Vol 56 No 11 November 2016 ₹ 100

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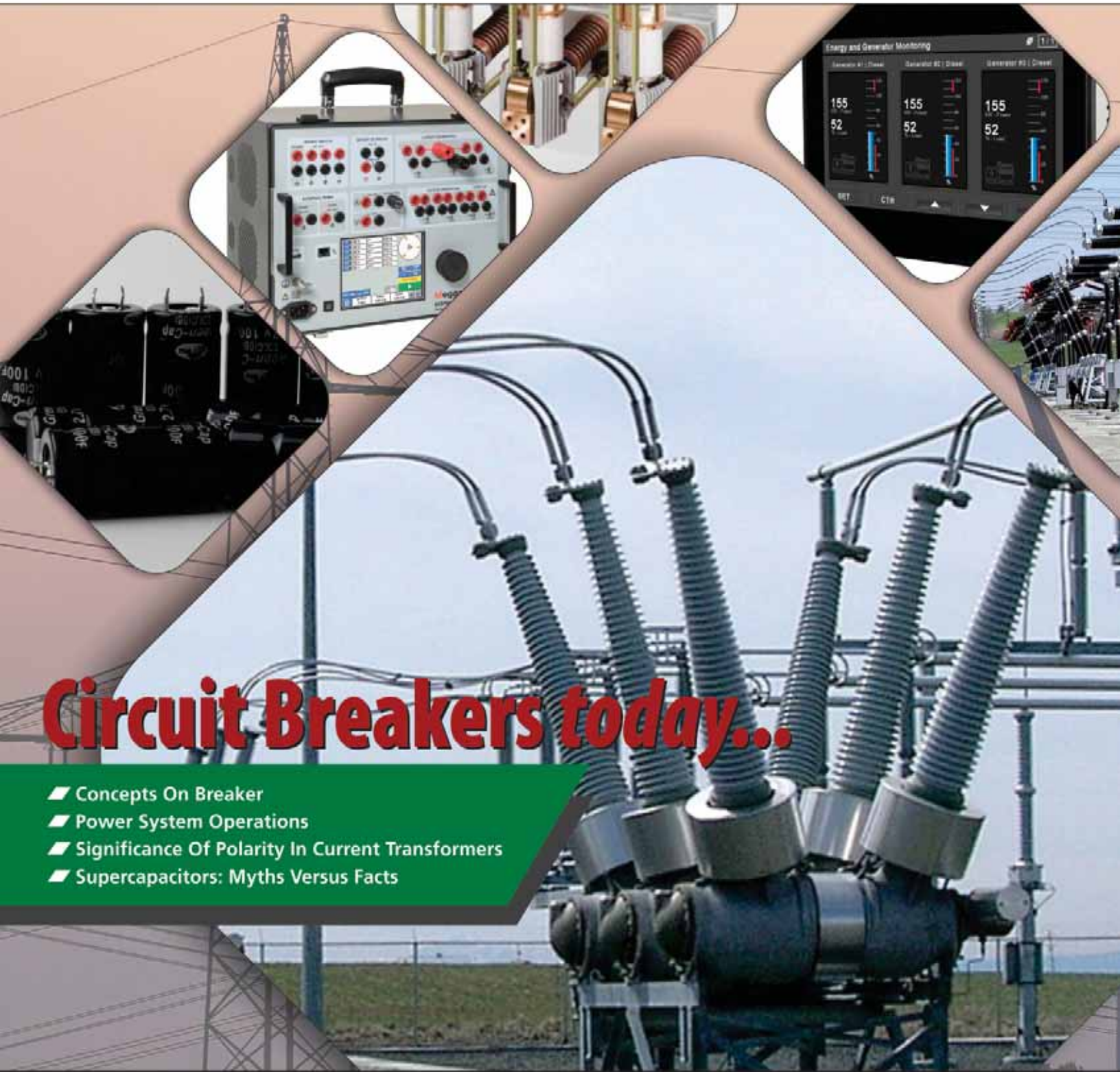

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Publisher's Letter

The Paradigm Shift

"As far as harnessing offshore wind energy is concerned, many innovations have the potential to make a substantial reduction in the cost..."

With the trend of growing offshore wind energy harnessing, the need for economic power transmission technology is also increasing. In addition to that, in such offshore projects, there are several other areas where project cost reduction is possible through proper design and selection of technology – which to a great extent depends on the availability of the line-devices or components. Observing some recent developments in the industry globally, I have no doubt that the industry is now focusing on this aspect.

For example, according to a recent statement by the US Department of Energy's Office of Energy Efficiency & Renewable Energy, "Innovation in the design and manufacturing of wind power generation components continues to be critical to achieving our national renewable energy goals. As a result of this challenge, the U.S. Department of Energy's Wind Program and Advanced Manufacturing Office are partnering with public and private organizations to apply additive manufacturing, commonly known as 3D printing, to the production of wind turbine blade molds."

Also, walking towards the same direction, Siemens is going ahead with a new 66 kilovolt (kV) solution. The company has recently made available its 66 kilovolt transformer and switchgear option for offshore wind turbines. The Siemens team is also targeting to reduce costs and curtail demand for copper, which is very exciting as we all know that copper is the essential material of the inter-array wires.

As per a communiqué from Siemens, "The 66kV voltage solution is expected to become standard for future offshore wind projects. As more turbines can be put on each string of turbines due to the higher voltage, fewer strings are needed, and thus fewer array 'feeder' cables. This provides additional advantages in logistics and installation. Total savings in the cost of the park grid are estimated to reach up to 15%."

Recently, KIC InnoEnergy and BVG Associates, the technical consultancy with expertise in wind and marine energy technologies, have launched a joint report, titled 'Future renewable energy costs: offshore wind.' It has highlighted over 50 innovations as having the potential to make a substantial reduction in the Levelised Cost Of Energy (LCOE) through changes to design, hardware, software or process. According to them, the technologies could reduce the LCOE by a third by 2030.

So, the shift in paradigm is very prominent, and we are ushering in a new era.

Do send in your comments at miyer@charypublications.in

Editor-In-Chief

{ The successful publishing house is the one that can guess ahead, not the one that imitates the past.
- Helen Jacobs }

Single Issue: ` 100 / Annual Subscription: ` 1000

Printed, Published and owned by Mahadevan Iyer from 201, Premalaya, Opp. Telecom Factory, Deonar, Mumbai 400088 and Printed at Print Tech., C-18, Royal Ind. Est., Naigaum Cross Road, Wadala, Mumbai 400031. **Editor: P K Chatterjee**

Vol 56. Issue No. 11 • November 2016

Directors
Pravita Iyer
Mahadevan Iyer

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

Editor
P K Chatterjee
pkchatterjee@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

Design
Nilesh Nimkar
charydesign@charypublications.in

Subscription Department
Nafisa Khan
sub@charypublications.in

Accounts
Dattakumar Barge
accounts@charypublications.in

Customer Care
Sonali Pugaonkar
mktg@*charypublications.in*

Electrical India is also available online on www.electricalindia.in. For online enquiries contact at: *dgmarketing@charypublications.in*

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Dr M K Shah
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Supercapacitors Are Advancing Apace

P K Chatterjee (PK)

> The striding supercapacitor technology will soon effect a big transformation in the world of energy-storage...

Batteries or combination of cells that we primarily use for energy storage today are expensive, heavy, short-lived, larger space-occupying and literally not environment-friendly. However, the era of their ubiquitously dominating presence will soon be over owing to the rapid progress in the field of developing 'supercapacitors.'

Like batteries, supercapacitors, also known as ultracapacitors, can be produced in different sizes and shapes as per various requirements. So, soon we may see them being used literally anywhere and everywhere. Naturally, the question arises – what is their status of development at this moment? Unlike batteries that store energy electro-chemically, supercapacitors hold the same electrostatically (except Electric Double-Layer Capacitor or EDLC). However, supercapacitors charge and discharge very fast. So, as far as releasing energy steadily during a reasonably long period of time like a battery is concerned, further R&D work is required to improve supercapacitors.

However, when it comes to application, a combination of both battery and supercapacitor technology is working very effectively, and the same is being deployed at different kind of projects. For example, Duke Energy, the largest investor-owned utility in the United States, has deployed a hybrid battery-ultracapacitor energy storage system at a distribution substation in Gaston County, N.C.

This hybrid system uses the ultracapacitors to perform solar smoothing at the distribution circuit in real-time – particularly when the solar power on the grid fluctuates due to overcast sky condition. The batteries are simultaneously used to perform energy shifting of a large solar system on the distribution circuit. This system combines the high power, fast response ultracapacitors with energy dense batteries to maximize utility system value by offering simultaneously occurring grid services at a lower system cost.

From the production point of view also, with the passage of time, supercapacitor or ultracapacitor manufacturing process is becoming easier. We all know that all supercapacitors currently use components made of carbon, which require high temperatures and harsh chemicals to be produced. But recently, researchers at MIT have for the first time developed a supercapacitor that uses no conductive carbon at all, and that could potentially produce more power than existing versions of this technology.

Obviously, the striding supercapacitor technology will soon effect a big transformation in the world of energy-storage.

P. K. Chatterjee

{ The future of Publishing is about having connections to readers and the knowledge of what those readers want.

- Seth Godin }

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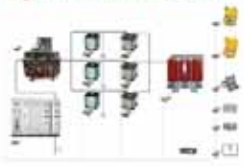

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Adani dedicates its solar power plant to the nation

Adani Green Energy (Tamil Nadu), a part of the Adani Group, a globally integrated infrastructure player, recently revealed that it has dedicated the world's largest solar power plant of 648 Megawatts (MW) to the nation. The plant is set up at Kamuthi, Ramanathapuram in the southern state of Tamil Nadu, with an investment of around Rs 4,550 crore.

The plant is part of the state government's ambitious yet highly achievable target of generating 3,000 MW as per its new solar energy policy unveiled in 2012. The company sourced equipments and machinery from various parts of the world to set up the entire 648 MW within a record time of 8 months. A total of around 8500 personnel worked hard day and night for averaging out about 11 MW of installation in a day to set up the plant in the stipulated time.

Gautam Adani

Gautam Adani, Chairman, Adani Group, said, "This is a momentous occasion for the state of Tamil Nadu as well as the entire country. We are extremely happy to dedicate this plant to the nation; a plant of this magnitude reinstates the country's ambitions of becoming one of the leading green energy producers in the world. I would like to express our deepest gratitude to the Hon'ble Chief Minister and the government of Tamil Nadu for their valuable support and guidance in achieving this gigantic feat". EI

BSES introduces innovative services as a solution to power theft

Whats App is BSES' latest ally in its fight against power theft. BSES Rajdhani Power Limited (BRPL) and BSES Yamuna Power Limited (BYPL) have launched an innovative service, wherein consumers can shoot videos and photographs of power theft and Whats App them (along with the location address) to centralised numbers. Identity of the people reporting power theft will be kept confidential.

The service has been primarily targeted at high power theft areas. Centralised teams have been set up to monitor and take appropriate action basis the photographs and videos received. The initial response has been encouraging.

To promote the service, BSES will soon start engaging with Resident Welfare Associations (RWAs) and residents. Posters are also being put-up by BSES in high power theft areas. Consumers will also be educated on how to capture evidence of power theft while shooting videos and photographs.

A BSES spokesperson, said, "Power theft has taken a shape of organised crime and it is an opportunity for honest and law abiding citizens of the city to report and help in controlling this menace. Apart from discoms, honest consumers also suffer due to power theft. We want more and more citizens to come forward and actively participate in this campaign to make Delhi a power theft free city. Citizen's identity will be kept confidential." EI

Hindustan Power inaugurates its solar power plant in Punjab

Hindustan Power has built the largest single location solar power plant in Punjab with a capacity of 31.5 MW. It is situated in the cotton farming region of Punjab. The solar farm is part of the effort by the State Government to promote clean energy and at the same time turn farmers into green energy entrepreneurs by leasing their lands for building the project.

The project was built with facilitation from various agencies of Punjab Government, especially Punjab Energy Development Agency (PEDA) and Punjab State Power Corporation Limited (PSPCL) and other local agencies. It was inaugurated by Sardar Sukhbir Singh Badal, Deputy Chief Minister of Punjab.

Ratul Puri, Chairman, Hindustan Power, said, "We chose to work in Punjab due to the high level of governance in the state; strong policy measures and equally effective implementation. We have built the largest single solar power plant with an investment of Rs 202.4 crores and are constructing a 50 MW solar power plant at an investment of Rs 300 crores. This reflects the positive experience for the company working in the State of Punjab."

Rajya Ghei, CEO – Domestic Solar, Hindustan Power, said, "The project will feed 50 million units of clean energy annually to the 66 KV grid, which is enough to cater to the energy needs of 24,000 households per year. Our experience of working in Punjab has been very good thanks to the proactive support and vision of PEDA officials along with the local authorities." EI

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Inox Wind receives repeat order from Malpani Group

Inox Wind, a well known wind energy solutions providers, has bagged repeat orders from D. J. Malpani for two wind power projects of 20 MW each in the state of Gujarat. Malpani Group is a diversified business house with presence in renewable energy, FMCG products and real estate. The two orders will be executed on turnkey basis and are scheduled to be commissioned by March 2017.

As part of the turnkey projects, the wind energy solution provider will offer end to end solutions from development and construction to commissioning. The company has also been contracted to undertake operations and maintenance services of the projects for a multi year period, post commissioning. The orders involve supply and installation of 20 units of the company's latest offering, the 113 meter rotor dia Wind Turbine Generator.

Kailash Tarachandani

Kailash Tarachandani, Chief Executive Officer (CEO) of Inox Wind Limited, said, "We are pleased to partner with Malpani Group again in our joint commitment to provide a cleaner and greener environment. The order has further boosted Inox's strong order book with major corporate clients in India. Inox 113 is one of the most technologically advanced WTG variants in India and is a groundbreaking product that will revolutionise the power sector in the country."

L&T attains RRVUNL unit synchronisation in record time

Larsen & Toubro (L&T), executing 2x660 MW supercritical thermal power project at Chhabra in Rajasthan, has on October 2, 2016 achieved synchronisation of its first 660 MW supercritical unit (Unit-5) of the project in record time of forty two months and four days from the date of Notice to Proceed (March 28, 2013).

Shailendra Roy

The thermal power project is being developed by the state utility, Rajasthan Rajya Vidyut Utpadan Nigam Limited (RRVUNL).

The synchronisation is significant since it is the fastest synchronisation for L&T amongst all its other projects to date and the speediest one so far for any indigenously manufactured supercritical unit in India. The previous best unit synchronisation achieved for indigenously manufactured supercritical unit was forty six months for the company's Rajpura project in Punjab, which has now been improved to forty two months.

Shailendra Roy, CEO and Managing Director-L&T Power, and Whole-Time Director, L&T, said, "The synchronisation achievement shows that L&T is well equipped to handle tighter project schedules and meet customer expectations. In this case, L&T has bettered its own record."

Prime Minister dedicates 1732 MW -Three Hydro Projects in Himachal

Prime Minister, Narendra Modi appreciated the contribution of Public sector and said these hydro projects will bring prosperity to the State of Himachal and other parts of the country while dedicating the flagship 800 MW Hydro Power Station of NTPC- Koldam, 520 MW Parvati Project of NHPC and 412 MW Rampur Hydro Station of SJVNL to the Nation in Himachal Pradesh recently. Acharya Devvrat, Governor of Himachal Pradesh, Vir Bhadra Singh, Chief Minister, Himachal Pradesh, Jagat Prakash Nadda, Union Minister of Health and Family Welfare; Piyush Goyal, Union Minister of State (I/C)for Power, Coal , New & Renewable Energy and Mines and eminent dignitaries from Himachal Pradesh were present on the occasion. With commencement of generation from four 200 MW units, NTPC- Koldam has achieved capacity of 800 MW and provides peaking capacity to the Northern grid. It shall annually generate 3054 GWh electricity at 90% dependable year basis.

Narendra Modi dedicates the plants to nation...

Twelve percent of the electricity generated from Koldam is being supplied to the home state Himachal Pradesh free of cost while 1% to the state on account of Local Area Development fund. All the Project Affected Families are being provided 100 units of electricity every month free of cost, which accounts for 0.62 % of the total generation. Thus a total 13.62 % of electricity generated from the plant is supplied free of cost to Himachal Pradesh, remaining power supplied to other beneficiaries namely Delhi, Haryana, Punjab, Rajasthan, Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir, Uttrakhand and Chandigarh.

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ABB develops power transformer to support India

ABB has developed, manufactured and energised a 1,200-kilovolt (kV) ultrahigh voltage power transformer to support India's plans to build a 1,200 kV transmission system, supplementing the existing 400 kV and 800 kV transmission grid as demand for electricity increases. This 1.2 million volt transformer represents the highest alternating current voltage level in the world and is installed at the national test station at Bina, Madhya Pradesh in Central India, as part of a collaborative initiative by the country's central transmission utility, Power Grid Corporation of India Limited (POWERGRID). The transformer was manufactured and tested at ABB's facility in Vadodara.

The 1,200 kV transmission system will help strengthen the grid and enhance load capacity up to 6,000 Megawatts (MW). Transmission at higher voltages enables larger amounts of electricity to be transported across longer distances, while minimising losses. At the same time, less space is needed for fewer transmission lines, which reduces the environmental impact and overall cost.

Pitamber Shivnani, Local Division Manager, ABB Power Grids division in India, said,

"This is a milestone achievement underscoring ABB's rich history and technology leadership in India, and our 'In country for country' approach."

"The achievement is a testimony to our customer commitment and comes at a time when India has resumed focus on high and ultra-high voltage transmission in line with development of large scale renewable energy projects," he further added.

BHEL undertakes another project in Uttar Pradesh

Bharat Heavy Electricals Limited (BHEL) has commissioned another 660 MW coal based supercritical thermal power plant in Uttar Pradesh. Notably, in the past 15 months, it has added 4,300 MW of power generation capacity in the state of Uttar Pradesh. The commissioning of the unit will result in significant improvement of electricity availability in the state of Uttar Pradesh. The unit has been commissioned at the 3x660 MW Prayagraj Super Thermal Power Project, located in Bara tehsil in Allahabad district of Uttar Pradesh. The project is owned by Prayagraj Power Generation Company Limited (PPGCL), a subsidiary company of Jaiprakash Power Ventures Limited. This is the second unit of the project to be commissioned. The first unit was commissioned earlier by BHEL in December, 2015 and the third unit of the project is also in an advanced stage of construction.

BHEL has been a major partner in the power development programme of Uttar Pradesh. Significantly, over 70% of UP's power generation capacity, aggregating to more than 16,500 MW, has been installation by BHEL. Supercritical units are more efficient, eco-friendly and consume lesser coal.

EPGL delivers a strong financial performance

Essar Power Gujarat Ltd (EPGL), a subsidiary of Essar Power Ltd (EPL), and the owner and operator of a 1,200 MW imported coal-fired thermal power plant at Salaya in Gujarat's Devbhumi Dwarka district, has recorded a 33% growth in EBITDA in the half year ending 30 September 2016 over the previous fiscal. The EBIDTA for the first of the current financial year stood at Rs. 300 crore compared with Rs. 226 crore in the same period last year. The revenues grew by 12% to Rs 951 crore in H1 FY17 from Rs 851 crore in H1 FY16.

The strong financial performance can be attributed to robust improvement in all operational parameters, like plant availability, which grew by 14%, as well as generation, which also grew by 14% to 2,953 million units as against 2,595 million units in the corresponding period last year. Input costs, on the other hand, were lower. The coal cost, for instance, came down by 9% to Rs 1.95/kWh from Rs 2.13/kWh.

Ramesh Kumar

Ramesh Kumar, Managing Director, EPGL, said, "While we registered a remarkable performance in the first quarter, our strong showing in the half year is a clear indication that we will close FY17 on a high. We have been working diligently on improving our operational parameters. Migration from a single-origin coal basket to a multi-origin one through inviting bids from global coal suppliers on our indigenously developed reverse e-auction platform has helped us better our margins. The upcoming sea water intake system and coal conveyor corridor will further enhance our margins once they are commissioned."

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Hindustan Power awarded 'Best Solar Developer' by IPPAI

Hindustan Power, a well known integrated power player, has been awarded the 'Best Solar Developer' by the Indian Power Producers Association of India (IPPAI), during its 17th Regulator and Policy makers Retreat.

The jury comprising Prof. S L Rao, Former Chairman, CERC; HL Bajaj, Former member, Appellate Tribunal for Electricity; Rakesh Nath, Former Member, Appellate Tribunal for Electricity; V Subramanian, Former Secretary, Ministry of New and Renewable Energy (MNRE); Ajay Shankar, Former Secretary, Department of Industrial Policy and Promotion, Ministry of Commerce and Industry; Dr. V K Garg, Former Chairman, JERC-Goa & Uts; RN Parashar, Former Chairman, Haryana Electricity Regulatory Commission; and VP Raja, Former Chairman, MERC, conferred the award to the company on basis of its significant contribution to the Indian solar sector.

Hindustan Power team with the award...

The company has distinction of commissioning India's first 5 MW and 30 MW solar projects and has pan India presence.

Deloitte, as the Knowledge partner short-listed the entries as per the set criteria for the jury to finalise the winner based on their contribution to the sector over the years.

Rajyawardhan Ghei, CEO, Domestic Solar Hindustan Power, said, "We are one of the early entrants in the sector and our international exposure helped us bring new practices and technologies to the country. We have been constantly delivering projects on time thanks to the designing and supply excellence. Close to 600 MW of solar assets commissioned, we have been at the fore front and would like to thank IPPAI for recognising our efforts."

Indiagosolar brings on board EMMVEE, Gautam Solar

IndiaGoSolar has brought on board EMMVEE Photovoltaic Power and Gautam Solar on its solutions, services and e-consulting and training platform. EMMVEE is a developer and manufacturer of high performance solar thermal systems, solar water heaters as well as mono- and polycrystalline modules and photovoltaic systems. On the other hand, Gautam Solar deals in affordable solar products – such as solar lighting, solar pump and solar power plants among others. IndiaGoSolar will be providing these companies higher visibility, premium listing, reach to wider base of retail and bulk customers accompanied with featured products and solar market insights. As a policy, Indiagosolar lists only those integrators and manufacturers on their platform, which are already empanelled by MNRE and state agencies.

Dr. Harish Ahuja

Dr. Harish Ahuja, Founder and CEO of IndiaGoSolar, said, "We are extremely pleased to bring on board these two solar companies on our industry-first marketplace platform. They needed better online reach and visibility to market their affordable and reliable solar products to the customers – and we are empowering them to do just that, through our platform. In addition to providing an exclusive range of innovative, best-of-breed solar products and services and 24X7 shopping from anywhere, anytime, across India, we also provide information and advisory services and work as a facilitator to arrange for finances."

KEC International bags orders worth Rs.1192 crore

KEC International (KEC), a global infrastructure Engineering, Procurement and Construction (EPC) major, an RPG Group Company has secured new orders of Rs.1192 crore.

Transmission & Distribution (T&D) Business: This business has secured orders of Rs.859 crore in India, Africa and the Americas.

- Secured EPC orders of Rs.631 crore for 765 kV and 400 kV Transmission Lines from various customers in India.
- Secured International orders of Rs.228 crore including supply orders across the Americas and Africa as well as a turnkey EPC order in Brazil.

Cables Business: This business has secured supply orders of Rs.105 crore.

Railways Business: This business has secured an Overhead Electrification order of Rs.120 crore for sections in the North Western Region.

Solar Business: This business has secured orders of Rs.108 crore for providing turnkey EPC solutions for Solar Power projects with single axis tracker.

Vimal Kejriwal

Vimal Kejriwal, MD and CEO, KEC International, said, "In the T&D business, with substantial order wins in India, we continue to consolidate our presence in the domestic market. We also continue to diversify our customer base to include SEBs and developers of Public–Private Partnership (PPP) projects."

