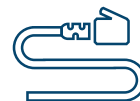
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INCUBATE

Top solar technology for 2018



Picture Courtesy: www.lovetoknow.com

**How much do you know about innovations in solar power?
Take a look at recent technological innovations that will
transform the energy landscape globally.**

By *Subhajit Roy*, Group Editor

Solar power on cloudy days!

Researchers at the Canada's University of British Columbia found a cheap, sustainable way to build a solar cell using bacteria that convert light to energy, even under overcast skies.

This innovation could be a step toward wider adoption of solar power in places like British Columbia and parts of northern Europe where overcast skies are common. With further development, these solar cells—called “biogenic” because they are made of living organisms—could become as efficient as the

synthetic cells used in conventional solar panels. “Our solution to a uniquely B.C. problem is a significant step toward making solar energy more economical,” said Vikramaditya Yadav, a professor in UBC's department of chemical and biological engineering who led the project.

Solar cells are the building blocks of solar panels. They do the work of converting light into electrical current. Previous efforts to build biogenic solar cells have focused on extracting the natural

dye that bacteria use for photosynthesis. It's a costly and complex process that involves toxic solvents and can cause the dye to degrade.

The UBC researchers' solution was to leave the dye in the bacteria. They genetically engineered *E. coli* to produce large amounts of lycopene—a dye that gives tomatoes their red-orange colour and is particularly effective at harvesting light for conversion to energy. The researchers coated the bacteria with a mineral that could act as a semiconductor, and applied the mixture to a glass surface.

With the coated glass acting as an anode at one end of their cell, they generated a current density of 0.686 milliamps per square centimetre—an improvement on the 0.362 achieved by others in the field.

"We recorded the highest current density for a biogenic solar cell," said Yadav. "These hybrid materials that we are developing can be manufactured economically and sustainably, and, with sufficient optimization, could perform at comparable efficiencies as conventional solar cells."

The cost savings are difficult to estimate, but Yadav believes the process reduces the cost of dye production to about one-tenth of what it would be otherwise.

'Funnelling' the sun's energy more efficiently

A team of experts from the University of Exeter has developed a breakthrough technique that could unlock new methods of making solar energy more efficient.

The new technique relies on 'funnelling' the sun's energy more efficiently directly into power cells, such as solar panels or batteries.

In the research, the team of physics experts developed how to 'funnel' electrical charge onto a chip. Using the atomically thin semiconductor hafnium disulphide (HfS_2), which is oxidised with a high-intensity UV laser, the team were able to engineer an electric field that funnels electrical charges to a specific area of the chip, where they can be more easily extracted.

"While current solar cells are able to convert into electricity around 20 per cent of the energy received from the Sun, the new technique has the potential to convert around 60 per cent of it by funnelling the energy more efficiently," the researchers claim.



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Designing high-efficient organic solar cells

Photo credit: Thor Balkhed



Semi-transparent solar module

Twenty-five researchers from seven research institutes have put their heads together to draw up rules for designing high-efficiency organic solar cells. The research is led by Feng Gao, associate professor at Linköping University (LiU), Sweden.

Organic solar cells, made from carbon-based materials, present unique advantages compared with other solar cell technologies. For example, they can be manufactured through low-cost printing technologies, and they can be made semi-transparent with selectable colours, which can be used

architecturally in building integration. Their flexibility and low weight make them perfect for powering the sensors for the internet of things applications.

A key challenge facing the development of organic solar cells is that they usually have large energy losses. The researchers have formulated some rational design rules to minimise energy losses in organic solar cells.

Using these design rules, organic solar cells promise to catch up with their competitors with respect to power conversion efficiency, which measures the fraction of the energy in the Sun's radiation that is converted to electricity. "The theoretical limit for the fraction of the Sun's energy that can be obtained in solar cells is around 33 per cent.

Laboratory experiments with silicon-based solar cells have achieved 25 per cent at best," an official statement said.

Researchers have until now believed that the limit for organic solar cells is lower. "But we now know that there is no difference – the theoretical limit is the same for solar cells manufactured from silicon, perovskites or polymers", says Olle Inganäs, professor of biomolecular and organic electronics, Linköping university.

Fluorination to enhance organic solar cells performance

An international team of materials scientists from France, Russia and Kazakhstan found a way to boost the efficiency of organic solar cells several times by incorporating fluorine atoms in the polymer. This process, known as fluorination, was previously shown to enhance polymer photovoltaic properties, but the mechanism was poorly understood. The new study clarifies the effect of fluorination on cell efficiency.

By experimenting with various polymer modifications, the team increased cell efficiency from 3.7 to 10.2 per cent. While this still falls short of the commercial silicon photovoltaics, the massive gain in efficiency suggests that polymer-based cells are a technology to be reckoned with. Perhaps with further tweaks organic solar cells could outperform their polysilicon-based counterparts.