"Further, leveraging on our Global EPC experience and expertise, we have secured another EPC order in Brazil, this being our 7th such order in Brazil from an International developer. Our railways business is poised for a significant growth on the back of successive new order wins. We continue to strengthen our footprint in the Solar EPC space with the new order wins." he added further

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NKT Cables to acquire ABB's cable business


Claudio Facchin

NKT Cables is acquiring ABB's global high-voltage cable system business with a total enterprise value of 836 million euros (US$934 million). High voltage cables are key components in sustainable energy networks, used for transmitting large amounts of electricity over long distances. The business is part of ABB's Power Grids division, which is currently undergoing a strategic review.

ABB's cable system business offers turnkey solutions including design, engineering, supply, installation, commissioning and service. It had adjusted standalone revenues of US$524 million in 2015, employs around 900 people, and has state-of-the art manufacturing and R&D capabilities for high-voltage submarine and underground cables in Karlskrona, Sweden. The transfer of assets also includes a new, cutting-edge cable-laying vessel, currently under construction. With experience of over a century, the business serves a range of applications and has commissioned hundreds of alternating current and direct current links around the world.

The transaction is anticipated to close in Q1 2017, subject to regulatory clearances and fulfillment of the closing conditions. Goldman Sachs acted as exclusive financial advisor to ABB and Freshfields Bruckhaus Deringer as legal advisor.

Claudio Facchin, President of ABB's Power Grids, said, "As part of the strategic partnership, ABB and NKT Cables will work together on future projects to access market opportunities in areas like sub-sea interconnections and Direct Current (DC) transmission links."

"This transaction will simplify and focus the Power Grids portfolio," he further revealed.

Klein Tools reveals its Electrician of the Year

Klein Tools recently revealed Eric Simmons as the winner of its annual Electrician of the Year award. He will receive $2,500 a year in free Klein Tools products for 10 years, totalling $25,000 worth of premium-quality, professional-grade hand tools. He has been an electrician for more than 20 years and is currently licensed as a master electrician, electrical contractor or electrical administrator in 15 states. Currently, he resides in Las Vegas, Nevada where he works for one of the largest electrical contractors in the nation as a Senior Project Manager.

Simmons was selected from more than 350 applicants and is recognised for his professional achievement, his dedication to safety and contributions to his local community. He dedicates a significant amount of time to learn and apply proper safety practices as well as teaches others about safety. He is certified by the Board of Certified Safety Professionals (BCSP) as both a Safety Trained Supervisor-Construction (STS-C) and as a Construction Health and Safety Technician (CHST). He is also an authorised OSHA outreach trainer for construction, MSHA Surface Miner Safety Trainer and an American Heart Association First Aid/CPR/AED instructor.

Eric Simmons is receiving the award

Saft bags a contract from CAF

Saft, which is well known for its design, development and manufacture of high technology batteries for industry, has been awarded a major contract by Construcciones y Auxiliar de Ferrocarriles S.A. (CAF) – the largest rolling stock manufacturer of Spain.

The company has been given the contract to supply the on-board backup power batteries for the new electric commuter trains currently under construction for Nederlandse Spoorwegen (NS), the Dutch railway network operator. The company's nickel-based MRX batteries will enhance the energy efficiency of the 118-strong fleet of new trains as the Dutch rail network makes the transition to running entirely on renewable wind energy by 2018.

CAF is adapting its Civity Electric Multiple Unit (EMU) design to provide Sprinter services on the Dutch railway network. These Sprinter New Generation units feature a low floor design that offers leading edge comfort, efficiency and safety technology. The aerodynamic design of the units, the shared bogie system for weight reduction, and other technological advances provide for optimum power efficiency. The fleet that CAF is manufacturing for NS comprises 68, three-car trainsets and 50, four-car trainsets scheduled to start revenue service from 2018.

Two Saft batteries will be fitted to each NS trainset where they will deliver a combination of high power and energy to ensure the continuity of critical control, safety and communications functions for over three hours should the main power supply be interrupted.

The batteries that Saft is manufacturing for CAF comprise 80 MRX115 cells for a nominal 110 V and 115 Ah capacity. It has developed the MRX cells specifically to provide a compact, lightweight battery solution that provides high performance within the limited space envelope available on modern train designs.

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Solar FlexRack bags largest utility-scale solar power generation project in Iowa

Solar FlexRack, a division of Northern States Metals and an well known photovoltaic mounting and tracking solutions, recently revealed the largest utility-scale solar power generation project in Iowa, a 2.3MW plant (the largest of the series, which will include 5 systems and total 5.5MW) is installed with the smartest racking solution available, the best-in-class G3 Fixed Tilt system.

One of the most cost-effective racking solutions, Solar FlexRack's G3 Series was independently verified for its ease and speed of installation. Developed and installed by Azimuth Energy, the installations under construction are primarily located in the central and eastern regions of the Hawkeye State.

Central Iowa Power Cooperative (CIPCO), Iowa's largest cooperative energy provider, will commission the carbon-free, solar plants and the clean energy will be delivered to their membership. CIPCO is part of a powerful movement among electric cooperatives to procure sustainable solar power as a part of their energy offering. When completed, the 5 solar electric plants will reduce over 5 million tons of carbon emissions annually.

Solar FlexRack Installed in the largest solar project in Iowa

Sydney Airport, BYD unveils Australia's Electric Blu bus

Sydney Airport and BYD company, recently in a ceremony, unveiled Australia's first pure electric airport bus in the first commercial operation of a pure electric bus fleet in Australia. It was as a part of $5 million investment in environmentally friendly ground transportation technology, delivering on Sydney Airport's and BYD's commitment to sustainability.

The Electric Blu bus is the first of a fleet of six electric buses – supplied by the well known electric bus manufacturer BYD in a joint venture with Carbridge. It will be operational by the end of this year, replacing the airport's existing diesel bus fleet servicing the 7 km shuttle route between the T2/T3 terminal precinct and the Blu Emu Car Park. These state-of-the-art electric buses have a carrying capacity of 70 passengers. It features purpose-designed luggage storage racks and have a range of 400km on a single charge, which can make up to 100 transfer journeys on a single charge. It will provide clean and sustainable transportation for the two million travellers, visitors and airport workers who use the Blu Emu shuttle service every year. The Blu Emu fleet will deliver carbon emission reductions of approximately 160 tons per year and improve local air quality through zero tailpipe emissions. The fleet will also lower external noise levels, reduce waste fluids to zero and decrease the amount of toxic material generated during servicing.

Electric Blu Bus to operate Sydney Airport's shuttle service…

Kerrie Mather, Managing Director and CEO of Sydney Airport Corporation Limited, said, "We're proud to be the first Australian airport to introduce electric buses to our Parking and Ground Transport operations, which will reduce our carbon footprint and enhance the passenger experience."

TI launches DDR memory power solution

Texas Instruments (TI) recently revealed the industry's first fully integrated power management solution for Double Date Rate (DDR) 2, DDR3 and DDR3L memory subsystems in automotive and industrial applications. The TPS54116-Q1 DC/DC buck converter is a 2.95-V to 6-V input, 4-A synchronous step-down converter with a 1-A peak sink/source DDR termination and buffered reference that reduces system size by up to 50 % compared to discrete implementations.

Designed for automotive applications such as infotainment, Advanced Driver Assistance Systems (ADAS) and instrument clusters, the TPS54116-Q1 can also power DDR memory in telecommunication, test and measurement, and factory automation equipment. Used in conjunction with TI's WEBENCH online design tools, the TPS54116-Q1 simplifies power conversion and speeds the power-supply design process.

The newest addition to TI's industry-leading DC/DC converter portfolio, the TPS54116-Q1 buck converter provides up to 2.5-MHz switching frequency and minimises solution size by integrating the MOSFETs and reducing inductor size. The switching frequency can be set above the medium-wave radio band for noise-sensitive applications and is synchronisable to an external clock.

TPS54116-Q1 key features & benefits

- Integrated low- and high-side power MOSFETs and a 1-A sink/source DDR VTT termination regulator support 4 A of continuous output current.
- Current-mode control with external clock-synchronisation capability keeps the frequency fixed across the entire output load range.
- Automotive Electronics Council (AEC)-Q100 qualified with 4-kV Electrostatic Discharge (ESD) protection for automotive applications.

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Entergy Corporation appoints new Senior Vice President (HR)

Andrea Coughlin Rowley

She has more than 25 years of HR management experience...

Entergy Corporation has roped in Andrea Coughlin Rowley, who is known to be a veteran human resources leader in the energy sector, as Senior Vice President of Human Resources (HR).

Rowley has more than 25 years of HR management experience. She will serve as a member of Entergy's office of the Chief Executive, reporting to Don Vinci.

She most recently served as the President and Chief Executive Officer (CEO) of Advance/Evolve, a leadership and change management consulting firm.

She began her career in HR at Shell and later served in a variety of HR leadership roles at Frito-Lay, BMC Software and Baker Hughes, where she became Vice President of global transformation and led the redesign of global HR.

She was Vice President (HR), at Schlumberger/Smith International in the Wilson division, where she led not only succession planning, compensation and benefit programs, but also the company's safety and continuous improvement departments. She later served as Vice President, HR – Residential, at Direct Energy, and as Vice President of HR at Dover Corporation.

Rowley received a Bachelor of Science degree in Business Administration, majoring in Human Resource Management (HRM), at Ohio State University. She then continued her education and received a Juris Doctor degree from the University of Houston Law Centre.

Brett A. Cope named as President and CEO of Powell Industries

Brett A. Cope

He holds a bachelor's degree in Applied Science from Miami University...

Powell Industries, a well known supplier of custom engineered solutions for the management, control and distribution of electrical energy, recently revealed that its Board of Directors has named Brett A. Cope, President and Chief Executive Officer (CEO) of the company. He was also named to the Board of Directors. Both his roles were effective from October 1, 2016.

He joined Powell in December 2010 as Vice President of Sales and Marketing and has served as Senior Vice President and Chief Operating Officer since December 2015. During the 20 years prior to joining Powell, he held roles of increasing responsibility at ABB, an international provider of power and automation products enabling the utility, industrial, transportation and infrastructure industries. He holds a Bachelor's degree in Applied Science from Miami University of Ohio.

Thomas W. Powell, Non-executive Chairman of the Board, said, "On behalf of our Board of Directors and the company, I am pleased to announce the promotion of Brett Cope to President and CEO. With over 25 years of industry experience, Brett has demonstrated great leadership over the past six years on his path to becoming our new Chief Executive Officer. As CEO, Brett's customer and product focus will strengthen the company's market leadership in customised engineered solutions. The Board and I expect his transition from Chief Operating Officer into his new role to be a smooth one and we welcome him onto the Board."

SolarCity appoints Radford Small as Chief Financial Officer

Radford Small

He has enjoyed a successful tenure at SolarCity...

SolarCity Corporation has promoted Executive Vice President of Global Capital Markets, Radford Small to the role of Chief Financial Officer.

Radford Small, among the most experienced executives in renewable energy finance, has enjoyed a successful tenure at SolarCity, where he helped the company create approximately $3 billion in new financing for solar projects. He initially joined SolarCity in 2015 to oversee financial business development and investor relations, and his role has steadily expanded to include all of the company's global capital markets activity.

He originally joined SolarCity from Goldman, Sachs & Co. where he was a Managing Director and Chief Operating Officer for the Clean Technology and Renewables group. Over his 17 year career in the Investment Banking Division, he raised more than $20 billion in financing and worked on over $25 billion of mergers and acquisitions transactions.

He holds a Bachelor of Arts degree in economics from University of California at Berkeley, a Juris Doctorate degree from Loyola Law School and Master of Laws (LLM) degree from New York University School of Law.

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Gyanesh Chaudhary wins Bengal Entrepreneurship Award 2016

Vikram Solar's, MD and CEO, Gyanesh Chaudhary recently won The Bengal Entrepreneurship Award 2016 in the manufacturing sector. Samjjal Ganguly, Vice President (VP) Projects, received the award on his behalf from Amit Mishra, Minister of Finance, Commerce & Industries, West Bengal. The Bengal Entrepreneurship Award is organised annually by The Bengal Chamber of Commerce and Industry (BCC&I).

Three successful entrepreneurs were adjudged and awarded as best entrepreneurs each from the manufacturing, service and start-up sectors.

The Bengal Entrepreneurship Recognition initiative is undertaken to identify and reward entrepreneurs of West Bengal who have outstanding entrepreneurial vision irrespective of their size, capital and competencies and who are instrumental in the socio-economic development of the state. The aim of the initiative is to encourage dynamic, sustainable and forward thinking entrepreneurs of West Bengal, who are contributing to the development of the state's economy.

Gyanesh Chaudhary, MD and CEO, Vikram Solar, said, "It is a

S Ganguly is receiving the award from Dr A Mitra on behalf of G Chaudhary...

proud moment and we are elated to receive this award. This is a noteworthy milestone for all of us as The Bengal Chamber of Commerce and Industry plays an instrumental role in recognising entrepreneurship and is aimed at promoting further entrepreneurial activity in the state."

DMRC bags the prestigious World Green Building Council Award

The Delhi Metro Rail Corporation (DMRC) has been awarded with this year's prestigious Asia Pacific Region Network Award constituted by the World Green Building Council for demonstrating "Industry Leadership in Sustainability".

DMRC team receiving the award...

The award recognises organisations, which are truly integrating sustainability into their business models and contributing to the transition towards a sustainable built environment. The award is the recognition of works done by DMRC in spurring green building activities in both construction and operations. This is the first time an Indian company has been awarded with this prestigious honour. The award committee considered the initiatives taken by Delhi Metro in the field of environmental sustainability by following 'management by objectives' approach towards climate change, green in-built environment, energy efficiency, Clean Development Mechanism (CDM), solar power etc. The award was presented to Dr. Mangu Singh, Managing Director, DMRC and AK Gupta, Director (Electrical), DMRC in Mumbai by Tai Lee Siang, Chair - World Green Building Council.

NTPC Dadri bags top Plant 2016 Power Magazine Award

The National Capital Power Station, Dadri (NTPC Dadri) has bagged the Top Plant 2016 award by prestigious Power Magazine of USA in the coal fired generation category. The Power Magazine is the official publication of Electric Power covering Business and Technology for the Global Generation Industry.

In the October 2016 issue of Power magazine the winning Attributes of National Capital Power Station, Dadri (coal based Station) has been mentioned as "Consistently one of NTPC's top performing plants, despite age and challenges in the Indian power market. Plant staff have worked to implement a range of innovative approaches to increase plant efficiency without increasing costs, and has achieved 100% fly ash recycling and implementing a zero liquid discharge system."

With the total installed capacity of 2,654 MW, it is one of the largest power plants in India. It consists of six coal-fired units, (4x210 MW and

NTPC Dadri, one of the largest power plants in India...

2x290 MW), 829 MW gas fired combined cycle plant and a 5 MW solar farm. Adjacent to the plant is a 5,300 MW switchyard, the largest in the nation, which connects to a 400kv transmission line.

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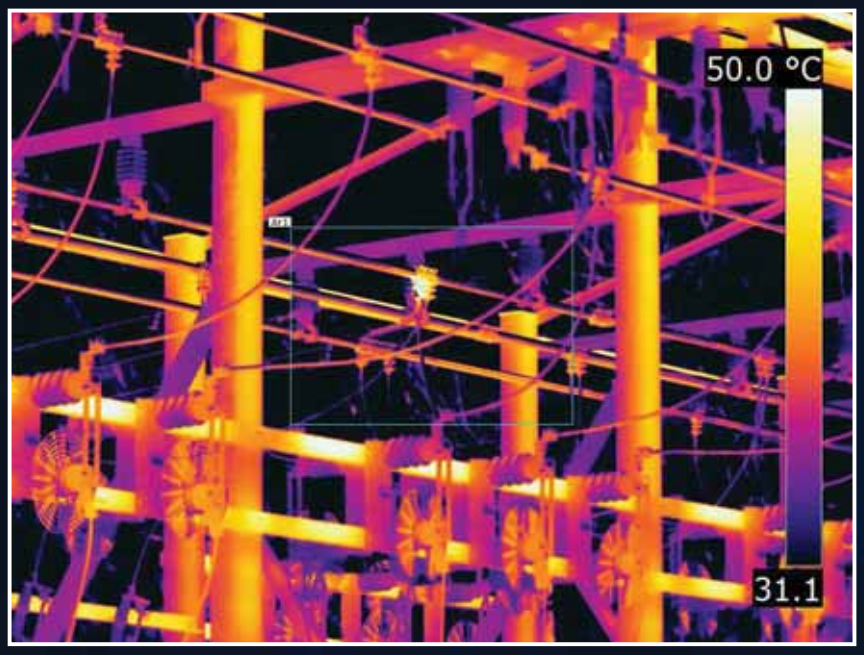

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CONCEPTS ON BREAKER

"Circuit breakers are mechanical switching devices, capable of making, carrying and breaking currents under normal circuit conditions – and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of a short circuit...

Right from the beginning of the use of electricity by human being (from the day of invention of electricity), need has always been felt for safety switching of the electricity. Switchgears and Circuit Breakers are the final development for such safety operation.

This very essential equipment plays the important role for the immediate disconnection of power supply for any kind of fault occurrence in the system by getting the pulse from the suitable relay or protective scheme in the network.

To avoid heavy flashover/arc during the disconnection, different quenching mediums are generally provided and for quick and fast disconnection, suitable operating mechanisms are used.

Definition of Circuit Breaker:- General definition by the International Electrotechnical Commission (IEC):

"Circuit breakers are mechanical switching devices, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions such as those of a short circuit.

Classification of Circuit Breakers

According to the type of quenching medium

1. Air Break Circuit Breaker (ABS)
2. Air Blast Circuit Breaker (ABCB)
3. Minimum Oil Circuit Breaker (MOCB)
4. Bulk Oil Circuit Breaker (BOCB)
5. Vacuum Circuit Breaker (VCB)
6. Sulphur Hexafluoride (SF_6) Circuit Breaker

According to the operating mechanism

1. Pneumatic (compressed air provides the required thrust)
2. Hydraulic (high pressure hydraulic oil of approximately 310 kg/cm^2 is used for opening and closing operations

3. Spring (During close, charged spring discharges and simultaneously charges the opening spring)

According to breaking type

1. Single break circuit breaker
2. Double break circuit breaker
3. Three break circuit breaker
4. Four break circuit breaker

According to on number of quenching chamber and break

1. Single break: One quenching medium per pole with one fixed and one moving contact for breaker operation.
2. Double break: Two quenching mediums per pole with two fixed and two moving contact for breaker operation.
3. Three break: Three quenching mediums per pole with three main and three moving contacts for breaker operation.
4. Four break: Four quenching mediums per pole with four main and four moving contacts for breaker operation.

Based on voltage

1. Low- less than 1kV
2. Medium- 1kV to 52kV
3. High/Extra High- 66kV to 765kV
4. Ultra High -above 765kV

Based on application

1. Indoor
2. Outdoor

Based on external design

1. Dead tank
2. Live tank

Choice of the Breaker

This equipment is the final breaking point for the interruption of power flow in the circuit. So, during this break the electrical parameters like voltage and current on this instrument change – and to avoid the unwanted situation, the following points are to be considered.

Use of number of interrupting chambers

The voltage dealing across this equipment and break point to limit the spark in the quenching chamber, the use of the chamber is decided – and as per the practice it becomes safe to use one chamber up to voltage class of 245 kV as one chamber and then more as per the increase of the voltage handling situation by this element.

Sr. No.	Voltage Range	No. of Chambers
1	Up to 245 kV	ONE
2	245KV to 550 kV	TWO
3	550 KV up to 800 kV	FOUR

Compliance to electrical requirements

The optimum conditions like Breaking Capacity, TRV (Transient Recovery Voltage), Capacitive and out of phase switching condition are to be complied during choice of the beaker for the circuit.

Choice of interruption time

The interruption time is one of the important factors for the protection scheme for the circuit breaker – and becomes critical for the case of higher system voltage application. So, choice of this factor to be considered as per the practice in the following table.

Voltage Class	Close (Max)	Open (Max)	CO (Min)	PIR Insertion	PIR and Main Over lap Time/ PIR
132	150	40	50	-	-
220	150	35	35	-	-
400	120	25	35	12 ± 4	5

Control of switching over voltage

For condition like unloaded long line, switching of shunt reactors, the transformers loaded with reactors etc. result over voltage in the system. Adding of CLOSING RESISTORS reduces the damping of over voltages.

Dead Tank...

Live Tank...

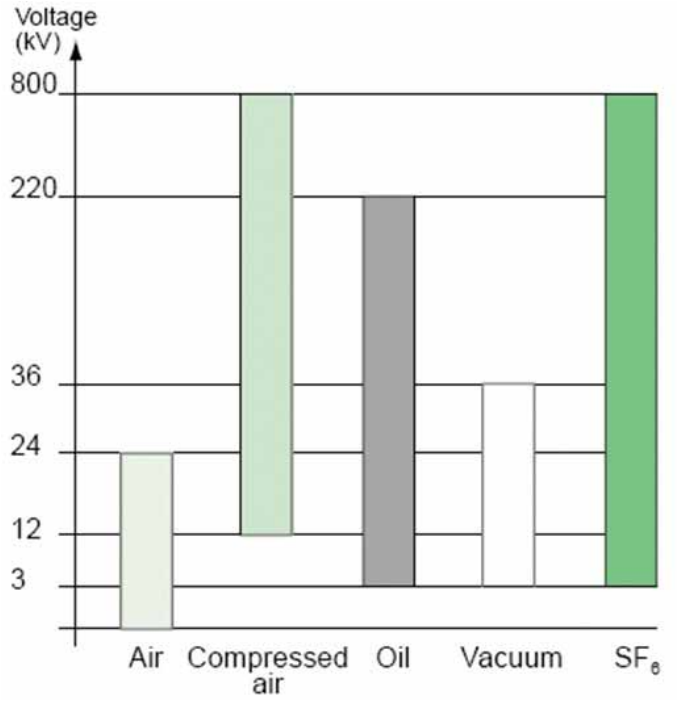


Figure 1...

Mechanical, electrical endurance

The mechanical and electrical endurance limits of Circuit Breakers must confirm to all the relevant electrical standards.

Selection of switching scheme

Calculation of available fault current for Breaker, Main bus continuous current rating selection, Current and potential transformer selection.

Other factors

The other factors like choice of protective relay selection, circuit breaker control power selection, operating mechanism desired, space for installation etc are to be considered for the design of Circuit Breakers

Latest Development in Switch Gears

Considering the different points/factors as described above, different manufacturers regarding Breaker construction have achieved many developments.

The commonly used Circuit Breakers for different rating voltages have been explained below. The graph shown in figure 1 is one of the tentative voltage class practices that could be used for the choice of Circuit Breaker.

Up to voltage range of 36 kV

VCB is one of the best suitable choices of Circuit Breaker up to the voltage range of 36 kV because of its following advantages.

- Rapidly restoring nature of dielectric strength of the gap.
- Short travel stroke at low pressure requires lesser control energy, which in turn results in reduced size and weight of Circuit Breaker.
- Moreover, the operating mechanism for such Circuit Breaker is of (spring-spring) in nature. This mechanism becomes more reliable due to lesser moving parts involved for the operation.

But the only disadvantage in the use of VCBs is the precaution in maintenance of Vacuum during its operation. However, this Circuit Breaker has gained maximum popularity for 36 kV range.

Voltage range of 72 kV up to 800 kV

For higher voltage range, SF_6 gas is used as the arc-quenching medium in a hermetically sealed chamber. SF_6 gas is being extensively used now-a-days, due to its inherent property of immunity to the climatic and environmental condition.

Advantages of SF_6 gas

- Colourless, odourless non-flammable, non-toxic / biologically inert
- High dielectric strength (RRRV 2.5 x air)
- High arc interruption capability (10 x air)
- High heat transfer characteristics (2 x air)
- Insulating properties remain un-altered as carbon is absent in the molecules
- Remains without condensation up to -30 degree temperature
- Density is 6 times as of air
- Chemically stable / non-corrosive
- easy to handle
- Electronegative in nature.

Function of SF_6 during puffing

During breaker operation, the contact movement creates the puffer action, which momentarily increases the dielectric strength and arc extinguishing properties of SF_6 gas. During contact opening, the puffer action forces a pressurised stream in the form of axial jet (in whirlpool formation) of SF_6 gas through contact area, cooling and extinguishing the arc at current zero. The action moves a large volume of SF_6 gas through the arc zone to absorb heat – and the free electrons from the plasma quickly reduce arc energy. Puffer action means minimum contact erosion and longer contacts life.

Concepts on Circuit Breakers

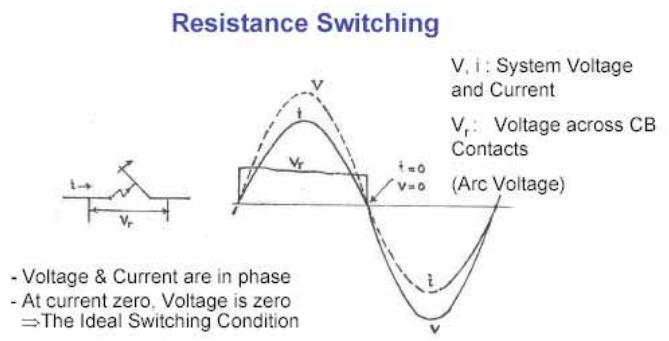
Graphic representation of switching action of breaker

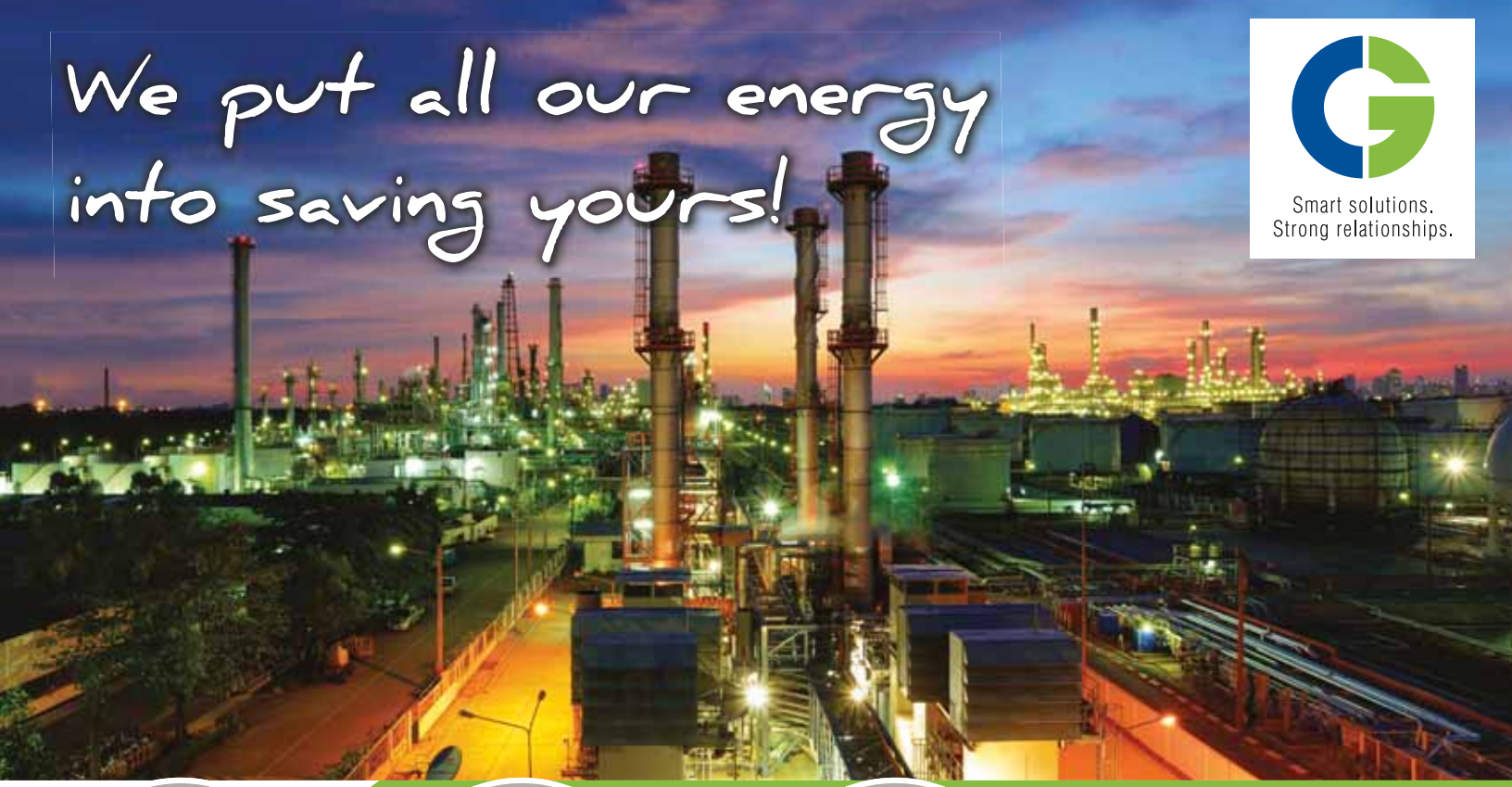
While switching the circuit, the electrical elements that come across the system are of three types (Resistive, Inductive and Capacitive). This paragraph describes the flow of current and its wave form analysis for the voltage application to the load. Basically, for resistive, the current becomes in phase to the application of voltage – and lags to the voltage for inductive load and leads to the voltage for capacitive load. The detail circuit and explanation is given below for circuit reference.

Graphic representation of current interruption in circuit breaker

The current interruption flow and its behaviour can be shown in the graphic representation form as shown below.

Graphic representation of switching action





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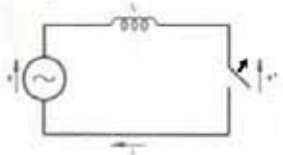
Inductive Switching

Emf induced

$V = L\, di/dt$

Energy

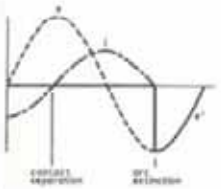
$W = 1/2\, L\, i^2$



- Current cannot change instantaneously

  Current lags Voltage by 90°
- Opening CB : ⇒ Current is zero at this instant

  ⇒ Voltage is at max. (peak) value



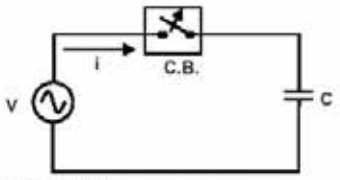
Capacitance Switching

Current flowing in Capacitor

$i = C\, dV/dt$

Energy in Capacitor

$W_c = 1/2\, CV^2$

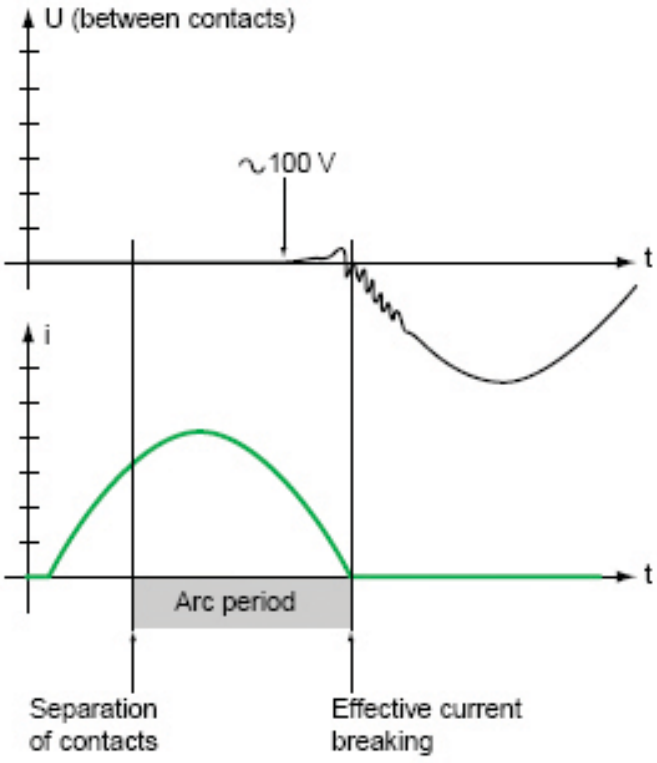


- Voltage across C cannot change instantaneously
- Current leads Voltage by 90°

  At current zero, voltage is at peak
- Closing of Capacitive Current leads to current inrush
- Causes Pre-arcing between C.B. contacts

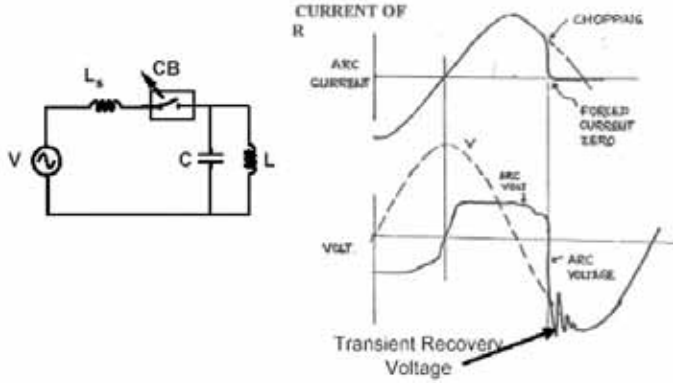
Examples: Switching of Capacitor Banks and Unloaded Transmission Lines

Graphic representation of current interruption



Interruption of Low Magnetizing Current

Interruption of Magnetizing Current of Transformer & Shunt Reactor



Notes on contact resistance

100 A DC current passed through main contacts & voltage across the terminals of the circuit breaker is measured. The contact resistance is calculated by V= IR formula.

The acceptance limit for contact resistance is 1.2* Ru, where Ru is the contact resistance measured during temperature rise test.

Notes on DCRM (Dynamic Contact Resistance Measurement)

The Normal Resistance Measurement is done as the ratio of voltage applied across the main contact to the current passes through it. But during breaker operation, the arc resistance plays the important role to monitor the status of the main and arcing contact – and calculated in the form of DCRM. So, Dynamic Contact Resistance Measurement is a signature of change in contact resistance of CB during operation. It plots the variation in contact resistance while first the main, then the arcing contacts engage and disengage during CO operation.

Req = R*r/(R+r) = r/(1+r/R),

r = Main contact, R = Arcing contacts

Comparison on concepts of contact resistance and dynamic contact resistance

Contact Resistance	Dynamic Contact Resistance
The CB is in closed condition during measurement	The CB undergoes CO operation during measurement.
Current is injected in CB contacts and milli volt drop is measured only at once	The current is injected in CB contacts and continuous samples of millivolt drop are taken
The contact resistance value reflects the contact resistance at that particular contact condition only	Thus contact resistance variation of both main and arcing contacts is measured on time scale

Notes on dew point measurement

In general, the dew point of SF_6 is defined as the temperature at which the gas in the breaker starts condensing. The measurement of this point is done either at the atmospheric pressure or at the rated pressure. Dew point when measured keeping regulating valve in service at the outlet of dew point kit to allow required flow rate of gas/air, it is called dew point at rated pressure of CB and when measured by regulating the gas flow at

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Lightning Impulse Test upto 220 kV, 100 MVA Power Transformer

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- CRGO Steel Laminations
- Evaluation of Solid Insulating Materials (Paper/Pressboard/ Laminated wood and boards/ Cork sheets/ etc.
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- Harmonic Measurements of Magnetizing Current
- Online Condition Monitoring by Acoustic Emission Method
- Third Party Testing (220 kV, 100 MVA) using calibrated Instruments at manufacturer's works
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- Noise Level Measurement
- Furan Analysis and Degree of Polymerization (DP) of cellulosic (Paper & Pressboards) insulating materials in Transformers

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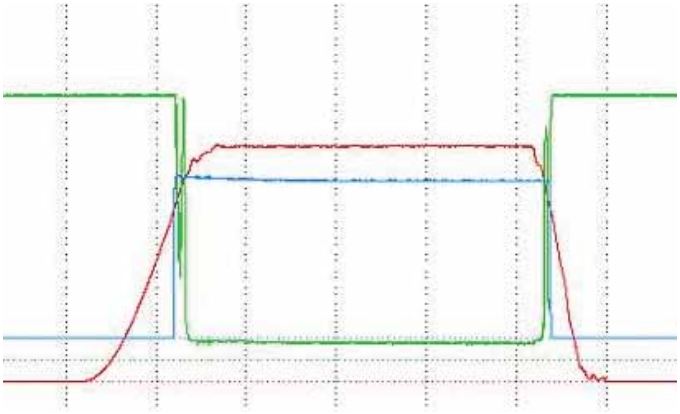
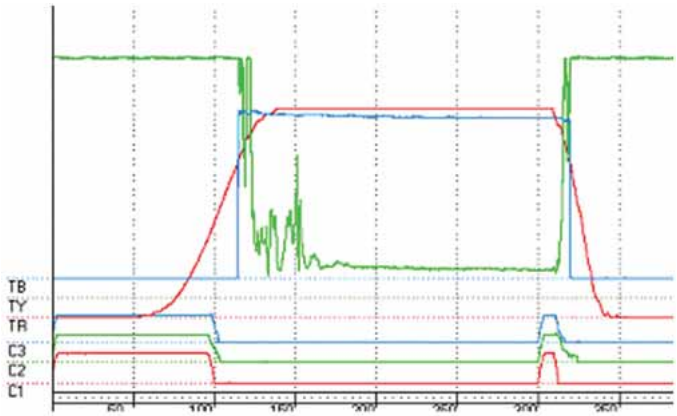
Typical DCRM graph for healthy pole...



Typical DCRM graph for suspected pole...



Data on Breaker System

Make	Travel in mm	Total Contact Insertion in mm	Main Contact Insertion in mm	Arcing Contact Insertion in mm	Trip Velocity m/sec	Close Velocity m/sec
CGL	230/140	28	12	16	5-6	3-4
BHEL	242/130	54	34	20	6-8	3-4
ABB	200	50	20	30	6-8	3-4
AREVA	180	45	25	20	5-8	2-4

BREAKER TYPE	145 kV SP-PN	145 kV SP-SP	245 kV	400 kV
CLOSING COIL STROKE	5.0 to 5.5	5.0 to 5.5	5.0 to 5.5	5.0 to 5.5
GAP BET TRIGGER & A/P LEVER	2.5 to 3.5	2.5 to 3.5	2.5 to 3.5	2.5 to 3.5
GAP BET A/P LEVER & A/P PIN	1.5 to 3.0	1.5 to 3.0	1.5 to 3.0	1.5 to 3.0
TRIP COIL STROKE	2.1 to 2.5	2.8 to 3.2	2.1 to 2.5	1.6 to 1.9
TRIP COIL GAP BET PLUNGER & TRIGGER	0.6 to 1.0	1.0 to 1.4	0.6 to 1.0	0.8 to 1.0

Important Practice Data on the Circuit Breaker

Voltage Class	C and Tan Delta			Breaker Timing in mS					Contact Resistance in micro- Ohm		
	Tan Delta Grading Capacitor	Rate of Rise /Year	Capaci-tance	Close (Max)	Open (Max)	CO (Min)	PIR Insertion	PIR and Main Over lap Time/ PIR	Main	CB Terminal	Per Break
132 KV	0.007 (Max)	0.001 Max	± 5 % of Rated Value	150	40	50	-	-	100	10	75
220 KV				150	35	35	-	-	100		
400 KV				120	25	35	12 ± 4	5	150		

the inlet of dew point kit and keeping outlet regulating valve in fully open condition, then it is called dew point at atmospheric pressure.

Notes on moisture effect to SF_6 gas

When arc results during breaker operation, SF_6 gas decomposes due to the chemical reaction with the eroded particles. If the moisture remains due to leakage, the chemical reaction also causes the degradation of insulation and corrosion in the interrupting chamber. So, the trace of objectionable moisture is to be done. Dew point measurement helps in monitoring this trace in the SF_6 chamber.

List of routine tests conducted on circuit breakers

- Mechanical operation tests
- Electrical sequence test (control & auxiliary circuit check)
- Measurement of speed & time (no load operating characteristics)
- CRM
- DCRM test and Analysis
- Milli volt drop test (contact resistance measurement)
- High voltage test on main circuit

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- Measurement of tripping & closing coil resistance
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- Pump charging time for operations
- Leak testing hydraulic mechanism
- N_2 leak test on accumulator
- Replenishing time measurement for compressed air
- Air pressure switches operation
- Safety valve operation
- Air leakage test
- Operational Analysis
- C & Tan Delta of grading capacitors

Type tests

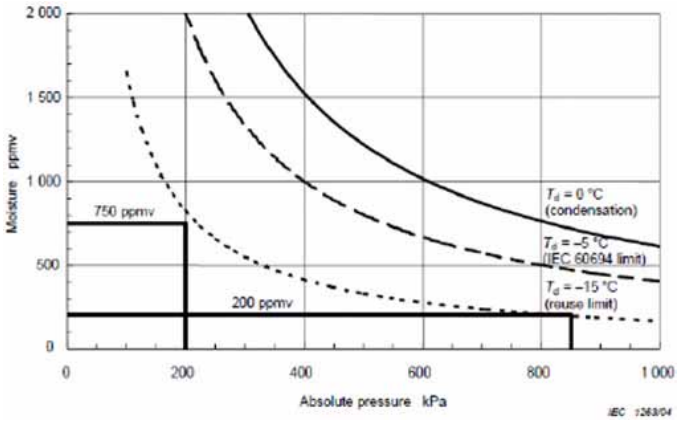
- High power tests
  - i. Direct tests
  - ii. Synthetic tests
    - – Short circuit tests
    - – Switching performance tests
- High voltage tests
- Mechanical and environmental tests
- Temperature rise test

Notes on Condition Monitoring

Health monitoring of the circuit Breaker can be done in various methods either ON- Line or OFF-line practices.

On line condition monitoring techniques

1. SF_6 gas pressure monitoring
2. Trip coil supervision
3. Auxiliary contacts operating timings



4. Contact speed measurement by installing transducers
5. Line current and cumulative fault current using external ct- under evaluation

OFF line condition assessment techniques

1. Operating timings of main and auxiliary contacts
2. Trip/close coil currents measurement
3. Static contact resistance measurement-
4. Vibration measurement under evaluation stage
5. Contact travel measurement
6. Dew point measurement of SF_6 gas
7. Dynamic contact resistance measurement
8. Tan delta measurement of grading capacitors.

Dr P K Pattanaik
Asst. General Manager (Elect)
E & MR Division
OPTCL

igus expands its cable range with integrated tear strip

New tool enables a quick removal of chainflex cable jackets by hand...

In chainflex CFRIP cables from igus, an integrated tear strip enables a quick and easy stripping of the cable jacket by hand – unique in cables for motion in energy chains. Now, 569 chainflex cables are available with the integrated opening strip. Thanks to the new CFRIP plastic tool, the stripping of cables has become even simpler.

The chainflex cables with the CFRIP tear strip can be easily opened like a zip fastener. This allows users to save up to 50 percent of the time when stripping cable jackets, which is especially useful in long lengths such as in control panels. In this way, the specially developed high tensile strength plastic thread – never damages the cores, and this has already be proven by igus in extensive testing in the 2,750 square metre test laboratory, the largest in the industry having. This unique stripping system for moving cables was awarded the iF product design award in 2016 for its innovative function and is increasingly being used in more and more chainflex cables from igus. At the 2016 Hannover Messe the motion plastics specialist has yet again expanded its product range and now offers a total of 569 cables with the integrated tear strip, which ranges from cables for control and measurement systems up to motor and servo cables from stock, and – as for all chainflex cables – a service life of36 months is guaranteed.

Grab the thread and pull!

To simplify working with chainflex cables even further, igus now provides a simple but useful tool. "After many customer requests, we developed a tool with which a chainflex CFRIP cable can be opened easily by hand," explains Rainer Rössel, head of chainflex division at igus.

"Just like putting on a thimble, the use can easily grab the tear strip and pull until the cable is stripped back to the desired length – and the thread doesn't hurt your hand while stripping. The new plastic tool is now available as 'MT.CFRIP', he adds.

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Interview

ERDA's Research Programs are based on the needs and challenges faced by the industry...

Electrical Research and Development Association (ERDA) is a cooperative research institution created by the Indian Electrical Industry and Utilities with the support of Governments of India and Gujarat. National in character, ERDA has established its laboratory facilities at Makarpura Industrial Estate, Vadodara. In an e- interview with Electrical India, Dr M K Shah, Director, ERDA, is explaining the facilities that his organisation extends to the Indian electrical equipment manufacturers to P K Chatterjee. Excerpts...

Q How do you see India in the global map as far as the latest electrical technologies are concerned?

A India can make it to top among the nations as far as the latest electrical technologies are concerned in Generation, Transmission or Distribution. With introduction of new technologies in Generation like of installation of Super Critical Thermal Generation units, MW scale Renewable solar parks, India has touched the total installed capacity of close to 300 GW and generation of almost 800 BU. In Transmission Sector PGCIL has developed indigenous 1200kV station & installation of +/- 800kV DC transmission. To increase the capacity of Transmission Lines, many of utilities have adopted the High Temperature Low Sag Conductors. Distribution in India is largely operated by states. With introduction of key technologies like Smart Metering, APDRP reforms, smart grid projects, Digital Substations by various utilities

there has been the reduction in AT&C losses from 35% to 26% against the global avg of 10 to15%.

With the penetration of latest electrical technologies, ERDA is also looking forward to establish the Centre of Excellence for Renewables and Smart Grid having facilities like PMUs Calibrator, Real Time Simulator, Flexi Power Lab for evaluation of power electronic devices used in solar roof tops and evaluation of HTLS conductors.

Q Has India been truly self-sufficient as far as our calibration and/or R&D needs are concerned?

A India is targeting the double digit growth in GDP in coming years. To enable this, it needs support from the power sector, which is witnessing heavy investment. The quality of BTG equipment, power transformers, HV switchgears, insulators manufactured by large companies is compatible with the global competition. Most of R&D needs of these large companies are satisfied by their global R&D centres either based in India or abroad. 90% of companies manufacturing 33kV switch gears and power transformers up to 132 kV and below equipment in T&D sector are SMEs. Some SMEs have kept pace with technology and upgraded their products. However, most of the SMEs have lagged behind in upgrading the technology, and hence quality of products. ERDA has been contributing to this very R&D need of SMEs in terms of product development, evaluation and contract research.

There is also need for High Power Test Laboratory for medium voltage class switchgear & 132 kV power transformers in India – in order to provide full range short circuit testing for the power equipment manufacturers and utilities. Bina Facility is coming up with high current fault availability up to 400kV and 765kV.

Q What are the top research priorities of ERDA at this moment?

A ERDA's Research Programs are based on the needs and challenges faced by the industry. Based on this ERDA has undertaken various research programs on

1. COE of Renewable and Smart Grid
2. COE for R&D in Medium Voltage Switchgear & Transformers
3. Nano Composite/ Fillers to enhance the performance of insulation and contact materials used in electrical products
4. Smart Solar Inverters for Rooftop applications
5. Renewable Energy integration using Micro Grids
6. LED Drivers for enhanced reliability
7. Controllers for Smart Grids
8. Intelligent Diagnostics

Q What are the benefits of the ERDA members and who can take ERDA membership?

A Any individual, firm, institution, body corporate, limited liability partnership, private or public electricity utilities or government electricity department who has subscribed to the Memorandum of Association and who shall fulfill the terms and conditions laid down in these Rules and Regulations shall be eligible to become an Ordinary Member.

ERDA members are entitled for various commercial benefits while availing services from ERDA i.e., Testing, Training, Library facilities apart from receipt of regular technical information along with participation in the formulation of policies of ERDA through selection in Managing Committee.