According to co-author of the study Professor



Dimitri Ivanov, what made the study challenging was the "need to optimise solar cell efficiency by picking the right molecular energy levels of the donor and the acceptor, while also creating the appropriate supramolecular structure that would facilitate charge transport to the electrodes."

Store solar heat with STF

Although the Sun is a virtually inexhaustible source of energy, it's only available about half the time we need it — during daylight. For the Sun to become a major power provider for human needs, there has to be an efficient way to save it up for use during night-time and stormy days. Most such efforts have focused on storing and recovering solar energy in the form of electricity, but the finding by MIT professor Jeffrey Grossman and his team could provide a highly efficient method for storing the Sun's energy through a chemical reaction and releasing it later as heat.

The key to enabling long-term, stable storage of solar heat, according to the team's findings, is to store it in the form of a chemical change rather than storing the heat itself. Whereas heat inevitably dissipates over time no matter how good the insulation around it, a chemical storage system, known as solar thermal fuels (STF), can retain the energy indefinitely in a stable molecular configuration, until its release is triggered by a small jolt of heat (or light or electricity).

Turn your building into batteries



Energy storage issue could soon become a thing of the past thanks to the discovery of new cement mixtures. Researchers at Lancaster University have developed a new smart cement mixture that is able to store electricity for long periods of time. When fully optimised, the potassium-geopolymetric (KGP) composites that is made from flyash and chemical solutions, could have the potential to store and discharge between 200 and 500 watts per square metre.



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Energy Management System

One of the major consumers of electrical energy are the industries. In today's scenario there is a huge demand for the electrical energy and but the two major hurdles are the scarcity of energy and the increased cost of electricity. Hence it is essential for the industries to optimise the usage and also keep the cost under control. It has become necessary for the industries to use less amount of energy for the same level of activity. Electrical management is one solution for monitoring and controlling the usage of energy and take preventive and precautionary measures.

The electrical management system is capable to collect, store and analyse the data that is obtained from the various remote monitoring devices to manage electrical cost associated with the electrical systems.

Importance of energy management system

Energy management is the key to save energy in any organisation. There is a global need to implement energy management system since the efficient energy management system has the positive impact on the energy prices, emissions targets, and hence there is a need to save energy at your organisation specifically. In spite of these advantages, there are some challenges that are faced while implementing an energy management system.

The challenges faced can be listed as below:

- Poor quality of electricity
- Increasing energy demand
- Poor systems of energy distribution
- High generalised cost of transport
- Lack of sense of ownership participation.

These challenges can be converted into opportunities by making energy-efficient buildings, transport of electricity, and efficient planning.



Monitoring energy consumption and collecting data

The advanced approach to the collection of data is to implement the interval-metering systems that automatically measure and record energy consumption at short, regular intervals such as every 15 minutes or half hour. Details of the regular interval energy consumption data make it possible to see patterns of energy waste that it would be impossible to see otherwise.

Finding and increasing opportunities to save energy

The meticulous meter data that is collected are invaluable for helping to find and increase energy-saving opportunities. Venlite Energy Limited has its systems equipped to monitor the status of production facilities, or something important or critical data

on the real-time basis since it is not possible to establish control rooms over some remote or hazardous locations.

Benefits of energy management system

- Reducing peak demand.
- Energy resource planning, eliminating in-efficient equipment operation.
- Measurement and verification.
- Benchmarking energy consumption or reduction in specific energy consumption.

By making good systems better and better systems best we can achieve an "Efficient Energy Management System". Venlite Energy Limited has a vision and mission of providing an efficient automation over the Internet and social networks, IoT and Cloud platforms. To become a worldwide technology leader in the smart cities, smart grid, being simple by introducing user-friendly technology-driven products and application to daily industrial operations in all type of domains.

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Tata Power, HPCL JV for EV Charging Stations across India

Tata Power and Hindustan Petroleum Corporation Limited (HPCL) announced the signing of a Memorandum of Understanding (MoU) recently for setting up commercial scale charging stations for electric vehicles at the HPCL retail outlets and other locations across India. Tata Power and HPCL, through this MoU, have agreed to collaborate in planning, development and operation of charging infrastructure for electric vehicles (e-cars, e-rickshaws, e-bikes, e-buses, etc.) at suitable locations across India. Both entities also intend to additionally explore areas of opportunities and collaboration in related fields like Renewable Energy.

Praveer Sinha, CEO and Managing Director, Tata Power, said, "We are delighted to announce our partnership with HPCL. It is a significant move towards expanding our services to our customers beyond conventional boundaries. By servicing electric vehicles through the proposed charging stations across India, Tata Power will be playing a crucial role in enabling a stronger penetration of EVs in the country, thus, fulfilling our commitment to power India's future in an environmentally sustainable way."