Q What are the steps that you have taken in the recent past to assist members in a more comprehensive way – as their technology demands are ever growing and diversifying?

A Apart from normal testing and calibration services, ERDA also undertakes sponsored research on behalf of its members to augment their new product development initiatives. ERDA also provides developmental test facilities to its members to evaluate their newly developed product design. A lot of small scale industries have been benefitted from such special support provided by ERDA.

Q What are the latest additions in your facilities?

A ERDA's latest moving mirror type 'C' Goniophotometer laboratory, with financial support from Govt. of Gujarat, was inaugurated by Hon'ble Minister of Energy and Agriculture of Govt. of Gujarat, Shri Chimanbhai Saparia on 6th Oct'16. This is having the best in class performance conforming to IES-LM-79-08 and others IS/IEC standards like IS 16106 for SSL (LED) Products, IS 16102(Pt-1 & 2) for LED Lamps, IS 16107 for LED Luminaire IS 16103 for LED Modules & IS 10322(Pt-5/ Sec-1 to 5) for Luminaire.

ERDA is also constructing High Voltage Partial Discharge Laboratory for the evaluation of products up to 245kV class with financial support from Govt. of Gujarat.

ERDA has also set up Solar Pump and Solar Inverter Testing Laboratory, supporting Govt. of India's "Environment Friendly Power."

ERDA is also in the process of constructing High Temperature Low Sag (HTLS) Conductor Testing Facility, the first of its kind in India. This will support Govt. of India's "Make in India" campaign.

> ERDA is in the process of constructing High Temperature Low Sag (HTLS) Conductor Testing Facility, the first of its kind in India. This will support Govt. of India's "Make in India" campaign. The organisation has developed over 30 technologies since its inception.

Q Please tell me (in brief) about ERDA's excellent research outcomes (say) in the last two years.

A ERDA has developed over 30 technologies since its inception. In past two year ERDA has done significant contribution in developing following technologies.

1. Nano Silver Contacts for LV switchgear
2. Anti-Dust coating for Solar PV Panels
3. Application Development for Thermoplastics in LV Switchgear
4. IE 4 Motor
5. Monitoring of Distribution Transformers using IEEE Thermal Models
6. Community based Charging System for solar lanterns

Q What kinds of product certification opportunities do you provide?

A In India, mainly Bureau of Indian Standards (BIS) runs product certification schemes, which are basically of two types e.g., voluntary and mandatory schemes.

The certification allows the licensees to use the popular ISI Mark, which has become synonymous with quality products for the Indian and neighboring markets over the last more than 55 years. Similarly, BIS is operating Compulsory Registration Scheme (CRS) for Electronics & IT Goods for the product categories notified by Department of Electronics & Information Technology (DeitY). The organisation is authorized by BIS to conduct testing of more than 100 nos. products under these certification schemes.

ERDA is an ASTA approved laboratory and it provides Intertek (ASTA) certificate for the export oriented customers as well as International Customers in the GCC region.

Q Do you support members from all parts of the country? How do you manage to do that?

A ERDA supports its members from all over India. Apart from Vadodara, ERDA is also having laboratories at Navi Mumbai (Rabale), Gurgaon and Rajahmundry (Andhra Pradesh) to serve its customers and members. The organisation has spread its Business Development Engineers and TPI Engineers all over India e.g., Kolkata, Lucknow, Meerut, Hyderabad, Jaipur and Indore to serve its members better.

Q What kind of training programs do you conduct?

A ERDA organizes regular and specialized skill development training programs regularly.

It conducted six regular training courses and three special training programs in the year 2015-16. ERDA has so far conduced 310 programs and trained nearly 7264 engineers.

22 nos. internal lectures and 6 nos. invited expert lectures were conducted by ERDA in the year 2015-16. 1500 students from 22 Engineering Colleges from Gujarat made industrial visits to ERDA. 17 students are presently undertaking ITI Apprenticeship in ERDA.

Q What are your suggestions to the Indian electrical equipment business owners?

A In order to manufacture world class products in India to turn the "Make in India" initiative of the government a success, Indian manufacturers must adopt world class quality standards for their products.

Without quality products, Indian manufacturers cannot expect to capture global markets. Also, Indian manufacturers must focus more on new innovations and increase their spend on R&D to develop indigenous products and be ahead of their global competitors.

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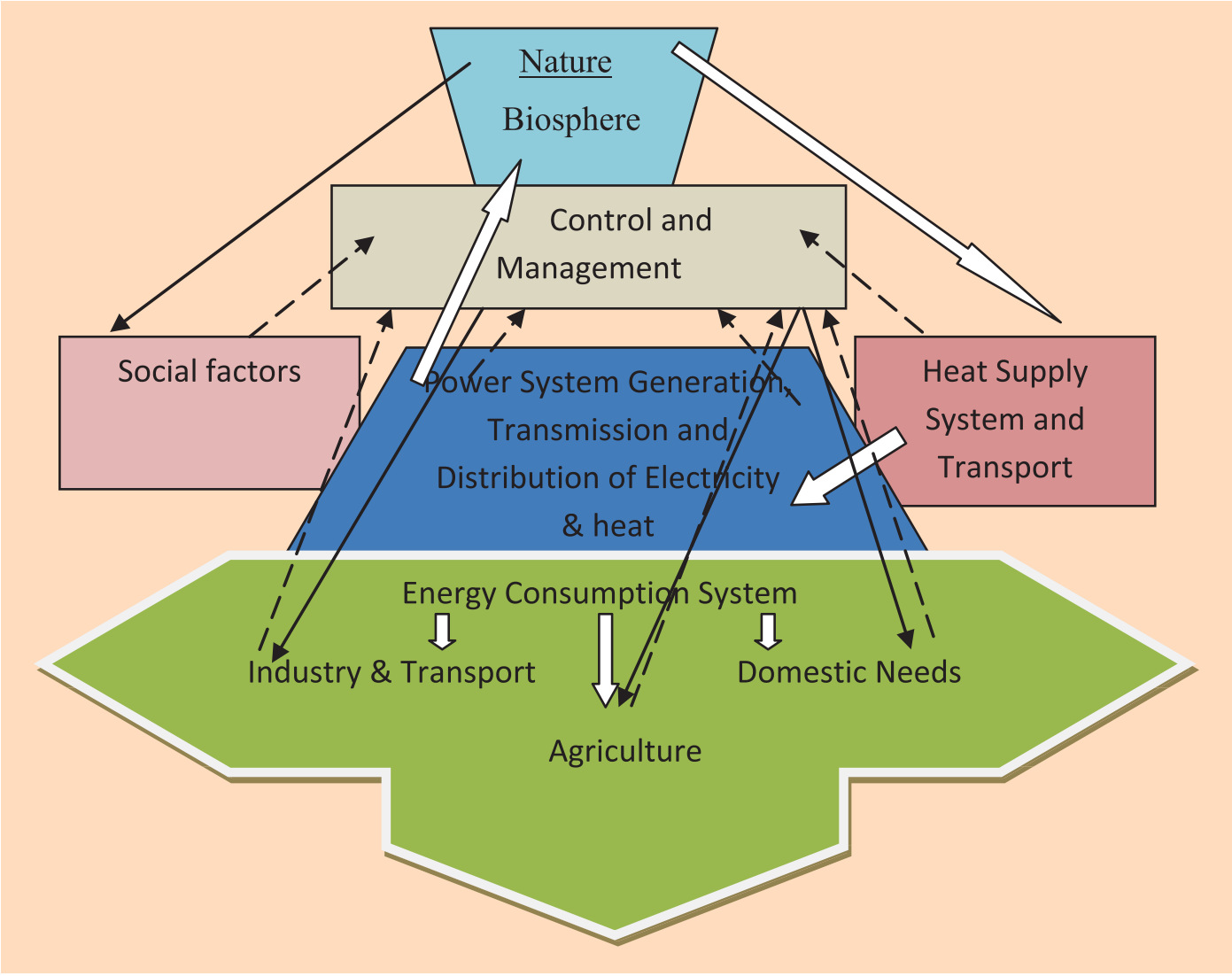
Power System Operations



Among the problems facing the control and management of large power systems, the most important is the search for a better method of power system optimization...

The problems that arise in system control and management are solved on models, using programming. A model is an intermediate process which is used for analysis of the prototype process. In economics, a model is a set of equations based on certain assumptions that describe the national economy as a whole or a part thereof. Among the problems facing the control and management of large power systems, the most important is the search for a better method of power system optimization

Tasks in control and management

The tasks involved in control and management of an interconnected power system are divided into three groups:

Group I – (from seconds to hours) -

This group includes the direct operational control of the power system. The control engineer does this as a matter of daily routine. The tasks include involving normal steady-state, normal transient state, abnormal state, post-fault or restorative (transient and steady) state.

Group II- Short-term management cycle (from days to weeks to months).

The tasks in this group involve short-term scheduling, including the near future.

Group III- Long-term management cycle (from one to several years)

This group involves long-term cycles, that is, long–term planning and forecasting. This group may include planning the level of operation for a day, or forecasting loads for the next month. However, in most cases forecasting refers to longer and planning to shorter periods of time.

The details of tasks involved in the three groups are given below:

Tasks involved in Group 1- (from seconds to hours)

Normal steady state:

1. Optimal system regulation on hourly basis, including active and reactive power dispatch at power stations and substations equipped with reactive power sources
2. Frequency and power interchange control over tie lines (including limits of interchange)

Normal transient state:

3. Routine system switching operations
4. Frequency and active power interchange control over tie lines (including limits of interchange)
5. Optimum system scheduling on hourly basis
6. Optimum economic and var dispatch at stations and substations with reactive power sources
7. Voltage control at system centres
8. Load limiting and load shedding (scheduled outages)- order to lower control levels

Abnormal state:

9. Integrated operation of automatic failure clearing means, including:
   - switching in networks (system sectionalizing and area isolation)
   - automatically connecting to inter-system and trunk lines
   - Emergency load shedding
   - Control of mechanical and electrical braking for generators
   - Emergency regulation of generator excitation and voltage at system centres
   - Limiting active power at stations.
10. Regulation of frequency and active power flow over transmission line in emergency.

Post-fault or restorative (transient and steady) state:

11. Integrated operation of automatic state-restoration means including:
    - Switching in network, re-synchronisation of isolated system parts, restoration of disrupted connections (including loads)
    - change-over to hot and cold stand-by sources
12. Frequency and active power control
13. System dispatch including
    - Economic and var dispatch for stations and substations with reactive power sources
    - Voltage regulation at system centres.

Tasks involved in Group 2 (from days and weeks to months)

Short-term management cycle

1. Forecasts on active and reactive loads at system centres (on daily and monthly basis)
2. Forecasts on river runoff
3. Calculation of static operating states of the system
4. Calculation of short-circuit currents
5. Calculation of protective relay settings, and creating a selectivity chart
6. Selection of gains of regulators for excitation, speed, transformers etc.
7. Selection of failure-preventive control settings
8. Analysis of steady-state stability, and determination of maximum power interchange over power transmission line
9. Transient analysis and determination of maximum power interchange over transmission lines under dynamic stability
10. System reserve dispatch (monthly, weekly, daily),including
    - Selection of plant mix
    - Selection of plant for cold standby
    - Maintenance scheduling on monthly basis
11. Determination of interoperation logic for automatic controls and regulators in case of emergency
12. Determination of logic for restorative conditions
13. Inflow, usage and spillage for hydro reservoirs and cascaded stations (on weekly and monthly basis)
14. Outage scheduling
15. Monthly power balance and power generation foe system areas

Tasks involved in Group 3 (from one to several years)

Long-term management cycle

1. Forecasts on active and reactive loads at system centres
2. Forecasts on reserve run-off
3. Forecasts on steady-state load characteristics for system centres
4. Processing of emergency and failure statistics
5. Calculation of static operating states for the system
6. Calculation of short circuit currents
7. Selection of gains for regulators(excitation speed ,transformers etc.)
8. Selection of settings for automatic failure-clearing means
9. Steady-state stability analysis and determination of maximum power flow over transmission line under steady-state conditions
10. Transient analysis and determination of maximum power flow under dynamic stability conditions
11. Reserve dispatch (on yearly basis) including:

- selection of plant mix in operation
- selection of plant for cold-standby
- scheduling of mail plant

12. Determination of interoperation logic for automatic controllers and regulators in emergency conditions
13. Determination of logic for post-fault (restorative) system state
14. Calculation of automatic frequency regulation on semi-annual basis
15. Calculation of over-voltages (internal and atmospheric)
16. Inflow, usage and spillage scheduling for hydro reservoirs and cascaded stations on annual and quarterly basis
17. Calculation of maximum and optimal levels of operation
18. Scheduled load outage
19. Annual power balance and power generation for system areas

Conclusions

Among the problems that face the control and management of large power systems, the most important is the search for better and novel methods of power system optimization.

It is necessary to work out newer mathematical models that could reflect the actual hierarchical structure of very large systems.

It is necessary to look for reliable methods for building such models.

It is also necessary to set up a system which would gather, process and present data, evaluate the effects of data corruption, and advance both theoretical and experimental work on data transmission.

The problems that need solution before a reliable management information system can be set up for the power industry are interrelationships between large power systems – and the national economy and the biosphere, which is the environment, in the broad sense of the word.

It is essential to study the principal directions in which the power system in the country may develop in the next few years, and evaluate the prospects of using more renewable energy sources and the converting means in the existing power system. EI

C S Indulkar
Retired Professor and Head of Electrical Engineering Department
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DEIF's Critical Power Solutions For Hospitals

According to the Department of Commerce, Govt. of India, the Indian healthcare sector is one of the fastest growing industries – and was the sixth largest market globally in terms of size in 2015. Healthcare revenue in India is set to reach USD280 billion by 2020.

Govt. of India has allowed 100% FDI in healthcare sector – a major growth driver for this sector. Medical tourism in India is on the rise because of state-of-the art private hospitals and diagnostic facilities available at low cost.

Treatment for major surgeries in India costs approximately 20% of that in developed countries. Patients from developing countries are also attracted due to lack of advanced medical facilities in their own countries.

For healthcare sector to grow further, availability of reliable power is the critical need.

Why is it so critical for hospitals?

Designing electrical systems for health care facilities, especially hospitals, is more demanding than for conventional buildings due to complexity of the system, and its size.

It involves many different systems consisting of alternate sources of power, switching equipment, controls, anddistribution equipment.

The stakes are so high that even a slightest interruption of power can result in to a tragic event. Seriously ill and injured people's lives could be at risk.

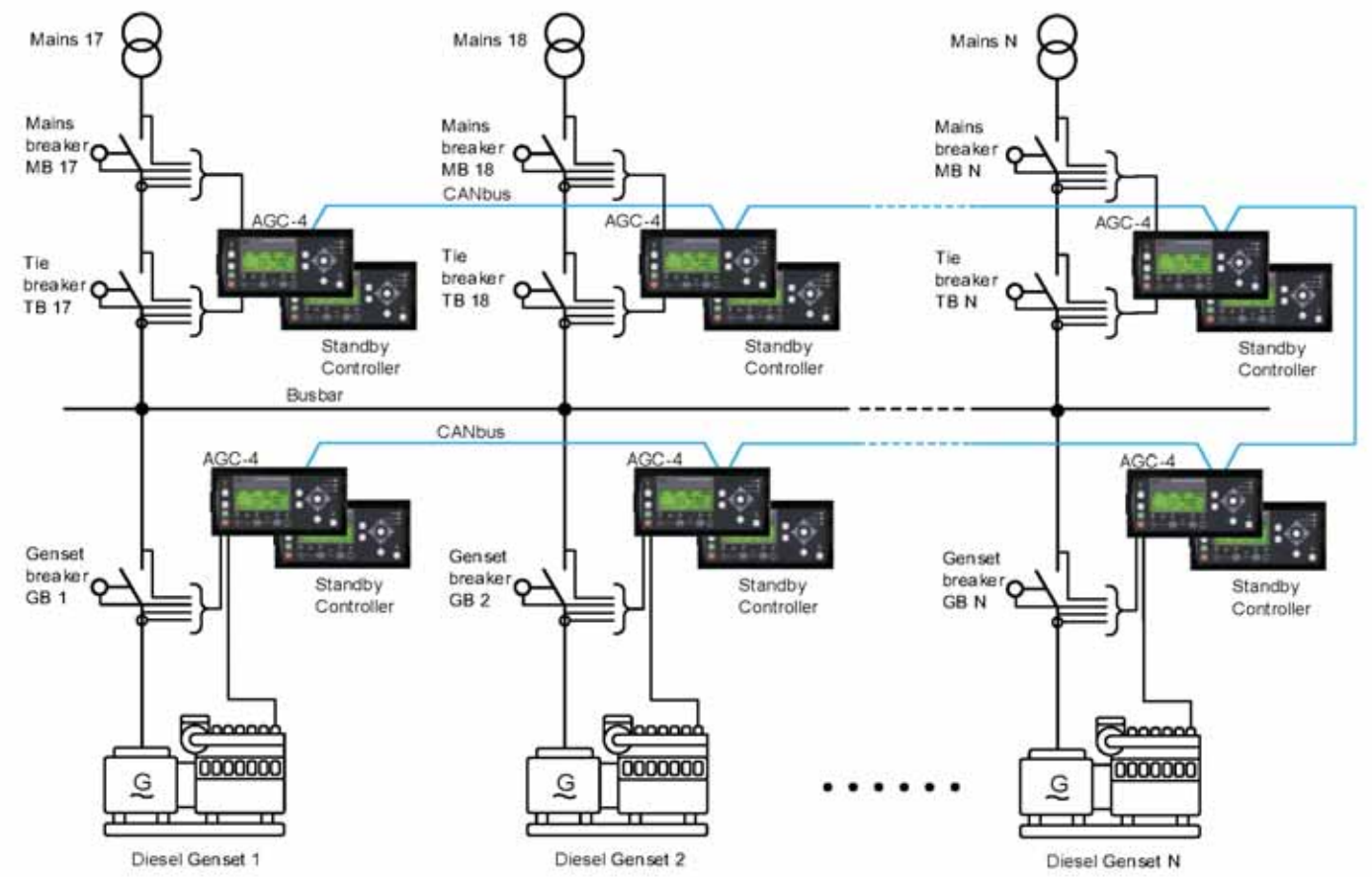
Modern healthcare facilities depend on reliable availability of medical equipment. Without power backup, high-tech healthcare equipment are vulnerable to software or hardware damage. It would result in loss of respiratory devices and other critical equipment for patients in intensive care, neonatal or cardiac units. ECG Monitors, Ventilators, Incubators, Laparoscopy system, Electrocautery, Suction Apparatus, Defibrillator, Ultrasound, Biochemistry analysers, and other equipment can stop working.

It would also result in loss of lighting, HVAC, refrigeration and water pressure, inability to sterilize instruments, transportation of patients and supplies between floors due to non-operational elevators. Disturbances of the power translate into failed processes, lost electronic patient medical records, decreased efficiency, unhappy patients and lost revenue.

A primary challenge for many healthcare facilities is to provide a high-quality source of electrical power that is backed up with highly reliable emergency and standby power systems to ensure uninterrupted flow of electricity to the entire facility, particularly during crisis and natural disasters. Power outages force hospitals to look for alternate power sources, where diesel gensets are the most favoured option for in house power generation. Control system that would support future expansion for at least over a decade without major modifications is preferred. Availability of local service and support during sudden breakdown is most sought for.

We suffice your requirements

DEIF specialises in developing emergency, standby and backup power solutions for hospital and healthcare facilities. DEIF has a strong



track record in developing emergency, standby and backup power solutions for mission-critical facilities.

Its Automatic Genset Controller, AGC-4 features proven technology for a wide range of generation systems in critical power applications.

Deploying DEIF's solution will keep your life saving and revenue-generating medical equipment operational giving you the crucial business edge with satisfied patients – and benefit you in numerous ways.

- **Increased reliability and flexibility**

In DEIF's redundant control system, two controllers operate in Hot Standby mode, with one as active controller while the other acts as a standby controller.

The standby controller is connected to the active controller through CAN bus and remains updated with the latest events and information at all times.

In case of any unexpected fault in the active controller, the standby controller assumes control without any load or speed jumps during transition, thus ensuring continuous flow of power.

- **Fast energy backup**

AGC-4 controllers are capable of synchronous starting of multiple genset using Close Before Excitation and can deliver record start-up from an impressive less than ten seconds for multiple genset in parallel, redundant control systems, or even an entire redundant power plant.

- **Fuel optimisation**

DEIF's controllers are designed to run optimum combination of genset, thus reducing fuel consumption, cutting emissions and operating cost, and increasing efficiency of your backup genset power making it greener with fast ROI.

- **Remote monitoring**

DEIF's Advanced Graphical Interface - AGI 300 series, allows the user to view the entire system on a single screen, thus facilitating convenient and effective monitoring and control of all systems or any other third party systems, and critical parameters simultaneously; over one centralised IP based network from a remote location at the touch of the graphical user interface.

- **Scalability**

Aiding your future growth and expansion plans, DEIF's controller system is fully scalable multi-master system of up to 992 genset with plant management option in one application without making major modifications in the existing project.

- **Quick service**

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Protection System Testing

When it comes to commissioning and testing protection systems, there are many testing options, methods, and approaches to choose from. In order to make the correct decision as to the most appropriate testing strategy, protection testers first have to define these and then constantly review them. Therefore, the goal is to minimize misoperations of the protection system, so that all associated installations are protected and network stability is ensured.

To do so, engineers and technicians must firstly be aware of possible causes of mis-operations. Once the causes have been identified, the testing requirement can be focused efficiently. As with all complex systems, it is almost impossible to foresee all types of misoperations and, therefore, to eliminate them all.

Fault statistics that contain almost all known causes for misoperations to date, as well as the frequency with which they occur, provide help here. For this reason, the North American Electric Reliability Corporation (NERC) has drawn up detailed fault statistics on misoperations of protection systems.

To this end, the above authority evaluated faults that occurred in North American protection systems during the period from 2011 to 2013 and published the results in a study.

Although the results initially had a regional focus, they can also be carried over to European systems, as the technology used is comparable in terms of its operating principle.

This article will now discuss the causes for the misoperation of protection systems identified on the basis of the NERC study. In addition, it will describe a series of test approaches that can be used to detect possible misoperation. Furthermore, with the system check, we will introduce a novel test approach that makes it possible for protection testers to test the protection system in a more comprehensive manner.

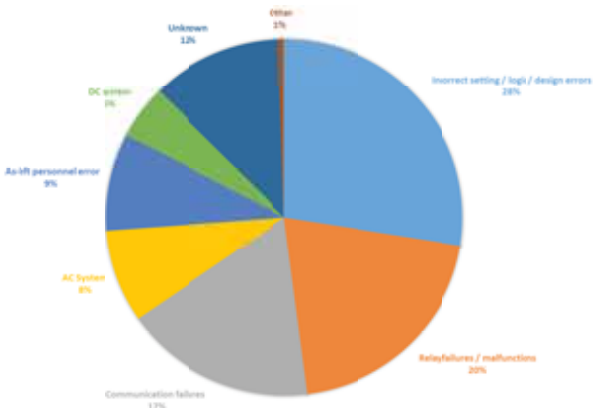

Figure 1: The NERC study analyzed the misoperations of protection systems between 2011 and 2013, based on possible sources of errors, and broke these down by the frequency with which they occurred...

Research into Causes

The NERC fault statistics provide a detailed breakdown of the possible misoperations of protection systems (Figure 1). Two important findings can be drawn from these statistics:

- A misoperation can be caused by every single component that is part of the protection system:
  The protection concept, communication, power supply and the protection relay itself
- Incorrect protection relay settings, together with logic and design errors, are the most probable causes of misoperations.

Changing Times for Protection Systems

The triggers for misoperations can be traced back to more than just rising cost pressure, indeed the requirements placed on the protection systems themselves have changed greatly in recent years. Not too long ago, network protection consisted of electromechanical relays that protected the energy transmission system on the basis of analog values and binary circuitry. It is true that electromechanical relays are still found in isolated installations, even today, but with the advent of digital technology, the task of network protection was largely taken over by multi-functional digital protection relays. Of course, modern protection relays offer a whole range of advantages: where in the past, multiple devices were required for different protection functions; today an extremely wide range of such functions can be combined in a single device. Based on IEC 61850 and the protocols defined there, today's protection devices can be connected with one another in a flexible and versatile manner. At the same time, the devices communicate with one another and therefore, enable protection system configurations that would previously have been inconceivable, or at least unprofitable, due to the outlay involved. In addition, digital protection relays provide the option of parameterizing logic, similar to a Programmable Logic Controller (PLC), which drives forward automation of installation technology.

Against the background of the challenges presented by increasingly decentralized energy provision, this is a major criterion. Accordingly, modern digital protection relays contain hundreds of different setting values so that they can be parameterized in line with the relevant customer requirements. However, both the logic functionality and the high number of parameters make correct configuration all the more complex for the user. Nonetheless, in this context the NERC study clearly shows that incorrect protection relay settings, together with logic and design errors, are among the most frequent causes of misoperations in protection systems.

Testing technology has also developed with modern test sets and software. However, the essence of testing has scarcely changed during this time. A typical testing process involves the output of ramps of different signals (voltage, frequency, impedance etc.) in order to review the pick-up values from a relay. This test was originally based on the maintenance of electromechanical relays, where it was necessary to check the setting

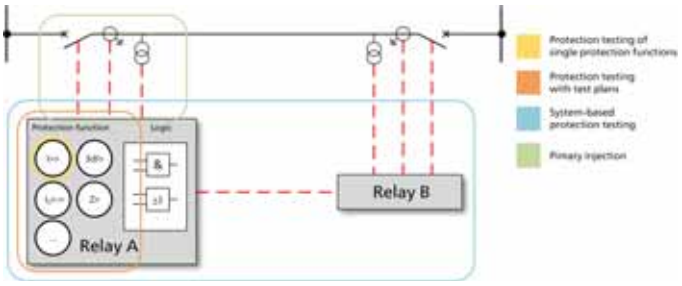

Figure 2: There is a range of different protection tests available, but these tests cover completely different areas...

parameters at regular intervals. Such electromechanical relays were exposed to the influence of external conditions such as temperature or contamination, with resulting effects on the mechanics of the system.

A further test is the static output of analog signal sequences to the protection relay and subsequent evaluation of the protection response. Such sequences consist of at least two states: the pre-fault and the fault itself. With more complex tests, such as for an automatic reclosure, such sequences can certainly be long and confusing.

In principle, however, automated tests greatly simplify the testing process with the use of a test plan, as provided by the OMICRON Control Center and the Protection Testing Library. They support the protection tester's need to test each individual protection function in isolation in order to be able to carry out a precise evaluation. However, overlapping functionalities among the protection devices render this difficult, or even impossible. As a result, the protection tester sometimes has no other option for testing individual protection functions than to switch them off and then reclose them. This process is virtually predestined for faults caused by operating errors, as clearly shown by the NERC study: modified/incorrect settings as a result of protection testing accounted for nine percent of protection system misoperations.

In this context, it is certainly worth posing the provocative question of just how worthwhile extensive testing of response thresholds and tolerances on digital protection relays actually is nowadays. Modern devices have an internal self-monitoring function and operate in a deterministic manner. Would it not, therefore, be more intelligent to focus on correct parameterization and the reliability of the complete system in accordance with its requirements?

Moving Forward to System Testing

In order to guarantee that a protection system will function correctly, all the components must work together. It is not sufficient to test components individually, isolated from one another, instead overlapping functions should be tested together wherever possible.

One simple example illustrates the underlying issue here: during commissioning, current transformers were tested first and the grounding terminal was verified using the corresponding circuit diagram. Next, the protection relay was tested with the documented polarity settings from the current transformer. Independently of one another, both components passed their tests, but the polarity setting on the protection relay was nonetheless incorrect. This is why, when recommissioning, a primary injection should ensure that analog values from the primary system are correctly reproduced via the transducer – and the secondary technology right through to the protection devices.

This test can also be referred to as a system test. Here, realistic scenarios are used to impinge on the functionality of the complete system (primary injection), so that the corresponding end result (direction of electric current at the protection relay) can be tested. The operational system can be regarded as a kind of black box.

The same issue also comes into play with protection testing. For pre-qualifications or design studies for a protection relay, testing individual protection functions and response thresholds is certainly absolutely vital. During field tests, however, the focus should lie on the correct function of the protection system in its entirety. (Figure 2).

Simulation of the Primary System

The main objective of the protection system is to protect the equipment in the primary system. Simulating this primary system using test software such as RelaySimTest can help to achieve better test coverage and simplify the test.

In this case, the simulated primary system aids the protection tester in creating realistic test scenarios. In addition, it automatically calculates the values to be output. This new approach opens up numerous new possibilities for protection testers.

Realistic Fault Scenarios under Control

The development, planning, and construction of the protection concept are based on diverse load flow and fault scenarios that are generated using network calculation programs. By using a simple network simulation, protection testers are also able to verify in the field whether the protection concept is working correctly with the current installation data. In this way, the quality of the engineering process can be ensured comprehensively (Figure 3).

More Important than Ever: Communication

As a result of the increasing level of automation in secondary technology, communication between the relevant components is becoming more and more important, including in protection technology. Applications such as line differential protection or reverse interlocking via IEC 61850 GOOSE rely on secure communication. It is, therefore, becoming increasingly important to test this communication along with the protection, particularly when distributed among multiple test sets. However, users often balk at the underlying complexity, as they first have to design and calculate the relevant test steps. What is more, it is imperative that each test set is controlled by an experienced protection tester. This is where RelaySimTest can simplify many of the work steps. It is possible to control

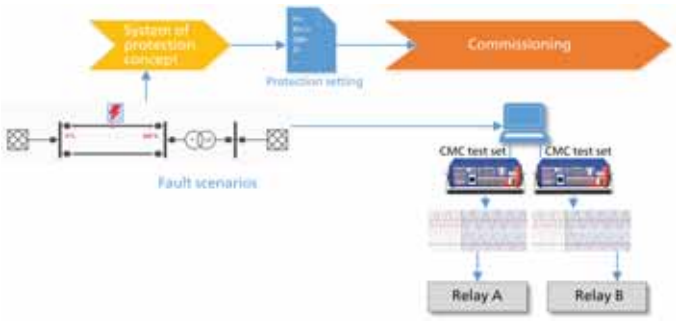

Figure 3: Faults that are caused by the design of a protection system can very easily be picked up by a system-based protection test and the associated simulation of the installation function...

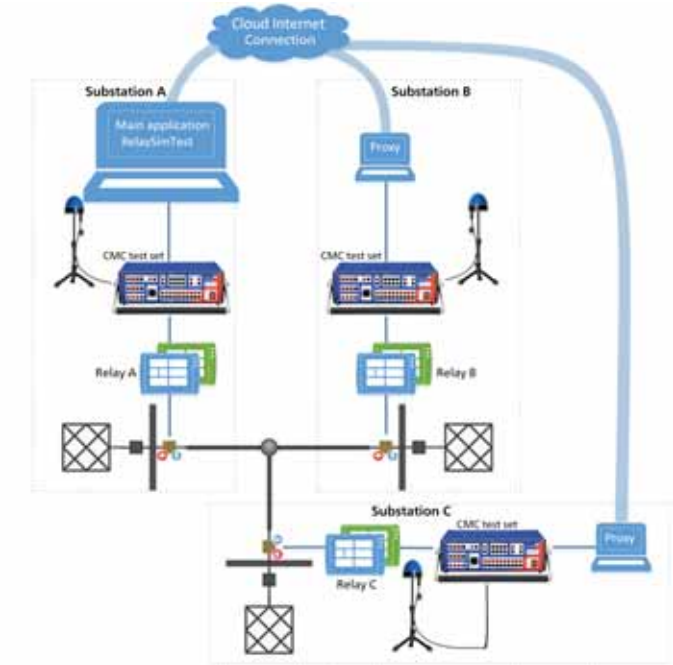

Figure 4: The test set-up for a distributed protection test initially appears relatively complex, but the complete test itself is simplified thanks to the intelligence integrated in RelaySimTest...

multiple CMC test sets from just one application. If there is no direct Ethernet connection available for this purpose, protection testers can access the connection via an online cloud. The central application calculates all the values to be output based on the primary system that is to be simulated, and outputs then to multiple CMC test sets with time synchronization. The response from the protection system is recorded and the protection tester receives all the results directly on site in order to carry out his or her evaluation. Many different protection testing approaches are possible using this system. These include, by way of example:

- Busbar protection – centralized and decentralized
- Line differential protection or distance protection with signal comparison – including those with multiple ends (Figure 4)
- Protection concepts with IEC 61850 – for example, reverse interlockings

From Logic to Simplicity

Testing the logic functionality of protection relays always presents protection testers with challenges. To achieve this, complicated sequences are parameterized in an attempt to satisfy all of the conditions required by the logic. This test is generally very abstract and not very realistic. Here, system-based testing provides a solution, with realistic scenarios. With one of its main functions, the Iterative Closed Loop, RelaySimTest adapts the simulation of the primary system by incorporating the responses from the protection system. This means that realistic fault scenarios are generated automatically, enabling evaluation of the logic functionality. Application examples for this include:

- Automatic reclosures
- Circuit breaker failure and final error protection

Testing Transient Scenarios

More and more protection functions now have to be tested with realistic transient values in order to ensure their correct operation. The transient network module in RelaySimTest also simulates these signal courses automatically, making it easy to test complex protection functions:

- CT saturation
- Transient and intermittent ground faults
- Adaptive protection functions
- Faults with different angles of incidence and DC offset

The Protection Tester's Expertise is Required

Although protection testers may be familiar with all the functions of their protection devices down to the fine details, if they cannot relate this to the primary system, they cannot ensure that the protection is fully functioning. For this reason, fundamental knowledge of the functionality of the system to be protected is vital for the protection tester. Only this knowledge will enable the protection tester to evaluate the protection system comprehensively. The information required can only be obtained from the development, planning, and design process. If protection testers have access to all the important information on the primary system with the rating plate and the nominal data, they are in a position to carry out a system-based protection test using RelaySimTest. In addition, the tester can incorporate current measurement values obtained during commissioning into the test. For example, following a line impedance measurement with the CPC and CU1, the results can be used in RelaySimTest, or the transient behaviour measurements of current transformers with the CT Analyzer can also be incorporated into RelaySimTest. As an outcome, the protection tester receives a test, including analysis, that documents the correct operation of the protection for realistic scenarios.

The Right Tool for Each Work Step

The system-based approach to protection testing will certainly not replace testing of setting and response values. However, it may complement the existing options, help to test overlapping functions of protection devices, and reduce the resulting test outlay (Figure 4).

Florian Fink
Application Engineer
Protection Testing Technology
Product Management, OMICRON electronics

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Prof. Sir C.V. Raman Road, Sadashivanagar P.O,
P.B. No.: 8066, Bangalore - 560 080, INDIA
Ph: +91-80-2360 2329 Fax: +91-80-2360 1213
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Significance of Polarity in Current Transformers

For certain kinds of measurements, even today, we need to know the correct polarity of the primary and secondary windings in current transformers...

Ensuring the correct polarity of the primary windings and secondary windings in Current Transformers (CT) is of paramount importance in various measurement and protection schemes in electrical power distribution networks. Even though this polarity may not matter much in modern day digital measuring instruments and protective relays, this is still of importance in certain measurement and protection requirements.

Polarity Test

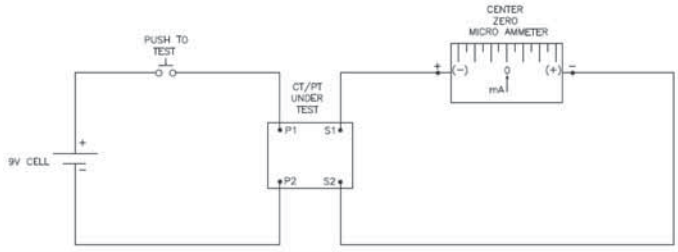
A typical polarity test kit schematic is given atop the next column.

Test Procedure

1. Identify & Mark permanently, the 'P1' & 'P2' Terminals in the CT to be tested for polarity.
2. Connect the '+'ve terminal of the 9V cell to the 'P1' terminal of the test CT, through a Test Push Button.
3. Connect the '-'ve terminal of the 9V cell to the 'P2' terminal of the test CT directly.
4. Assume the 'S1' & 'S2' Terminals in the test CT. (This has to be assumed as of now, as we are yet to know this polarity for sure)
5. Connect the 'S1' terminal of the test CT to the '+'ve terminal of a Centre Zero Analogue DC Micro Ammeter. (This ammeter can be of 48sq. mm size with a scale of -10 µA to 0 to +10µA).
6. Connect the 'S2' terminal of the test CT to the '-'ve terminal of the Centre Zero Analogue DC Micro Ammeter.
7. Now, the test set up is complete.
8. Now, when you press the Test Push Button, if the pointer of the Centre Zero Analogue DC Micro Ammeter deflects in the '+'ve side in the scale, then the assumed 'S1' & 'S2' are correct. Mark them permanently now.
9. If the pointer in the meter deflects in the '-ve' side in the meter scale, then the assumed 'S1' is actually 'S2' and vice versa.
10. Reverse the meter connections & repeat the test to ensure positive deflection.
11. Caution: Do not extend DC voltage to the primary for more than a few seconds. Otherwise, the cell will drain soon.
12. Do not get confused between the '+'ve terminal of the meter and the '-'ve marking in the meter dial on the same side. Terminal and dial are two different things.
13. Repeat this test for all cores in the CT and mark each CT secondary polarity permanently.
14. Do not use any digital ammeter or digital multimeter in place of the Centre Zero Analogue DC Micro Ammeter. They will not serve the purpose of this test.

CT Installation

1. The primary of the CT is always marked as 'P1' & 'P2'.
2. The CT shall be mounted such that the primary current flow shall always be from 'P1' to 'P2'. Take care while mounting CTs in Incomer Feeders and in Outgoing Feeders. The primary current flow direction and thus the P1/P2 orientation will change between incomers & outgoings.
3. For Bus Couplers, if CTs are installed in these feeders, consult engineering team for proper orientation of P1/P2 of the CTs.
4. Particular care must be taken in case of special schemes like Bus Differential



Polarity Test Kit Scheme...

Protection Schemes

5. Mark the CT secondary terminals as below:
   Core-1: R Phase: 1s1r & 1s2r; Y Phase: 1s1y & 1s2y; B Phase: 1s1b & 1s2b
   Core-2: R Phase: 2s1r & 2s2r; Y Phase: 2s1y & 2s2y; B Phase: 2s1b & 2s2b
   Core-3: R Phase: 3s1r & 3s2r; Y Phase: 3s1y & 3s2y; B Phase: 3s1b & 3s2b
   Core-4: R Phase: 4s1r & 4s2r; Y Phase: 4s1y & 4s2y; B Phase: 4s1b & 4s2b
   (More than 4 Cores in a single CT is not anticipated)
   For dual ratio CTs, an '-s3-' will be added in all the above cases.
   For triple ratio CTs, a further '-s4-'will be added in all the above cases.
6. Connect the 'S1' terminal of the CT to the phase side terminal of the CT secondary burden (may be a meter or a relay or a Test Terminal Block or a meter selector switch)
7. Connect either 'S2' or 'S3' or 'S4' terminal of the CT – depending upon the ratio selected - to the neutral side terminal of the CT secondary burden (may be a meter or a relay or a Test Terminal Block or a meter selector switch)
8. Loop all 'S2', 'S3', 'S4' (as the case may be) of all the R, Y & B phase CTs together and earth ONLY at the CT end.
9. Please note that if you are using only S2 terminal, short only S2 terminals of R, Y & B Phase CTs. Leave S3 & S4 open in all the CTs. Follow similar for S3 & S4 too, if you select higher ratios.
10. It is always preferable to earth the CT Secondary (either S2 or S3 or S4) at the CT end.

11. If it is not possible to earth the CT Secondary at the CT end, then ONLY IF THERE IS NO OPTION, earth the CT Secondary at the CT Terminal Block (Disconnecting Type Terminal Block) in the LV Chamber.
12. It is not enough to only 'see' a green earth wire connected to the CT secondary terminal either at the CT or at the CT TB. Please ensure that this green wire is taken right upto the panel earth bus and is properly connected to the panel earth bus with proper bolt, nut, plain washers & spring washer.
13. The length of the wire connecting the CT Secondary and the Panel Earth Bus shall be as short as possible.
14. The size of the earth wire shall be a minimum of 2.5 sq.mm PVC Insulated Flexible Copper conductor, unless specified otherwise by the customer.
15. Do not earth the CT secondary by terminating the earth wire at the panel enclosure sheets. It MUST be directly connected to the panel earth bus. Ensure proper contact of this earth wire at the panel earth bus.
16. Ensure proper tightness of all terminations of CT Primary & Secondary connections.
17. Use proper tools for tightening screws/bolts/nuts. Do not use undersized or oversized screw drivers for tightening/loosening screw connections. And, do not use cutting pliers/nose pliers for tightening/ loosening bolted joints/connections. Use proper type & size of spanners for the same.
18. Caution: DO NOT EARTH THE CT SECONDARY AT BOTH THE CT END AND AT THE LOAD END. This might lead to circulating currents and possible damage to CT insulation.
19. Design / Engineering departments may mark these polarities & CT Secondary earthing details appropriately & precisely in the drawings. This may be shown in GA/Cross section/SLD/Power Schematic, as applicable.
    Note: It may please be noted that the earthing of the CT Secondary is done for reducing the stress on the secondary insulation and it, in no way, will affect the performance of the CT, as long as a closed path is established.
    Do not get confused that if we do not earth the CT Secondary, the secondary current will not 'return' to the CT. It will definitely 'return' to the CT, through the CT Secondary Neutral Wire, even if you do not earth the CT Secondary.
    Having said this, do not take the liberty of not earthing the CT Secondary on the presumption that 'anyhow' it is not going to affect the performance of the CT.
    Safety is more important than performance.
20. Though incorrect polarity connections may not hamper performance in modern day digital instruments & in numerical relays, it is always a good engineering practice to observe & practise proper polarity in CTs. This will be of significance – just in case, someone still opts for olden days' electro-mechanical type meters or relays. If proper polarity marking & wiring are practiced, it will help us in both the cases. We need not keep on changing the drawings/wiring based on the type of relay or meter. EI

K Sivakumar
Manager - Design & Training
Megawin Switchgear Pvt. Ltd.
Salem

Supercapacitors

Myths vs Facts

Supercapacitors and ultracapacitors are one and the same. The difference in the nomenclature can be attributed to the Europeans and the Americans. Europeans call the same device supercapacitor while the Americans know it as ultracapacitors...

Supercapacitors or ultracapacitors, have garnered a lot of interest as an emerging environment friendly device with its unique characteristics, like high power density and cyclability, that is currently unmatched by other storage devices. Similar to the conventional capacitor, the supercapacitor stores energy by charge separation. Thesecharacteristics are already being exploited in variousapplications ranging frommobile charging, toys, sensors,large scale transport systems like subway trains and buses, energy storageat intermittent generators and smart grid applications. The enthusiasts of this technology believe that it can garner a large part of the global $85billion battery market. But due to various factors this seems to be far from the reality.Here are some common myths about this technology, along with the facts to set the record straight.

Myth

Supercapacitors, ultracapacitors and electrochemical double layer capacitors are different devices.

Fact

Supercapacitors and ultracapacitors are one and the same. The difference in the nomenclature can be attributed to the Europeans and the Americans. Europeans call the same device supercapacitor while the Americans know it as ultracapacitors. Electrochemical Double Layer Capacitors (EDLCs) are the most common type of supercapacitors which store charge at the positive and negative electrodes by the separation of charges at the electrode-electrolyte interface. Each electrode–electrolyte

interface represents a capacitor and the complete cellcan be considered as two capacitors connected in series thereby making the double layer capacitor. Contrary to what most people believe, there are other types of supercapacitors that use surface chemistry like pseudocapacitance for charge storage. They are technically known as pseudocapacitors. Another variant is the hybrid capacitor which stores charges similar to the pseudocapacitor on one electrode and like the EDLC on the other electrode. The figure below shows the classification of supercapacitors depending on the mechanism of charge storage.

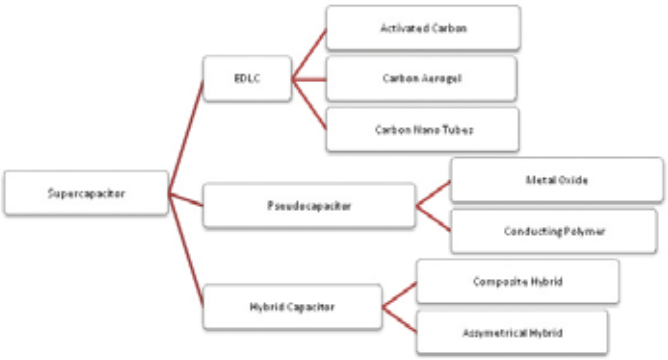


Figure 1: Types of Supercapacitors...

Myth

It can replace batteries.

Fact

Replacing batteries with supercapacitors entirely is just not possible except in very few applications where for short bursts of current is the main requirement. This is due to the fact that supercapacitors do not have the high energy density which is the hallmark of batteries. A typical supercapacitor has an energy density in the range of 1-5Wh/kg while the same of the battery is range of 8-400Wh/kg. This means that when energy is required for extended periods of time, supercapacitors will not help. Thus in the near future the chances of the supercapacitor replacing the battery are remote. However, battery-supercapacitor with electronic controller combine power pack is likely to find use in many low voltage applications.

Myth

It can be used like a plug and play energy storage device.

Fact

Due to their fast charging-discharging times and high currents, the supercapacitors requires very specialized power electronic interfaces for proper functioning in an application. Unfortunately, there is a scarcity of such modules and these interfaces have to be application specific. In other words, it is not possible to use the same power electronic interface for two applications which require the same energy storage ratings with different loads.Another issue is that power electronic devices work at high frequencies but manufacturers do not provide the necessary data like bode plots and frequency response in their datasheets. Thus, it becomes difficult for any application engineer to incorporate a supercapacitor in their circuit.

Myth

It has infinite life.

Fact

Having infinite life is an ideal condition. In generalsupercapacitor lifetime is dependent on three things: electrolyte life, voltage rerating and temperature dissipation. The fluid in an electrolyte can evaporate and cause the supercapacitor to fail under extreme operating conditions. This device is also highly vulnerable to excess heat. Moreover, using a supercapacitor at close to its maximum voltage will cause it to fail more quickly than using it at a lower voltage. Typically, a manufacturer provides data regarding the change in capacitance and internal resistance to be expected after 1000 cycles.

If this value is less than what is required after the 1000 cycles, then the conditions. This device is also highly vulnerable to excess heat. Moreover, using a supercapacitor at close to its maximum voltage will cause it to fail more quickly than using it at a lower voltage. Typically, a manufacturer provides data regarding the change in capacitance and internal resistance to be expected after 1000 cycles.

If this value is less than what is required after the 1000 cycles, then the supercapacitor might need to be replaced. If proper attention is given to the rating and characteristics of the supercapacitor while choosing it for an application, the supercapacitor will easily outlive the system in which it is being used. The figure 2, illustrates the life in hours as a function of temperature and voltage...

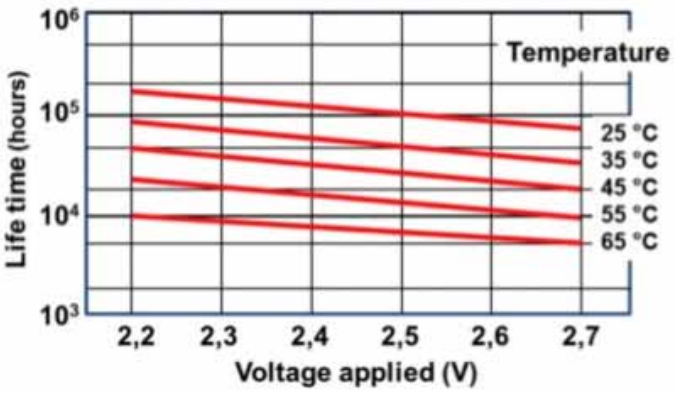


Figure 2: Supercapacitor life as a function of temperature and voltage...