Rahul Shah, Chief Strategy, New Business Services,

Business Excellence, Tata Power, said, "We aim to continuously grow our EV charging infrastructure footprints by installing charging stations at strategic locations. Our association with HPCL will help us to scale our EV infrastructure at the national level as well as provide our customers with world-class services".

Rajnish Mehta, Executive Director, Corporate Strategy Planning and Business Development, HPCL said, "A major impediment to electric vehicles adoption is the range anxiety which needs to be addressed through establishment of nationwide charging infrastructure. We believe that a robust network of charging stations is very critical for market acceptability of EVs which will also ensure last mile connectivity and thereby, facilitate widespread adoption of EVs. Tata Power with its focussed approach towards sustainable and clean energy and wider outreach across the power value chain, provides an excellent opportunity for an integrated Oil and Gas company like HPCL to collaborate for promoting the e-mobility initiative. We intend to leverage on our vast marketing infrastructure network in the form of Retail Outlets and other locations for setting up of electric vehicle charging stations on pan India basis".

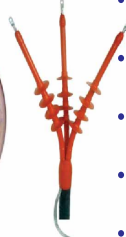


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HPS distribution transformers for indoor & outdoor applications

For over a century, Hammond Power Solutions (HPS) has been an innovative leader in the transformer industry. HPS excels at designing and manufacturing a broad range of standard products and engineered-to-order solutions to meet many demanding applications.

The company's extensive and durable line of Oil Filled, Cast Resin and VPI transformers and reactors provide a complete magnetic solution. HPS has product designs that meet a range of global standards and regulatory compliance (IEC, IS, CSA, UL, IEEE, GOST, DNV, RINA).

With multiple manufacturing facilities located throughout Asia, Europe, and North America, HPS is able to service the global needs of its customers.



Product Overview

HPS distribution transformers are available for both indoor and outdoor applications. They are typically used for voltage conversion at primary voltage up to 35kV.

HPS offers distribution transformers in both dry-type and oil filled technology utilising the best insulating materials. Their product designs are suitable for almost any application in the world including commercial/industrial buildings and

distribution substations. With the increasing trend towards safe and reliable transformer designs, HPS brings many years of experience to meet these demands.

For more details, visit: www.hammondpowersolutions.com

HPL launches Solar Home Lighting Solutions

HPL Electric & Power Ltd. an established electric equipment manufacturing company in India has added a new product in its umbrella.

The company announced the launch of its new product, Solar Home Lighting Solutions, which is designed to provide solar lighting solutions for homes.

The product is portable and perfect solutions for remote or rural areas especially where people don't have access to the power supply. In line with the government's rural



HPL Solar LED

electrification programme, the product is designed in a way so as to help people get access to electricity by means of using renewable energy sources like the solar energy, and thus improving living conditions.

Requiring negligible maintenance, it is also a perfect fit for outdoor activities. While having all these advantages, the new product is backed by HPL's PAN India service set-up.

For more details, visit: www.hplindia.com

ABB Launches Economical Charging Solution for EVs in India



ABB's easy to fit and compact AC wallbox for homes & businesses

The new AC wallbox portfolio, comprised of 52 different types in total, provides a high quality, cost effective electric car charging point for private and business use. The latest addition further strengthens ABB's comprehensive portfolio of smarter building solutions from lighting to heating, music, security and car charging.

Easy to fit and with a compact design of 50 by 25 cm², the wall box can be installed at homes or offices. It is particularly suited to businesses that wish to provide overnight charging facilities for customers, such as those in the hospitality business. ABB has the technology to create a robust eco-system for electric mobility across the electrical value chain from the grid to cars or buses to homes and factories. Frank Mühlon, Head of ABB's Global Business for Electric Vehicle Charging, said, "With the continued growth in sales of hybrid and battery powered electric cars, businesses and drivers are looking for simple and cost-effective vehicle charging solutions. Charging should not be an interruption to the day, which is why we have extended our portfolio with the AC wallbox, which is simple to install and use at home or work."

For the first time in India, ABB recently showcased the Terra HP fast-charging system, which can power up a car for 200 km in just a single 8-minute charge at the recently concluded MOVE Summit. Demonstrating its commitment to clean energy and sustainable transportation, ABB has also installed a Terra 53 fast charging station for electric vehicles at NITI Aayog's office in the heart of New Delhi.



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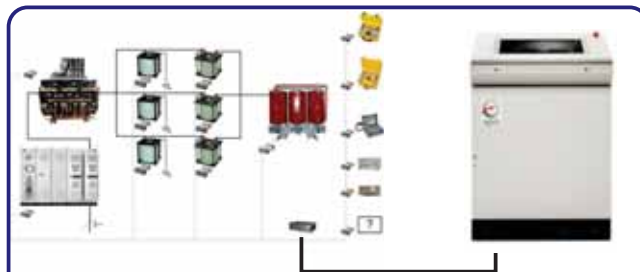
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