Myth

Electrode area and weight is used in calculating energy density and power density.

Fact

Energy density is a measure of how much energy the supercapacitor can store, in a given mass. So a supercapacitor with a higher energy density can power a load longer than one with a low energy density and the same physical size or mass. Its SI unit isWh/kg. Power density measures how quickly the supercapacitor can deliver energy and its unit is W/kg. While calculating these densities, the total mass of the active

material of the electrode is used. Many times researchers consider the mass of activated carbon or that of metal oxide used in the electrode for calculations which leads to confusion about values of energy and power densities in comparative analysis. In calculation of area based specific capacitance, some researchers use total measurable area of both electrodes and of both sides of electrodes. However, correct practice is to use only area of one electrode and that too of one side only. This often leads to confusion in comparative analysis of specific capacitance.

Myth

It does not require voltage balancing like in a battery stack.

Fact

It is practically not possible for two supercapacitors to have thesame value of equivalent series resistance. The equivalent series resistancemainly depends on the electrolyte, specifically its ion concentration, ionmobility, solvent or solvent mixtures, and temperature. Even if two supercapacitors are of the same rating and brand all of these parameters like temperature can never be equal. Another issue is the leakage current which is caused due to unwanted oxidation-reduction reactions, ionic charge diffusion or/and electronic partial discharge through the separator and impurities in electrode-electrolyte materials. Non uniformity of cell voltage in a stack of supercapacitors connected in series is mainly due to the variation in these two parameters between cells. Those cells that are under higher voltage stress tend to have lower life compared to those under less stress. To combat these issues a stack of supercapacitors requires active or passive cell balancing. This is the main hurdle in its use in high voltage applications. The figure shows a passive and active cell balancing circuits that are typically employed.

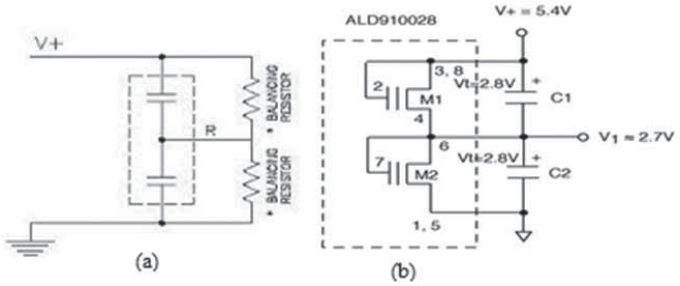


Figure 3: Cell balancing circuits for supercapacitors in series (a) Passive and (b) Active...

Myth

It can be used in AC circuits.

Fact

A typical supercapacitor is a polar capacitor with fixed polarity i.e. positive and negative terminal similar to a battery, so they cannot be used in AC circuits. Moreover, since the time constant is high they are not suitable for high frequency applications. However, for pulsating DC supply they will not pose any problems.

Myth

It can withstand higher operating voltages.

Fact

The operating voltage of the supercapacitor is completely dependent on the voltage window or the electrochemical stability of the electrolyte. When asupercapacitor is subjected to more than its rated voltage, the electrolyte within the cell begins to decompose, producing a gaseous byproduct. If the overvoltage condition persists long enough, the pressure may build up until the safety vent on the supercapacitor's package opens. Consequently, more of the electrolyte will decompose and vaporize until the supercapacitor's effective internal resistance increases and becomes an open circuit. Presently, the various electrolytes used in its construction have low voltage windows such as 1.6V for aqueous electrolytes, 2.7V for organic electrolytes and 3V for ionic liquids. Thus for a typical application, supercapacitor cells need to be connected in series for higher operating voltages with proper voltage balancing circuits and power electronic interface.

Myth

A short circuit can reduce the life of a supercapacitor.

Fact

Even if a charged supercapacitor is externally short-circuited by any possibility, there is no leakage of electrolyte, no smoke, no ignition or no rupture. This is due tothe fact that it has low energy inside unlike in a battery.Heating depends on handling of energy during charge or discharge of supercapacitor.As the discharge time is very small the temperature increase is momentary and it will decrease quickly by heat dissipation.

Myth

Due to low voltage and low energy, supercapacitors are safe compared to other energy storage devices.

Fact

In asupercapacitor the discharge time is very low and all of the stored energy is dumped into the load in a matter of milli-seconds. This causes very high currents to flow during discharge which can reach dangerous levels and induce sparking if proper precaution is not taken. This type of arc discharge can result in damage to both human life and property.

Myth

Non aqueous supercapacitors are better.

Fact

Most of the commercially available supercapacitors use organic electrolytes since their voltage window is larger. But on the flipside, these non-aqueous supercapacitors use salts dissolved in organic solvents which are poisonous. This causes issues during disposal. Aqueous electrolytes do not have any such environmental blueprint. A few of them do have a larger voltage (upto 2.2V) making them a better option. Another electrolyte which looks promising in the laboratory is the ionic liquid.

Myth

Capacitor or battery manufacturing companies can easily manufacture supercapacitors.

Fact

Supercapacitor manufacturing requirements are completely different from that of capacitors or battery. Of the two, capacitor manufacturing companies are better equipped as some of their existing facilities can be used for the manufacture of supercapacitors.

In this niche market, the top vendors are largely either aluminium electrolytic capacitor manufacturers or power film capacitor manufacturers. Some of the vendors (only a few) were involved in the battery market

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beforehand, but an increasing number of manufacturers are standalone vendors who produce just supercapacitors. As of now, the most successful companiesin the manufacture of supercapacitors are manufacturers of capacitors for which they have existing channels of distribution and contacts with customers who have an interest in expanding their consumption to include capacitors in the Farad range.

Myth

It is easy to do research in this field.

Fact

Even though there is a lot of interest in supercapacitors, it is still not amenable to research. This is because any research in this field requires different types of costly instruments for the preparation of prototypes and for their testing such as cyclic voltammetry, charge discharge machine, glove box, calendaring machine and packaging machine. A few of these instruments are shown in figure 4.

Furthermore, the different materials required for the preparation of prototypes are difficult to procure and are costly. Funding agencies are hesitant to provide the required capital as the technology is still in the nascent phase and the risk is high. Researchers are also discouraged from taking up this field of research as it requires a thorough knowledge of various diverse fields like chemistry, material science and electrical engineering thereby making it an interdisciplinary subject.

Figure 4: Some of the instruments required for supercapacitor research. Anticlockwise from the top (a) Calandering machine (b) Cyclic Voltammeter (c) Glove box (d) High Precision Electronic balance (e) Muffle Furnace...

Myth

Commercially available materials can be used in manufacturing of supercapacitors.

Fact

The activated carbon that is used as supercapacitor electrodes have to be of very high purity with less than 1% ash content. Attaining this level of purity is costly and there are very few carbon manufacturers who have the requisite technology.

Other materials which are used as the active electrode material like carbon nano tubes, carbon aerogel and graphene have still not managed to crossover successfully from the laboratory to the industry.

Proper optimizing of the electrode-electrolyte pairing, suitable method for coating the current collector with active material so that the penetration of electrolyte is maximum and reducing the equivalent series resistance are some of the issues that need to be addressed for the proper scaling up of these technologies to make them suitable for mass production. Debate is still ongoing about the pros and cons on stacked type configuration vis-a-vis rolled configuration for the cell design. In the former, the electrodes and separatorsare stacked like in a battery and the cell has a cubical shape. In the latter case, the electrodes and separator are wound and the cell has a cylindrical shape similar to the conventional capacitor. Another major deterrent is the non-availability of the necessary grade of separators, electrolytes and current collector. The materials for electrode, current collector and separator materials needs more research. As these components need to be of very high quality, an OEM finds it very difficult and costly to procure.

Myth

This technology has potential to generate its own market.

Fact

Though partly true, this is not really the case on the ground. There is still a lot of reluctance in industry to embrace this technology. Even though the automobile industry is the largest perceived market and a few automobile manufacturers are claiming to use the supercapacitor in some of their models, we haven't yet seen them accept this technology in their entire range. Moreover, as most of the supercapacitor manufacturers in possession of path breaking technology are small players in the energy storage market, they are not able to use existing channels of distribution and contact with customers.

This keeps them from completely exploiting the energy needs of the consumer. In many countries, apart from manufacturing of this device, developing market for this is also a challenge.

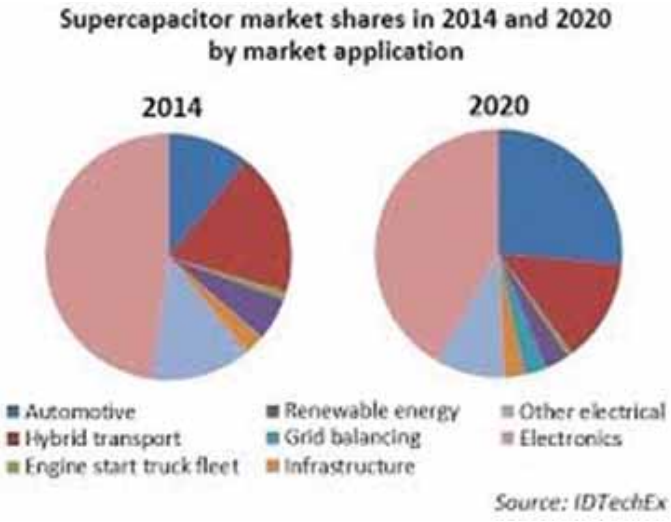

Figure 5: Supercapacitor Market Shares by Application...

In conclusion, the myths surrounding the supercapacitor are many and it is high time that they are dispelled so that the supercapacitor can

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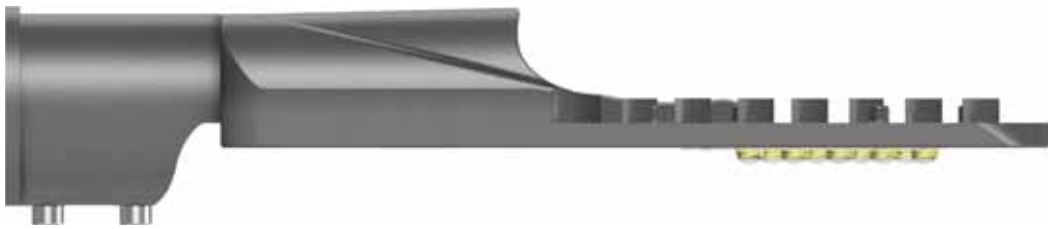

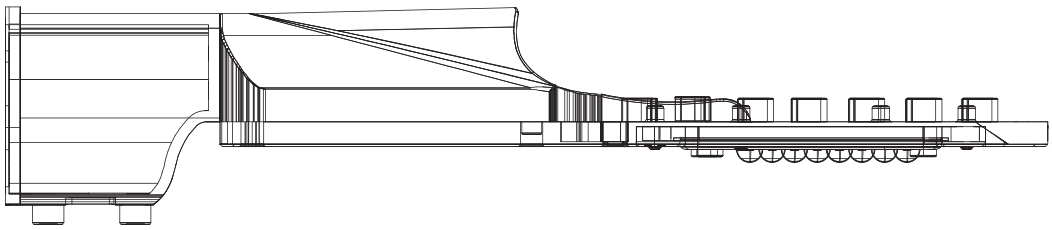

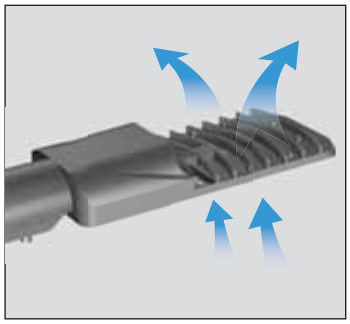

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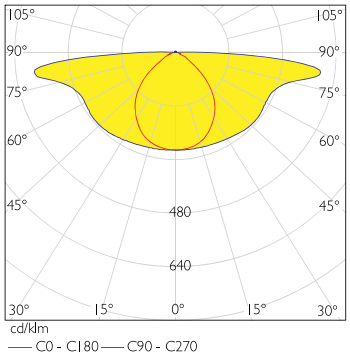

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be given its proper place among the various energy storage devices. At present, the low energy density, the requirement of voltage balancing circuit and power electronic interface are still a major problem for the widespread use of supercapacitors.

Another area which is a major hindrance to its acceptance is the cost. This is in spite of the fact that in the 1980s, a 470F 2.3V supercapacitor cost $2.00/F while in 2012 the same had come down to $0.03/F.

It is expected that supercapacitor demand will grow in value by about 30% overall by 2020 and remain in the hundreds of millions of dollars and not billions, as was earlier stated by various experts.

At present, the United States is the market leader for supercapacitors with more than 40% share in the market.

Europe and countries like China and Japan are also active players in this market. India is still taking baby steps and there is an urgent need to adopt this technology into the mainstream.

The present push by the government towards electric mobility and the commitment to bring in 5 to 7 million electric vehicles on the Indian roads by 2020, will certainly boost this sector. EI

Dr P B Karandikar
Associate professor
Army Institute of Technology
Pune

Dr N R Kulkarni
Vice Principal and Head of Electrical Department
P.E.S's Modern College of Engineering
Pune

Seema Mathew
Assistant Professor
P.E.S's Modern College of Engineering
Pune

6 major facts found in the GWEC's latest report

Renewables are now firmly established as competitive, mainstream sources of energy in many countries around the world...

According to the latest annual overview of the state of renewable energy, Renewables 2016 Global Status Report, published by the Global Wind Energy Council (GWEC), the renewables are now firmly established as competitive, mainstream sources of energy in many countries around the world.

The report brings out 5 major facts:

- 2015 was a record year for renewable energy installations. Renewable power generating capacity saw its largest increase ever, with an estimated 147 GigaWatts (GW) added.
- Modern renewable heat capacity also continued to rise.
- Renewables' use expanded in the transport sector.
- Distributed renewable energy is advancing rapidly to close the gap between the energy haves- and have-nots.
- Government leadership continues to play a key role in driving the growth of renewables, particularly wind and solar, in the power sector. As of early 2016, 173 countries had renewable energy targets in place and 146 countries had support policies.
- Better access to financing, concerns about energy security & the environment and the growing demand for modern energy services in developing and emerging economies are other driving factors for growth.

These results were driven by several factors. The first and foremost factor is: renewables are now cost competitive with fossil fuels in many markets.

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Cooperation Among European Countries Produces Tangible Results

Success of cooperation in gas sector to be replicated in renewable energy sector...

Recently in Budapest, European Commission's Vice-President Maroš Šefčovič, Commissioner for Climate Action and Energy Miguel Arias Cañete and Energy Ministers from 12 EU and Energy Community countries and contracting parties in Central and South-Eastern Europe signed important infrastructure and regional cooperation agreements.

Maroš Šefčovič, Vice-President of the EC in charge of Energy Union

Cooperation under the European Commission Initiative on Central and South-Eastern European Gas Connectivity (CESEC), launched in 2015, has produced tangible results.

At the recent meeting, the Bulgaria–Romania–Hungary–Austria (BRUA) Connecting Europe Facility Grant agreement of 179 million euros was signed. In addition, Joint Statements were signed by the Governments and Transmission System Operators (TSOs) from Greece, Bulgaria, Romania and Hungary on cooperation on gas projects along the so-called 'Vertical Corridor.'

Furthermore, a Memorandum of Understanding was signed by the TSOs from Ukraine, Romania, Bulgaria and Greece on reverse flows on the Trans-Balkan pipeline. Ministers also welcomed the imminent completion of the new interconnector between Bulgaria and Romania – and the project to reinforce the Bulgarian network preparing it for further interconnections with neighbouring countries.

Looking ahead, the relevant Ministers committed to the rapid completion of four further priority projects: the LNG terminal in Croatia and connecting infrastructure towards Hungary, the Greece–Bulgaria interconnector and the Bulgaria–Serbia interconnector.

Miguel Arias Cañete, Commissioner for Climate Action and Energy

Commission Vice-President for Energy Union Maroš Šefčovič said, "Today's (September 09, 2016) meeting is a milestone in regional cooperation and in advancing our plans for Energy Union. In working together, we can achieve heightened energy security and diversification in a region which has already experienced severe vulnerability to its gas supplies."

Commissioner for Climate Action and Energy Miguel Arias Cañete said, "I'm glad that our cooperation in the region has produced tangible results: Bulgaria now has access to LNG and Ukraine will soon have it too. But we want to go further including beyond cooperation in the gas sector. This is why we are also extending our cooperation to renewable energy and energy efficiency to help also boost energy security by lowering dependence on external energy suppliers."

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India

Tel: +91-80-41150039
Fax: +91-80-41480171
Email: info@pamas.in
Web: www.pamas.in

PAMAS GmbH Head Office:

Dieselstraße 10,
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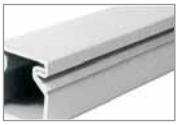

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Embedded or distributed generation schemes, where a local generator is connected directly to the distribution network, are becoming widespread. The operators of these schemes face an important challenge: how to ensure that the system behaves safely and predictably if the local generator becomes isolated from the network – a condition known as islanding.

There are numerous potential hazards associated with islanding, not the least of which is that engineers working to restore the network connection may not realise the system is still powered.

Another hazard is that the generator may continue to supply local loads but, without support from the network, this may result in it being heavily overloaded.

The solution usually adopted to address these hazards is to immediately shut down the islanded generator, but this can only be done if a fast and dependable way of detecting islanding is available. Many approaches are possible, but one that is widely used is Rate Of Change Of Frequency (ROCOF) protection, which has established a reputation for responding faster and more reliably than alternative protection techniques.

ROCOF protection relies on the fact that once a generator is islanded, its output frequency will no longer be locked to that of the network, but will change rapidly to a frequency determined by its own characteristics and those of the loads it is still supplying. It is this change in frequency that is detected by ROCOF protection devices.

ROCOF protection conforms to engineering requirements such as G59/3 in the UK and standards – such as ANSI 81R in the USA. There are strict guidelines for ROCOF settings and unless these are optimised, the protection may unnecessarily trip a generator when problems occur with the power network, and the resulting loss of capacity may make the problems worse.

To help guard against this situation, G59/3 was revised in 2014 to require new settings for ROCOF protection when used in conjunction with generators connected to the UK power network. The grace period that was granted for adoption of the new settings in conjunction with certain classes of equipment expires in July 2016. After this date, ROCOF protection for all generating sites with a capacity in excess of 5 MW that are connected to the UK power network must comply fully with the new requirements.

The foregoing makes it clear that a reliable method of checking the settings and accuracy of ROCOF protection is essential. Suitable functionality is provided by Megger's innovative three-phase SVERKER 900 instrument, which has been conceived as an engineer's multifunction test box for protection testing.

This novel instrument does not need to be connected to a PC and features an intuitive user interface with a colour touchscreen. This provides access to a wide range of pre-configured virtual test instruments, allowing the required test function to be selected quickly and easily. Full manual control and configuration are also supported and, in addition to the touchscreen, the SVERKER 900 is provided with a large rotary knob that can be configured as required to control the voltage and current generators.

When testing ROCOF protection, the SVERKER 900's ramping instrument is used. Because this generates a very smooth and accurately controlled ramp, this has proved to be an excellent and dependable tool for these tests. The instrument is easy to configure for ROCOF testing, and once the start and stop criteria have been defined, it can be used to check the operation of low and high level trips – and also to verify the trip time delay set for low and high level operation.

Website: www.tiny.cc/ROCOFnote

Lennart Schottenius
Support specialist, Megger

Niclas Wetterstrand
Program manager, Megger

Valmet To Supply Technology For The E-Ferry Project

E-ferry is a project that has received funding from the European Union's Horizon 2020 research and innovation program...

Valmet, a well known global developer and supplier of process technologies, automation and services for the pulp, paper and energy industries will supply automation and remote control technology for a new, game-changing, purely electric ferry concept, the E-ferry.

The order was placed by Visedo Oy, a Finnish high-tech company responsible for the E-ferry's electric propulsion system.

Typically, the order value of automation system deliveries ranges from below EUR 1 million to EUR 3 million. The delivery will take place in the second quarter of 2017.

Totally new environmentally friendly ferry technology

E-ferry is a project that has received funding from the European Union's Horizon 2020 research and innovation program. It involves the design, building and demonstration of a fully electric-powered 'green' ferry that can operate without pollution or CO_2 emissions.

The project promotes energy-efficient, zero greenhouse gas emissions and air-pollution-free waterborne transportation for island communities, coastal zones and inland waterways in Europe and beyond.

The ferry will be equipped with a 4.2 MWh battery system, giving it the highest capacity of any electric ferry to date. It is estimated that the annual savings in CO_2 emissions will be around 2,000 tons and NOx emission reductions will be 41.5 tons compared with a similar-sized diesel-powered ferry.

The first new 100% electric ferry solution will connect the island of Aeroe in the Baltic Sea with the Danish mainland.

The E-ferry, a fully electric-powered 'green' ferry that can run without polluting, will operate with Valmet's automation and remote control technology.

Technical details about Valmet's delivery

Valmet's delivery for the E-ferry includes a Valmet DNA Integrated Automation System (IAS) to cover the control, alarm and monitoring of machinery systems, and a bridge remote control system for the electric propulsion drives and bow thrusters.

The Valmet DNA system is designed according to the half-ship concept with fully redundant process controllers and multifunctional operator stations. This means that the ship can return safely to port in any unfavourable event using its remaining propulsion. The remote control system includes touch-screen control panels and an electric shafting system for safe and fast transfer of operation command between the control positions.

Furthermore, the delivery includes a history and analysing station that will collect data from both Visedo's electric power management and consumption control systems.

Influence Of Overvoltage Current

The work presents the research of high voltage circuit breakers characteristics influence on switching over-voltages and over-currents conditioned by inductive and capacitive load's Switchings. The suggestion for the circuit breakers choice from the point of view of permissible levels of voltages and induced Electro-motive Force in secondary circuits are given...

As is known, the characteristics of circuit breakers mainly have an influence on the process of commutation. In particular, chopping currents of circuit breakers define the peak level of over-voltages during switching off of low inductive currents, law of restoration of di-electric strength affect disconnections of all types of loads and functions of distribution of angle of switching determine the statistical characteristics of current and voltages during switching. In addition, according to the reference literature the issues of influence of circuit breakers characteristics (in particular chopping currents and recovering di-electric strengths) to commutation processes, specifically to the processes of switching off of unloaded autotransformers, switching on and switching off of capacitor banks were not completely addressed. The importance of the problem is enforced by the fact that presently “old” (oil and air) circuit breakers get displaced by auto compression and vacuum circuit breakers of the new generation. The report highlights the results and analysis of numerical researches of influence of circuit breakers characteristics to Commutation

processes conducted in the Azerbaijan Republic. The information with reference to the applied calculations are given in the Appendix to the paper.

Level of switching over-voltages

It is known that level of switching over-voltages is determined by the characteristics of circuit breakers, first of all depending on chopping currents and di-electric strengths. Summarizing (a few) research works carried out in the area of impact of strength characteristics of circuit breakers to the levels of over-voltages, a number of common rules to be identified as follows:

Low probability of re-ignitions of switching in disconnection of circuit breaker as the speed of recovery of its di-electric strength grows: according to various sources the above mentioned probability for air circuit breakers is estimated circa 10% and for the oil one – up to 100%. The results of our research would estimate probability of reignitions of circuit breakers is circa (13÷47)% for vacuum and auto compression circuit breakers (whereby the lower probabilities correspond to higher speeds of recovery) and about (70÷75)% for oil ones; - in a certain increase of peak level of commutation over-voltages as the recovery speed of dielectric strength grows: it is known that oil circuit breakers disconnect unloaded transformers "softer", i.e. with less over-voltages than the air ones. The results of our research were similar: the largest estimate ratios were found during switching off of power installations by vacuum circuit breakers and more "soft" auto compression circuit breakers were producing less switching surge; - maximum estimate ratios during switching off of capacitor banks would not exceed level 3 and the same ratios during disconnections of unloaded auto transformers 110÷220 kV do not exceed more than 2,8. Generally speaking those levels of switching surge are within the levels of acceptable impact on insulation of power installations with standard voltage up to 220 kV inclusive. However, to enable commutation of capacitor banks the probability of the transition of waves of switching surges from the step of the capacitor bank connection to the step of higher voltages with less reserves of isolation levels should be accounted. This possibility is confirmed physically as follows:

a) By relatively low (from the point of view of attenuation) natural (self) frequencies of capacitor banks with the values of around hundreds of Hertz;
b) By the fact that planned disconnection of capacitor banks mainly takes place in case of increased switching surge in the buses of switch gears, i.e. at relatively high established voltages. It is obvious that under those conditions the most preferred of all the potential circuit breakers will be those, which would provide the softest switching off of capacitor banks. For example, auto compression circuit breakers are more preferable in comparison with the vacuum ones and among two or more auto compression circuit breakers the most preferred will be the circuit breakers with the minimum speed of recovery of the electric strength dU_{es}/dt, i.e. with the minimum "stiffness". However, if for the given specific scheme the level of switching surges is higher than the level of permissible impacts to insulation it is possible to apply more powerful circuit breakers of higher "stiffness". It should be noted that strength (dielectric) properties of circuit breakers determine the switching processes and levels of over-voltages. Our researches proved that their impact to the process in a number of cases can prevail over the influence of chopping

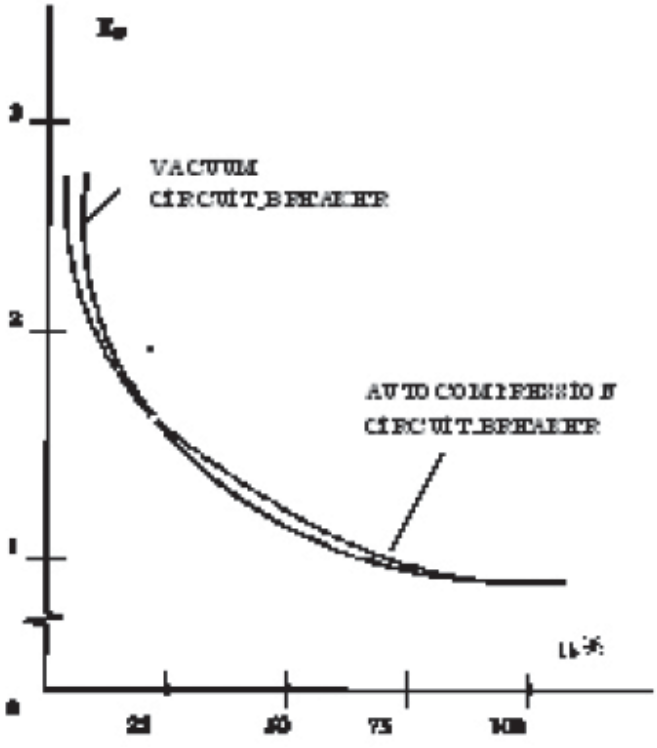


Figure 1: Calculated probabilities of surge ratios on Switching's off of unloaded autotransformer 220 kV by auto compression and vacuum circuit breakers...

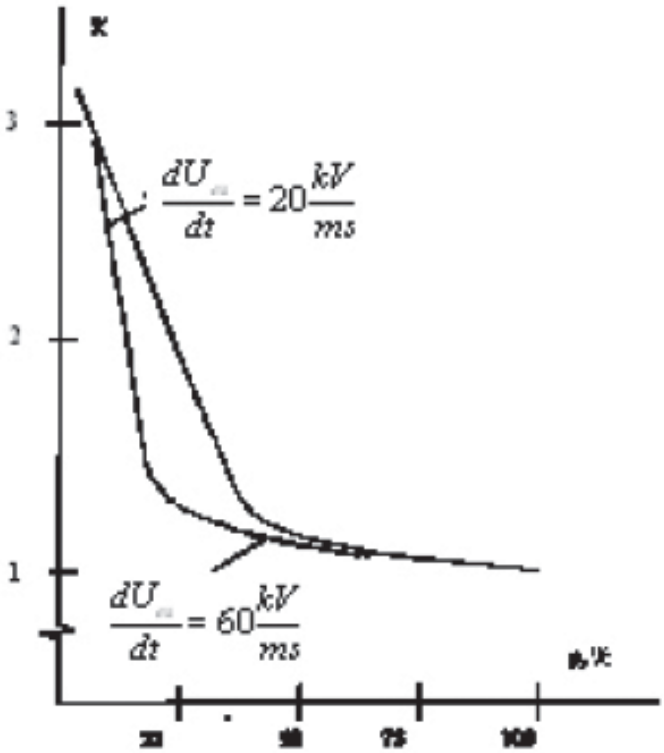


Figure 2: Calculated probabilities of surge ratios on switching off of capacitor banks 110 kV by vacuum circuit breaker...

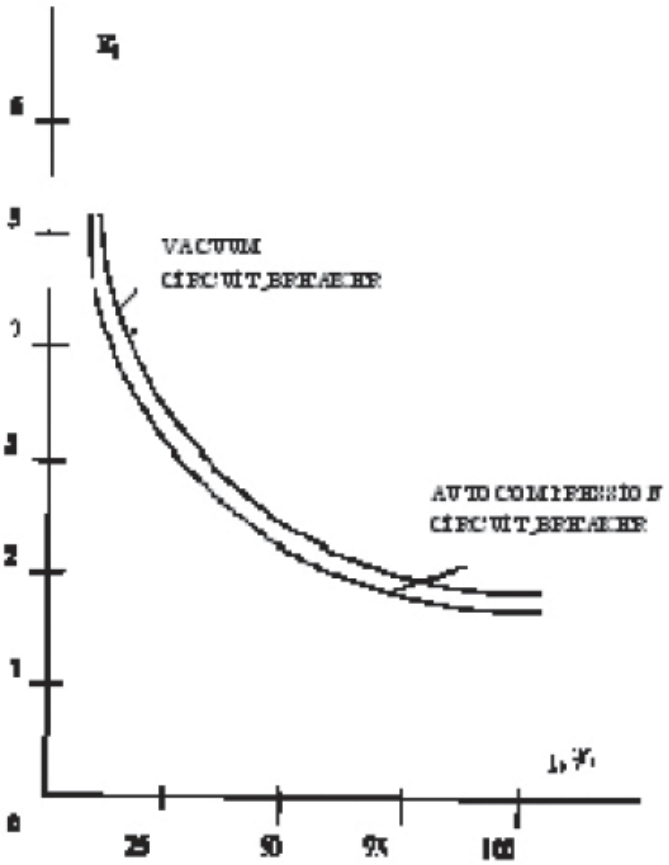


Figure 3: Calculated probabilities of over-currents ratios on switching on of capacitor banks 110kV by auto compression and vacuum circuit breakers...

currents. The formula for the maximum overvoltage U*max* when low inductive current is disconnected:

$U_{max} = i_{ch} (L_{\mu} C_i^{-1})^{1/2}$,

(where Lμ is induction of idling, C*i* is input capacitance of auto transformer; i*ch* is chopping current with no account of the impact of the recovering di-electric strength of circuit breakers to the level of over-voltages. In our calculations the circuit breakers with lower chopping currents (5A) were producing higher surges compared with the circuit breakers with higher chopping currents (10A). The reason is that speed of recovery of voltage in circuit breaker's contacts *dU/dt* are proportional (as is given in correlations shown in [1]).

$dU / dt \sim (\beta^2 U_o^2 + C_i^{-2} i_{ch}^2)^{1/2}$,

Where β is cyclic own frequency; U_0 is voltage at the moment of the current chopping. According to the given formula it is clear that the more higher the steepness of recovering voltage, the higher the current of chopping i_i. Therefore, in higher chopping currents the repeated breakdowns would be expected during shorter time intervals and correspondingly during lower values of voltage between the contacts of the circuit breakers. Calculated distribution of probabilities of surge ratios on switching off disconnection of unloaded autotransformer 200 kV are given in Fig.1

These curves were got in the process of series of numerical experiments on models given in. Taking into account that vacuum circuit breakers have lower chopping currents compared with auto compression ones (values 5 A and 10A introduced in the calculations accordingly) and higher speeds of restoration of dielectric strength, the conclusion is that the maximum ratios in case of equal probabilities are conditioned with the law of recovery of dielectric strength.

This means that more preferable would be to use more "soft" circuit breakers for autotransformers, transformers and reactors even though with higher value of the chopping current.

Calculated distribution of probabilities of surge ratios on switchings off of condense battery by the vacuum circuit breakers as shown in Figure 2.

Switching over-currents and level of induced voltages in secondary circuits

Switching over-currents of electrical installation have a great practical interest as they are the main reasons of hazardous (short term) impacts to secondary communications and circuits.

As currents and voltages of switching regimes affect from one side to electro-magnetic compatibility and from the other side they depend on type and characteristics of commutating circuit breakers, then the level of switching voltages in secondary circuits may alter depending on choice of circuit breakers.

One of the most dangerous commutations with so-called impact to electromagnetic compatibility is switchings (including repeated voltage breakdowns on switching off) of the powerful capacitor bank by auto compression and vacuum circuit breakers (see Fig.3)

As is shown in Fig 3, the influence of characteristics of circuit breakers to currents ratios is quite drastic and particularly in the area of low probabilities: as such in the area of probabilities ≤15% the difference between the ratios may reach even 15%. As it was shown in, higher ratios of over-currents of switching take place for high-speed circuit breakers. Thus, in case of proximity of design switching voltage in the secondary circuits to maximum permissible level the most optimal choice of the circuit breakers could in fact provide electromagnetic compatibility of the capacitor banks with the secondary circuits.

It goes without saying that in this case it would be necessary to take into account coordination of over-voltages between the levels of permissible impacts to insulation as well (see above). However, it should be noted that more "soft" circuit breakers which produce less over-voltages during switching off and lower over-currents during electrical installations switching on have higher probability of breakdowns of the between contacts intervals during disconnection compared to "stiff" circuit breakers and that could lead to premature exhaust of resources of secondary circuits elements.

Let's consider one more specific feature of our research. Initially those breakers were supposed to be used for long-distance extra-high voltage power transmission lines; limitation of Over-voltages during connections, including automatic repeated connection is quite important for such lines due to low levels of permissible influences to insulation and from the other side – due to increased steady-state voltages.

Synchronous connection was applied to powerful capacitor banks. It is obvious that use of synchronous circuit breakers located in sensitive electromagnetic environments can require additional measures to provide limitations of induced voltages as the highest making currents are observed in making angles close to zero. It should be noted, however that presently only around a thousand of synchronous high voltage circuit breakers are in operation throughout the world.

Conclusions

The research results provide the evidence of significant dependence of switching voltages and currents on characteristics of circuit breakers. Therefore when choosing circuit breakers as additional condition, the following is to be proposed:

– coordination of level of switching over-voltages with the level of permissible impact to insulation, also when choosing circuit breakers with low or medium-voltage winding, the probability of transformation of overvoltage to windings of higher voltage with lower relative levels of permissible impacts should be noted;

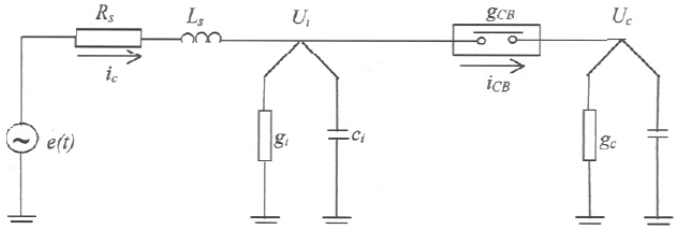
– co-ordination of level of induced voltages in secondary circuits with permissible values of longitudinal induced electro motive force to improve electromagnetic compatibility.

Appendix

On using numerical models

I. Capacitor banks' switchings

a) Circuit (only one phase was shown)



b) Equations

$dUs / dt = L_s^{-1} [e(t) - R_s \times i_s - U_L]$;

$dU_L / dt = C_L^{-1} [i_s - g_L \times U_L - g_{CB} \times (U_L - U_C)]$;

$dUc / dt = C^{-1} [g_{CB} \times (U_L - U_C) - g_C \times U_c]$.

c) Conditions of current chopping

$g_{CB} \times | U_L - U_C | \le i_{ch}$

and arc re-ignition

$| UL - UC | \ge Ur(t)$.

d) Abbreviations

Rs, Ls parameters of source

gL, C_L parameters of load

gc, C parameter of capacitor bank

g_{CB} conductivity of circuit breaker, depending on it's position

e (t) matrix of electro motive force.

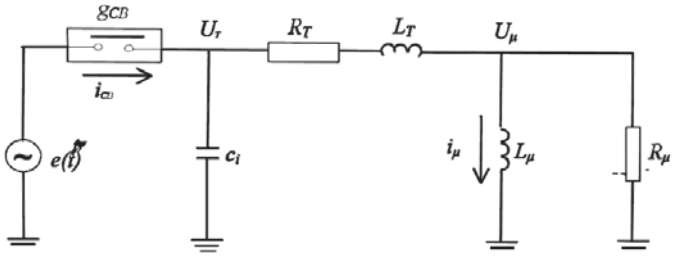
i_s, i_{CB} matrixes of currents

ich chopping current, depending on circuit breaker's type

Ur(t) matrixes of restoring electrical durability of circuit breaker, depending on it's type.

II. Unloaded autotransformers switching offs.

a) Circuit (only one phase was shown)



b) Equations

$dU_T / dt = gCB\ C_i^{-1} [e(t) - g_{CB}^{-1} \times i_T - U_T]$;

$di_T / dt = L_T^{-1} (U_T - R_T \times i_T - U\mu)$;

$dU\mu / dt = R\mu \times T\ \mu^{-1}\ L\mu^{-1} R\mu \times U\mu$.

b) Conditions of current chopping

$| iT + Ci\ dU_T / dt | \le ich$

and arc re-ignition

$| e(t) - UT | \ge Ur(t)$

c) Abbreviations

Ci input capacitance of autotransformer

RT, LT longitudinal parameters of autotransformer

Lμ, Rμ cross parameters of autotransformer

iT, iμ matrixes of currents

UT, Uμ matrixes of voltages

gCB, e(t), i_{CB} see upon

Described numeriacal models were realised by means of methods of Merson and Fehlberg.

Amol Sonawane
Lecturer
K. K. Wagh Polytechnic
Nashik

Kumbhat Becomes National President Of ISLE

Dilip Kumbhat of K-LITE Industries (Chennai) has earlier held several prestigious positions...

The Indian Society of Lighting Engineers (ISLE), a professional body in the field of illumination engineering and head quartered in Delhi, has elected Dilip Kumbhat of K-LITE Industries, Chennai, as its National President. Elections to the Governing Body for the four year term 2016-20 was held recently in the city, following which he assumed the post on 13th October and has replaced the outgoing president Gulshan Aghi.

ISLE has a broad based membership of 3500 including scientists, engineers, architects, academicians, researchers, designers and others interested in lighting issues. It is affiliated to the International Commission on Illumination and is also a member of Lux Pacifica, a lighting body representing 60% of the world population. It is closely associated with BIS (Bureau of Indian Standards), ELCOMA (Electric Lamp and Components Manufacturers Association of India), Ministry of Non-Conventional Energy and Department of Science and Technology.

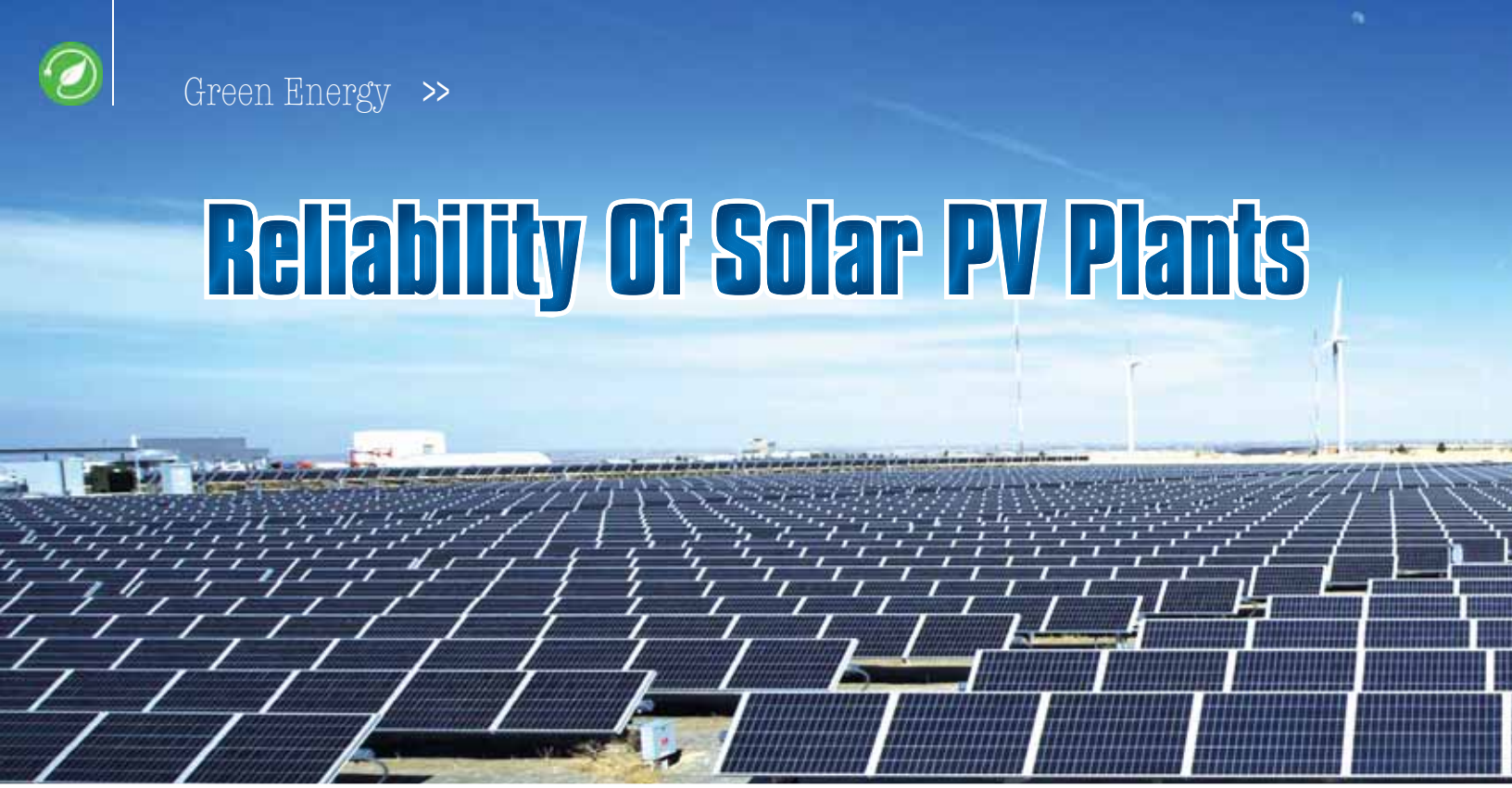
As the head, Kumbhat would helm the high profile team of the society with a commitment to the upgradation of the domain giving due importance to advancing education and research in illumination engineering; promoting the illumination engineering services; maintaining liaison and technical interaction with national/international organisations; creating awareness on latest trends and innovations through technical seminars / exhibitions; organising trade fairs for improving trade; and providing guidance to lighting fraternity to continue to cater to the needs of evolving lighting market with solutions of international standards.

An industrialist and a mechanical engineer with more than 40 years in the manufacture of luminaires, Kumbhat has earlier held prestigious position as Chairman of a Government of India joint sector company CAIIUC (Chennai Auto Ancillary Industrial Infrastructure Upgradation Company) in Ambattur.

Also Kumbhat, in the past presided and led industrial associations like AIEMA (Ambattur Indutrial Estate Manufacturers Association) and ATC (AIEMA Technology Centre). Conducted international exhibitions for AIEMA under the banner ACMEE and lighting exhibition Lii2011 and Lii 2013. He was the Chairman of Chennai State Centre of ISLE since inception till 2011 and Vice President of ISLE, Governing Body.

The recent poll saw Harabhandhu Mukherjee from Kolkata elected to the post of Vice President; Dr.Rajat Mandal (Mumbai) as Hon'y General Secretary; R.Balasubramanian (Chennai) as Hon'y Treasurer and five others - P.K.Sood, H.R.Vaish, Bipin Dattani, Stan Alvares and Dr. Prakash Barjatia as members at national level.

Reliability Of Solar PV Plants



Against the background of increasing costs of conventional power, concerns regarding availability and reliability of power from grid and long term commercial feasibility of solar power, commercial and industrial consumers are installing rooftop solar technology to meet their captive needs...

India is endowed with abundant free solar energy. Using the country's deserts and farm land and taking advantage of 300 to 330 sunny days a year, India could easily generate 5,000 trillion kilowatt-hours of solar energy. Solar power is one of the fastest growing renewable energy technologies and within a relatively short period of five years we have seen a steep fall (more than 60%) in solar PV capital cost and tariff.

Against the background of increasing costs of conventional power, concerns regarding availability and reliability of power from grid and long term commercial feasibility of solar power, commercial and industrial consumers are installing rooftop solar technology to meet their captive needs. Investing in solar power is also helping companies meet their corporate social responsibility initiative along with long term commercial gains.

India is poised to become a global force in the solar power industry, an emerging regulatory regime and high peak prices make this opportunity real and attractive.

Solar power could present a rapidly scalable solution for both on-grid and off-grid applications, some of the advantages of Solar Power are the ease of access to power, a renewable energy source, reduction in electricity bills etc.

Challenges

Researchers and experts argue that meeting the said targets will require potentially difficult reforms by both the central and the state governments. It can be achieved by merely building massive solar parks that are on the government's radar. Encouraging rooftop and off-grid solar projects will help create the broad political support crucial to the solar push.

For the bigger solar projects, which India hopes will account for 60 gigawatts of capacity by 2022, the cost of the electricity produced has already fallen beneath the cost of power generated from imported coal, and could soon be cheaper than power from domestic coal. Yet solar developers face difficulties acquiring land and getting permissions to build transmission lines. Deeper obstacles lie with the utility companies that buy and distribute electricity to homes and factories.

With over 300 days of sunshine in almost all parts of the country, the concern with solar energy is the technology and quality of the products, unlike wind energy where the challenge lies in situating the wind farm in the right location.

For any bank, cash flow is important and the performance of a PV plant impacts the cash flow. A PV solar panel is the heart of the plant and the energy generating unit.Today, the problem is that there are so many technologies available when it comes to PV power plants like Crystalline, Thinfilm, Concentrated PV which are competing with each other but the problem is these technologies are proved in laboratories but not on the field. Modules are the biggest concern for the banks and some banks have a well-defined bankability program, which is a combination of factory inspections where they want a third party to visit their facility where their modules are being manufactured and they want the production process to be audited according to their protocol.

Way Forward

The previous UPA Government in 2010 took a big step towards large-scale solar deployment in the country with the Jawaharlal Nehru National Solar Mission (JNNSM). Originally, this program set a target of 20GW of government-deployed solar projects by 2022.

The progress from 2010, when installed solar capacity in India was a mere 18 MW, to 2015, when installed capacity is around 4.5 GW (as of August 2015) and growing, has demonstrated the viability of India as a major solar market. However, a consolidated effort between the Industry and the government in introducing reforms across various levels, along with accelerating testing and certification of PV plants will be essential in ensuring the bankability and safety of solar projects in India.

Reforming the Utilities and the need to harmonize state and central policies is key. The power grids that largely operate across majority of the states face several issues that would discourage solar investment. In the long run, India will need to pursue a transformation of its utility sector to increase renewable generation while keeping power affordable and reliable.

In order to ramp up solar power capacity, India will now need to implement an efficient division of labour between the centre, which sets overall targets, and state governments, that implement the targets and oversee most of the deployment of the targeted capacity. Therefore, it is essential that the government at the centre and state coordinate their policies to ramp up the solar power.

India will need to evaluate a balance between its reliance on foreign technology and the limitations it faces domestically in the technical know-how in the solar PV space. Governments and institutions around the world are well placed to undertake collaborations with India to ensure access to foreign products, modify technologies for use in the Indian climate, and train a workforce capable of deploying reliable installations.

The government will have to strengthen ties with existing third party testing and certification institutions to ensure reliability of the PV plants. The role of a third party player is key in overcoming the challenges of underperforming panels, installations and availability of trained manpower and quality of workmanship. Also required will be significant investments in the energy efficiency testing labs, thereby supplementing government efforts in safeguarding the environment while enabling economic growth.

In solar energy, safety and performance go hand-in-hand. The challenges are quite evident in terms of estimation of the yield of a particular solar power plant. A critical factor is the right design of the solar plant and right selection of components within the plant. The quality and performance of PV modules and inverter efficiency among others will decide the overall efficiency of the plant.

The demand for PV equipment has increased and, hence, there is an increased need for an effective testing and certification solution. With an expected lifespan of 20-25 years, it is difficult to guarantee the safety and performance of products and components used in renewable energy resources. Testing for reliability and durability and certification program with strong surveillance mechanisms is the only way to ensure bankability in terms of safety, quality and performance of these products. Creating awareness on the dangers of various applications of solar and wind energy and solutions to mitigate the same are crucial steps towards ensuring complete success of renewable energy projects. Handling of hazardous equipment and material can have catastrophic effects if safety and quality standards are not followed.

Conclusion

India is on the threshold of a green energy revolution that can light up a new era of energy, economic and environmental security. To achieve this goal, India needs to fundamentally transform the manner in which it produces, distributes and consumes energy. In recent years, cost cutting measures are compromising on quality of the components used, the technology needs to be well established and available. If properly developed and used, India's abundantly available renewable resources could meet all of its energy demand by 2030.

Rajnikanth
Business Head – Commercial & Industrial, South Asia, UL

inter solar connecting solar business | INDIA

Dynamic Expansion In The Indian Solar Market

The Indian solar market is experiencing strong growth, bringing it ever closer to the Indian government's goal of increasing the installed photovoltaic (PV) capacity to 100 gigawatts (GW) by 2022. Against the backdrop of this progress, Intersolar India opened in the Bombay Exhibition Center in Mumbai. Over 230 exhibitors presented their products, services and solutions for the solar industry until October 21. The exhibition was accompanied by the Intersolar India Conference, where the Indian solar market and private roof-mounted installations were the centre of attention...

Intersolar India 2016 was inaugurated by Falk Senger, Managing Director, Messe München GmbH, Michael Schmela, Executive Advisor - Solar Power Europe, Belgium, Dr. Daniel Strowitzki, CEO - Freiburg Management and Marketing International GmbH, Dr. Amarpal Singh, Chief Executive - Punjab Energy Development Agency (PEDA), Dr. Robert Habeck, State Minister – Ministry of Energy, Agriculture, the Environment and Rural Areas, Schleswig Holste in Germany, Gregory Taevs, Commercial Consul of United States in Mumbai, Dr. Florian Wessendorf, Managing Director – Solar Promotion International Co. Ltd., Bhupinder Singh, Chief Executive Officer – Messe München India.

Big steps towards the 2022 target

The Indian solar market is growing at a breathtaking pace. According to the India Solar Map 2016, published in September this year by the consultancy firm Bridge to India, India's installed solar capacity grew by 80% to 8.1 GW from mid-2015 to mid-2016. 75% of the deployment took place in four states in the south. When all the projects currently under construction are added to the current installations, the result is a total photovoltaic capacity of 23 GW. And this is only the beginning – as the Indian government plans to reach the 100 GW milestone by 2022.

The market conditions were therefore ideal for Intersolar India, with the event once again anticipating positive figures to mark the 25th anniversary of the Intersolar exhibitions in 2016. A total of 230 exhibitors and over 11,000 visitors were expected at the exhibition space in the Bombay Exhibition Centre, and it crossed the expectation.

Star-studded conference

This year, the Intersolar India Conference was taking place from October 19–20 in parallel with the exhibition. It was inaugurated on Wednesday 19th by distinguished speakers, including Dr. Robert Habeck, the Minister of Energy, Agriculture, the Environment and Rural Areas for Schleswig-Holstein and Dr. Amarpal Singh, Chief Executive - Punjab Energy Development Agency (PEDA).

The session titled Residential Rooftop Systems – System Design and Field Experience in India (auditorium, hall 1 on October 20, 2016, 2:30pm–3:55pm) offered visitors the opportunity to find out more about private roof-mounted installations. Experts, market analysts, architects and decision makers were set to share their experiences with regulations, client expectations and technical problems.

Another conference highlight: Experts from operations and maintenance were discussing the question Operation & Maintenance – a Burgeoning Business in India, on October 20 in hall 1 (4:30 - 6:00pm). This session addressed uncertainties, risks, challenges and other factors which companies in this field faces in the Indian solar market.

ees India

Once again this year, Intersolar India was accompanied by ees (electrical energy storage) India. As many Indian companies operate in both the photovoltaic and energy storage sectors, this supplemented the event perfectly, and supported India on the path to a renewable future.

Collaboration with HUSUM Wind

In addition to the exhibitors from the solar sector, the internationally renowned exhibition HUSUM Wind also ran a shared booth at the exhibition, where visitors found out more about the wind energy industry and expanded their knowledge of the Indian market. Visitors at the specialist conference additionally had the opportunity to discuss the various facets of wind energy with international experts.

Further information is available at www.intersolar.in

Glimpses Of InterSolar 2016

SWITCH Debuts At Vadodara With Huge Response

The organisers of SWITCH made it a point to create a Technology Transfer Network to bring together businesses that can share their knowhow and grow further...

Switch Global Expo 2016, took place between 6th to 10th of October, at Vadodara, Gujarat. The expo was inaugurated by Chief Minister of Gujarat, Vijay Rupani in esteemed presence of Minister of State (I/C) for Power, Coal, New & Renewable Energy & Mines, GOI, Piyush Goyal; Deputy Chief Minister of Gujarat, Nitin Patel; along with eminent dignitaries from Power and Electrical sector across the globe.

As India continues to forge its way to an even stronger power grid and nation-wide electrical connectivity, the call of the hour is very evident to let no household be without power. Hence, Prime Minister Narendra Modi's 1,000 day deadline to power every village has been backed by strong steps. An ambitious target of 175 Gigawatts of renewable energy by 2022 has also been established. Switch represented this ambitious and powerful spirit of India. It had one of the biggest networks of electrical manufacturers, innovators, technologies and partners in the industry.

The technological progress of any country depends on its rise of knowledge base. And it is a time-tested fact that knowledge increases through sharing, interaction and visualisation. Considering all these facts, the organisers of SWITCH made it a point to create a Technology Transfer Network to bring together businesses that can share their knowhow and grow further.

Innovations on the existing knowledge level take any process or business to the next higher plane, which require developing good insight, well maintained focus and thorough understanding of the technological ins and outs of the latest equipment, systems and their components. The organisers of SWITCH also took care of this fact, thus they created the innovation showcase platform, where several national talents were recognised and rewarded.

The five-day biennial expo attracted large number of footfalls in terms of buyers, sellers, solution providers, entrepreneurs, policymakers and general public. The expo featured multiple unique events including World Electrical Buyers' Summit, Innovation & Technology Summit and Innovation Lecture Series.

It offered a unique platform for companies across India and abroad to meet, network and explore business opportunities in the power and electrical sector. It was a definitive electrics marketplace and provided the widest range of switchgears, cables, conductors and fiber optic wires, transmission line technologies, control and automation, transformers, among many other products. It also had specific pavilions for students and institutes.

World Electrical Buyers' Summit (WEBS) was a focused attempt to get quality buyers on a single platform to offer an efficient way to do business. The Innovation and Technology Summit was first of its kind in the country, wherein innovators showcased their works. In addition, The Innovation Summit also hosted special Innovation Lecture Series featuring 13 leading innovators and celebrities as speakers.

Moreover, an Incubators Forum was held to exchange information with Investors, Bankers and HNIs for giving an interaction platform to encourage Venture Capital funding in the industry.

The Summit had wide-ranging discussions on Manufacturing Technology, Asset Management, Renewable Energy and Other Technical subjects. The event also offered a pavilion dedicated to resale and refurbishing options.

Glimpses of SWITCH 2016 Event

Electrical India, managed to seek inputs from the following companies with regards to Switch Global Expo 2016

Nitin Deshpande, Marketing Head of Rishabh Instruments, in a conversation with Electrical India, said, "Rishabh has been participating in many national and global level exhibitions since years. For SWITCH, to be its first time, we received tremendously good response. There were very rare patches when our stall was unattended. Continuous flow of visitors was indeed a positive side of Switch. We received some potential inquiries too and we are working over it. Vadodara being one of the leading cities of electrical manufacturers, we received reasonably good response. We have displayed our innovative combination products comprising of three different types - Analog Products, Digital Products and Test & Measurement Products, under this we showcased our Innovation of Touchscreen Multi Function meters, Energy meters, Power Supplies, Digital Relays, Transducers, Recorders, HMI, Controllers, Digital Multimeters, Clamp Meters, Earth Testers, Insulation Testers, Analog Meter, CTs, Shunts, CAM Switches and some others. The overall management at Switch was good with some scope improvements."

Marketing Team of Rishabh Instruments (Nitin Deshpande at the centre)...

Rajib Chattopadhyay, Business Development Head of ERDA...

Rajib Chattopadhyay, Business Development Head of Electrical Research and Development Association (ERDA), said, "SWITCH Global Expo 2016 held in Vadodara, 'The Electrical Capital of India', offered a unique Global platform to local manufacturers, researchers and innovators.

The exhibition and conference, offered a good platform for business transaction in national level and international level. We could meet several key officials from Indian utilities, which opened up additional business opportunities from them for the complete gamut of services offered by us.

Similarly we could initiate new business opportunities with International customers who visited our stall.

We had displayed the innovative technologies developed by us, which are available for sale, (say for example) Online Fault Sensor for Power Transformer, Fault current limiter for L.V. application and Anti-dust coating for PV panels."

Nilo Han, Vice President, as well as Senior Engineer of Beijing Hezong Science & Technology Co., Ltd, introduced his company saying, "We, Beijing Hezong Science & Technology Co., Ltd, which is based in Beijing China, are a specialised manufacturer of power distribution equipment."

"In spite of wealthy experience in African and Southeast Asian countries with RMU & C-GIS and other products, we still felt somehow confused when facing India market. Participation in SWITCH EXPO-2016, undoubtedly, has given us an opportunity to get to know India's electricity and power distribution market better," Han revealed.

The Hezong Vice President further continued, "The great inspiration drawn from SWITCH has confirmed our determination to leap into this unfamiliar territory in enabling safe and efficient distribution of electricity to homes and industries as always."

A view of the Hezong Power's stall in the exhibition...

Ajay Goyal, Managing Director, Megger India, said, "The exhibition was a great experience in connecting with our valued and potential customers. Megger showcased its latest innovations like the TRAX - A multifunctional transformer and substation test system, which received a lot of appreciation. As a part of Megger's "Make In India" initiative, the Compact City – Cable Test Van for locating underground cable faults was showcased. We are looking forward for the next edition of the SWITCH Global Expo."

Power Supply Position (Energy & Peak) in Sep 2016

Region	Energy (MU)				Deficit (%)	
	Requirement		Availability			
	Sep '15	Sept '16	Sep '15	Sept '16	Aug.15	Aug. 16
Northern	33179	33,300	31202	32,646	-6.0	-2.0
Western	28537	28,683	28461	28,679	-0.3	0.0
Southern	23656	24,689	22832	24,686	-3.5	0.0
Eastern	11089	10,976	10894	10,964	-1.8	-0.1
North Eastern	1279	1,373	1224	1,336	-4.3	-2.7
All India	97740	99,021	94613	98,310	-3.2	-0.7

Region	Power (MW)				Deficit (%)	
	Peak Demand		Peak Met			
	Sep '15	Sept '16	Sep '15	Sept '16	Aug.15	Aug.16
Northern	52912	52772	50622	51816	-4.3	-1.8
Western	43946	46100	43325	46000	-1.4	-0.2
Southern	37530	40654	35564	40592	-5.2	-0.2
Eastern	17856	18227	17573	18210	-1.6	-0.1
North Eastern	2442	2430	2255	2373	-7.7	-2.3
All India	154686	159243	148463	158059	-4.0	-0.7

Source: Central Electricity Authority (India)

PTL Rolls Out Surge Protection Devices

Process Technique Electronic (P) Ltd (PTL) has built up over 2-and-a-half decades' specialized experience in the field of electrical energy management and protection technologies. Set up in 1981, PTL was amongst the first Companies approved by the Govt. of India (DoE) to manufacture a wide range of electronic PF regulator systems.

Process Technique's product installations are in operation in varied applications like, petro chemicals, automobile plants, wind generation mills, commercial buildings, cement plants, iron & steel mills and software development centres.

PTL has gained enormous expertise in providing accurate and reliable solutions in automatic PF control and energy management. Process Technique has high quality technically trained and well experienced staff, for its production facility, technology support and integrated quality control systems. The Company has a nation-wide acceptance and presence today with various Original Equipment Manufacturers, Electrical Integration Companies and its sales network across India.

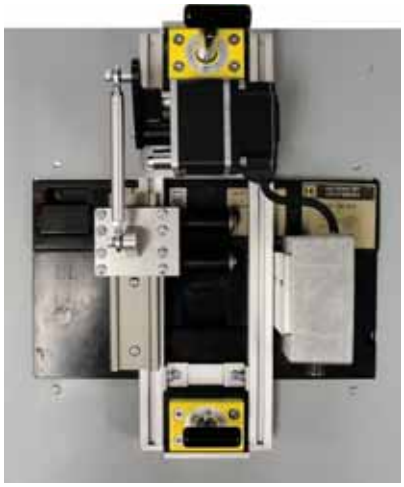
Continuously newer solutions and products are being introduced for power protection and measurement applications. Some of these technologies cover, real-time power factor control, surge protection devices, meters and loggers, using advanced technology, to equip users with the latest in technology and reliable answer to their growing needs in power quality and energy management.

The facility of Process Technique is ISO 9001 certified and follows highest quality and traceability standards for delivering unmatched technology products with reliability and certified performance.

The recent introduction of SURGE PROTECTION DEVICES in technical cooperation with NOVARIS Pty Ltd., Australia, is a major step in delivering more comprehensive POWER QUALITY solutions to INDIAN clients.

The range of SURGE PROTECTION DEVICES cover LV-power, Telecom, Rail applications, Data and Signal lines and also specialised equipment. Going hand in hand products for POWER FACTOR CONTROL and SURGE PROTECTION provide an excellent base for more enhanced PQ-solutions delivering the highest performance and reliability that the company always stands for. EI

CBS ArcSafe launches RSA-57T for Square D N-Frame MCCB



CBS ArcSafe, a well known manufacturer of remote racking and switching solutions for low- and medium-voltage switchgear, introduced its Remote Switch Actuator (RSA) for the Square D N-Frame Molded Case Circuit Breaker (MCCB). The lightweight, portable CBS ArcSafe RSA-57T allows technicians to remotely close or trip the MCCB from a safe distance of up to 300 feet while remaining stationed outside the arc-flash boundary.

Installation and operation do not require any modifications to the existing electrical equipment. The RSA-57T is compatible with flush-mounted N-Frame breakers with ratings of 600-1200 A, with or without factory lockouts, including NE and NX frames. Typical applications include switching and protection of squirrel-cage, wound-rotor, and synchronous motors. The RSA-57T is a cost-effective solution for keeping operators safe when compared to other arc-flash mitigation alternatives.

Optional features include radio remote with range of up to 300 feet, 24 V DC LED light, wireless video camera system with LCD monitor and rugged protective case assembly. All RSA units are portable, fast, and easy to set up, offer mechanical and/or electrical safety protection, are adjustable to fit unique electrical equipment configurations, reduce the requirements for personal protection equipment, and help customers with NFPA 70E arc-flash safety compliance.

For further information: www. cbsarcsafe.com

GE introduces ElfaPlus Miniature Circuit Breakers with UL Rating

ElfaPlus, a Miniature Circuit Breaker (MCB) designed and manufactured by GE, recently achieved an Underwriters Laboratories (UL) rating, making it a global MCB platform. Suitable for branch circuit device protection, the ElfaPlus platform offers a range of UL489 and UL1077 MCBs up to 63 amperes.

ElfaPlus circuit breakers and supplementary protectors provide several features that are important to OEMs and global players in the electrical distribution segment. These include:

- Small, compact size: The compact ElfaPlus products mount easily onto a 35-millimeter DIN mounting rail.
- Simple installation: The bi-stable DIN rail extraction system in ElfaPlus enables secure, quick and easy installation and removal of devices while helping to ensure a firm adjustment to the DIN rail.
- Improved protection: ElfaPlus is designed with a high-performance arc management system capable of clearing short circuit failures more efficiently than conventional MCBs. Additionally, ElfaPlus supplementary protectors and MCBs limit let-through current, providing faster separation of the component from the fault — thereby reducing system damage.
- Reliability: ElfaPlus' specially designed thermal system uses high-performance materials and alloys to enable a wider temperature range. This can result in smaller enclosures and more reliable operation in harsh thermal environmental conditions such as outdoor applications. Additionally, each breaker has an endurance of 10,000 operation cycles and voltage withstand of 6,000-volt impulse rating.
- Extensive variety of accessories: The UL range is completed with supplementary protection, ground fault devices, auxiliaries, busbars, surge protective devices and net analysers.

For further information: www.ge.com

FLIR India presents non-contact Infrared Thermometers

Extech infrared thermometers provide non-contact, point-and-shoot temperature measurements ensuring safety and accuracy on the job. It is an ideal tool for maintenance professional for various industrial application.

Key Features:

Specification	IR260	IR267
IR Temperature Range	-20°C to 400°C	IR: -50°C to 600°C
		Ambient: -20°C to 70°C
		Type K: -50°C to 1000°C
Basic Accuracy	+2% of reading or 2°C	
Distance to Target	12:01	
Emissivity	0.1 to 1.00 (adjustable)	0.05 to 1.00 (adjustable)
Built-In Laser Pointer	Yes	
Adjustable emissivity for better accuracy	Yes	
Programmable high/low alarm alerts	Yes	
Product Warranty	1 Year	

Email: flirindia@flir.com.hk

Automate your power distribution with Elmeasure's Intelligent ACCL

Frequent power failure in a day is exhausting due to repeated manual switching of the DG Set. This over usage causes wear and tear and leads to switch failure in the expensive equipment.

Elmeasure's Intelligent Automatic source Change over with Current Limiter (iACCL) gives freedom from such maintenance problems. Built with high precision microcontroller that offers automatic changeover between main supply and generator supply, iACCL replaces dedicated manpower and also grants protection against overload/over voltage from the DG Set.

iACCL allows supply from mains as long as the load current is below the programmed current. When the mains supply fails and stand by generator supply is on, it connects the DG power to each consumer in sequence & starts monitoring its load.

Whenever the load current exceeds the allotment, power is automatically switched off for 10 seconds, and automatically restored. This cycle repeats for 5 times each time with double the time (20, 40, 80 & 160) and then enters into lockout mode until it is 'Reset' manually. This helps to protect against over voltage from DG.

Its current limiting capabilities are ideally suited to the efficient utilization of the standby generators frequently used in multi-storied apartments, commercial complexes, etc.

Features:

- Microcontroller based automatic source changeover with neutral isolation.
- DIN Rail/surface mountable for single phase and Surface mountable for 3 phase.
- SMPS based design for low power consumption.
- Intelligent re-connection once trip has occurred due to either over voltage or over load.
- Manual Reset provision when in sleep mode for restoring power supply.
- Energy, Current, Voltage measurement for DG & Current measurement for EB.
- Programmable threshold setting for both sources independently.
- Over voltage protection for DG.

For further information Email: marketing@elmeasure.com

Mitsubishi Electric launches colour TFT-LCD Modules

Mitsubishi Electric Corporation has launched 6.5-inch VGA and 8.4-inch SVGA / XGA colour TFT-LCD modules equipped with projected capacitive touch panels using cover glass of up to 5 millimeters in thickness.

These new modules are designed to meet increasing industrial demand for thick cover glass and glass allowing operation with gloves. They also facilitate multi-touch sensing and accurate sensing even on wet screens. The combination of these cutting-edge touch capabilities and the company's proven TFT-LCD technology will support diverse applications and installation scenarios.

6.5-inch VGA 8.4-inch SVGA / XGA

Mitsubishi Electric Colour TFT-LCD module with projected capacitive touch panel

Product Features

1. Projected capacitive touch panels offering superior operability for diverse industrial uses
   - Thick, 5-millimeter cover glass withstanding rugged usage
   - Ten-point touch operation with accurate sensing
   - High-level operability, even using gloves or on wet screens

Total touch-panel solution

- One-stop solution for TFT-LCD, touch panel and touch-control board
- Optional optical bonding (resin bonding of the TFT-LCD module, touch-panel sensor and cover glass, offering clearer images in bright light)
- Tempered cover glass and anti-reflection/anti-smudge surface treatment allowing a wider range of uses
- Factory-installed TFT-LCD, PCAP touch panel, cover glass and touch controller offering superior reliability

For further information: www.mitsubishielectric.com

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KEMET launches Ultra Hi-Q Radio Frequency Capacitors

KEMET Corporation, a well known global supplier of electronic components, recently revealed the expansion of its Radio Frequency (RF) and microwave product portfolio to include a new series of Ultra HiQ-CBR Squared Multilayer Ceramic Capacitors. These new devices feature a geometrically square construction resulting in lower inductance than standard EIA case sizes, thus improving low loss performance and operation at higher resonant frequencies.

Ultra HiQ-CBR Squared MLCC capacitors are ideal for high power applications such as wireless, satellite and microwave communications, RF and power amplifier modules and medical electronics.

Ultra HiQ-CBR Squared Capacitors are 250 VDC rated and are available in capacitance values up to 100 pF. The company is also expanding the existing HiQ-CBR product portfolio to include 200 VDC rated RF and microwave capacitors in EIA 0402 case size as well as extended capacitance offerings in EIA 0603 case size.

For further information: www.kemet.com

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Field of activities

- Repair, Rewinding, Overhauling & testing of rotating electrical machines (Steam/Gas/Hydro) Generators of lower, higher voltages & power ratings more than 250 MW & Power Transformers (220 KV)
- Manufacturing of Transposition coils and remaking the same.
- Commissioning of all electrical equipments.
- Dynamic balancing of Rotors, Fans & Impellers.
- Generators Redesigning & uprating of capacity of existing machines without disturbing the rotor winding.
- Redesigning of cooling systems like air cooled to water cooled and vice versa.
- Redesigning with change in voltage like 415V to 660 volts or 3.3KV to 6.6KV or 11KV to 15KV & vice versa.

Profile

- RKEW is one of the premier and experienced service outfit in the field of electrical motors, generators and transformer repair in India.
- RKEW an exclusive expertise in executing Repair/Rewinding & Refurbishment of worst damaged industrial steam generators, motors & power transformers. It extends expert service to various locations of its large industrial clients spread across the globe.
- RKEW team that includes management, technical & skilled man power understands the urgent need of its clients and is well prepared to deliver faster services (with no limitations on size of the machine) to client's satisfaction.

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- Integrated single phase relay test system and built-in insulation resistance testing capability
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